PROJECT MANUAL

JOHNSTON COUNTY PUBLIC SCHOOLS

FOUR OAKS ES – HVAC REPLACEMENT

180 W HATCHER STREET
FOUR OAKS, NC 27524

CPL PROJECT NO.: R23.00325.00

DOCUMENT TITLE: BID SET
DOCUMENT DATE: FEBRUARY 17, 2025

DESIGN PROFESSIONAL'S CERTIFICATION

The undersigned certifies that, to the best of his or her knowledge, information, and belief, that the "Design conforms to all applicable provisions of the Building Code of North Carolina State.

ARCHITECT/ENGINEER
CPL ARCHITECTS & ENGINEERS
1111 HAYNES ST., SUITE 100
RALEIGH, NC 27604
(919) 833 - 6064 PH

OWNER
JOHNSTON COUNTY PUBLIC SCHOOLS
2320 US-70 BUSINESS EAST
SMITHFIELD, NC 27577
(919) 934-9201 - PH

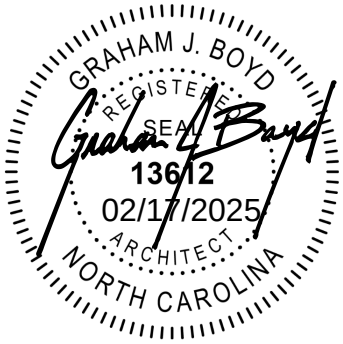
CPL
ARCHITECTURE
ENGINEERING
PLANNING
CPLteam.com

JOHNSTON COUNTY PUBLIC SCHOOLS

SECTION 000107
SEALS PAGE

JOHNSTON COUNTY PUBLIC SCHOOLS
MULTIPLE PROJECTS : CES, FOES, SSES - HVAC REPLACEMENT
CPL PROJECT NUMBER: R23.00325.00, R23.00487.00
FEBRUARY 17, 2025

CPL ARCHITECTS & ENGINEERS



MECHANICAL
CPL ARCHITECTS & ENGINEERS

PLUMBING
CPL ARCHITECTS & ENGINEERS

ELECTRICAL
CPL ARCHITECTS & ENGINEERS

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SECTION 000110
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ADVERTISEMENT FOR BIDS

INVITATION FOR PROPOSALS FOR
MULTIPLE PROJECTS:
CLEVELAND ELEMENTARY SCHOOL – HVAC REPLACEMENT
FOUR OAKS ELEMENTARY SCHOOL – HVAC REPLACEMENT
SOUTH SMITHFIELD ELEMENTARY SCHOOL – HVAC REPLACEMENT

Pursuant to Section 143-131 of the General Statutes of North Carolina, formal single prime bids are solicited for the HVAC replacement projects at Cleveland, Four Oaks, and South Smithfield Elementary Schools and will be received in the office of Mr. Joshua Woodard, HVAC Coordinator, JCPS located at 601 W Market St, Smithfield, North Carolina, 27577 at any time before **3:00PM on Monday, March 17, 2025** and then publicly opened and read aloud.

Bidders are welcome to attend the bid opening, but bidder presence is not required and no weight or other consideration toward any award decision will be given to any bidder's attendance or absence at the bid opening.

Attendance is **highly recommended** at the pre-bid conference, which will be held at the JCPS Facilities Office, located at 601 W Market St, Smithfield, NC 27577 on Wednesday February 26, 2025 at 10:00 am, followed by project site visits at each Elementary School.

Any questions shall be submitted directly to Lauren Beverly with CPL by email prior to March 5, 2025 at 3:00 pm at: lbeverly@cplteam.com. A copy of the questions and written responses will be sent to all bidders interested in the project.

Proposals must be enclosed in a sealed envelope addressed to Mr. Joshua Woodard – HVAC Coordinator, JCPS. The outside of the envelope must be marked "PROPOSAL FOR MULTIPLE PROJECTS" and shall indicate the name, address, telephone number and state GC license number of the bidder. Proposals must be submitted on the printed form, or exact copies thereof, contained in the Contract Documents.

Performance and Payment Bonds for 100% of the Contract Amount will be required for this project.
Bid security required is 5% of the Bid in cash, certified check, or Bid Bond.

All Contractors are notified that North Carolina Statutory provisions as to licensing for contractors will be observed in receiving, reading, and awarding of contracts.

Iran Divestment Act: Bidders shall note that the submission of a bid constitutes the bidder's certification to the State Treasurer that, as of the date of bid, it is not listed in the Final Divestment List created and maintained by the North Carolina Department of State Treasurer (the Treasurer's Office") pursuant to the Iran Divestment Act of 2015, Chapter 147-Article 6E of the General Statutes of North Carolina (the "Iran Divestment Act").

Contract Documents, including plans and specifications, will be available as of February 17, 2025 upon request from CPL Architects & Engineers by email to Lauren Beverly at: lbeverly@cplteam.com.

The bidder understands that he may submit pricing for any or all of the individual projects, and JCPS reserves the right to select the successful contractor for any combination of these projects, or none at all, at JCPS' sole discretion. The bidder to whom the contract may be awarded must comply with the requirements of G.S. Section 143-131, as amended.

No bids may be withdrawn after the scheduled closing time for the receipt of proposals for a period of sixty (60) days.

END OF SECTION

SECTION 002113
INSTRUCTIONS TO BIDDERS

INVITATION

1.01 BID SUBMISSION

A. Bids signed and under seal, executed, and dated will be received at the office of JOHNSTON COUNTY PUBLIC SCHOOLS FACILITY SERVICES at 601 W Market St. Smithfield, NC 27577 before 3:00 p.m. local standard time on the 17th day of March, 2025. Attn: Joshua Woodard, HVAC Coordinator.

B. Offers will be opened publicly immediately after the time for receipt of bids.

C. Amendments to the submitted offer will be permitted if received in writing prior to bid closing and if endorsed by the same party or parties who signed and sealed the offer.

1.02 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete three separate projects, one at Cleveland, one at Four Oaks, and one at South Smithfield Elementary Schools. Scope of work as outlined in 01 10 00 - Summary. located in Johnston County, North Carolina for a Stipulated Sum contract, in accordance with Contract Documents. The Bidder understands that he may be on one, two, or all three projects as outlined in the Bid Form.

1.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises renovation, including mechanical and electrical Work.

1.04 CONTRACT TIME

A. Perform the Work within the time stated in Document 007300 - Supplementary General Conditions.

B. The bidder, in submitting an offer, accepts the Contract Time period stated for performing the Work. The completion date in the Agreement shall be the Contract Time added to the commencement date. The bidder may suggest a revision to the Contract Time with a specific adjustment to the Bid Amount.

BID DOCUMENTS AND CONTRACT DOCUMENTS

2.01 DEFINITIONS

A. Bid Documents: Contract Documents supplemented with Instructions to Bidders, Bid Form Bid securities identified.

B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.

C. Bid, Offer, or Bidding: Act of submitting an offer under seal.

D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

2.02 CONTRACT DOCUMENTS IDENTIFICATION

A. Contract Documents are identified as Project Number: NC Architect Project Number, as prepared by NC Architect Name who is located at 1111 Haynes St. Ste 100, Raleigh, NC, and with contents as identified in the Table of Contents.

2.03 AVAILABILITY

A. Bid documents may be obtained electronically from CPL by contacting Ms. Lauren Beverly at LBeverly@CPLteam.com. Documents will be distributed to bidders at no cost to the Contractor.

B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.

2.04 EXAMINATION

A. Upon receipt of Bid Documents verify that documents are complete. Notify Architect should the documents be incomplete.

B. Immediately notify Architect upon finding discrepancies or omissions in the Bid Documents.

2.05 INQUIRIES/ADDENDA

A. Direct questions to in writing to Ms. Lauren Beverly, email; LBeverly@CPLteam.com.

B. After the Bid issue date, all communications between the Issuing Department and prospective Bidders shall be in writing. No oral questions will be accepted. All questions concerning this Formal Bid shall reference the section and page number. Questions and responses affecting the scope of the goods will be provided to all prospective bidders by issuance of an Addendum. All written questions will be received by CPL no later than 3:00 pm March 5th, 2025. NO EXCEPTIONS. This includes any requests for substitution and "or equal" items. All addenda pertaining to this Bid will be forwarded to known recipients, but it is the bidder's responsibility to check within 72 hours after the deadline for questions by emailing Ms. Lauren Beverly at LBeverly@cplteam.com.

C. Verbal answers are not binding on any party.

SITE ASSESSMENT

3.01 PREBID CONFERENCE

A. An optional, however, highly recommended pre-bid conference is scheduled for February 26, 2025 at 10:00 am at JCPS Facility Services located at 601 W Market St. Smithfield, NC 27577followed by site visits at each project site.
   1. South Smithfield ES located at 201 W Sanders St, Smithfield, NC 27577.
   2. Four Oaks ES located at 180 W Hatcher St, Four Oaks, NC 27524.
   3. Cleveland ES located at 10225 Cleveland Rd, Clayton, NC 27520.

B. Representatives of Architect will be in attendance.

BID SUBMISSION

4.01 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.

4.02 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may at the discretion of the Owner, be declared unacceptable.

B. Bid Forms, Appendices, and enclosures that are improperly prepared may, at the discretion of Owner, be declared unacceptable.

C. Failure to provide security deposit, bonding or insurance requirements may, at the discretion of Owner, be waived.

BID ENCLOSURES/REQUIREMENTS

5.01 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance and Payment bond as described in 007300 - Supplementary General Conditions.

B. Include the cost of performance assurance bonds in the Bid Amount.

5.02 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form.

5.03 FEES FOR CHANGES IN THE WORK

A. Include the fees for overhead and profit on own Work and Work by subcontractors, identified in Document 00 72 00 - General Conditions 007300 - Supplementary General Conditions .

5.04 BID FORM SIGNATURE

A. The Bid Form shall be signed by the bidder, as follows:
   1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
   2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
   3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.

OFFER ACCEPTANCE/REJECTION

6.01 DURATION OF OFFER

A. The bidder understands that he may submit pricing for any or all of the individual projects, and JCPS reserves the right to select the successful contractor for any combination of these projects, or none at all, at JCPS' sole discretion. The bidder to whom the contract may be awarded must comply with the requirements of G.S. Section 143-131, as amended.

B. Bids shall remain open to acceptance and shall be irrevocable for a period of sixty (60) days after the bid closing date.

6.02 ACCEPTANCE OF OFFER

A. Owner reserves the right to accept or reject any or all offers.

B. Pursuant to North Carolina General Statutes Sectoin 143-129, "award shall be made to the lowest responsible, responsive bid or bidders, taking into consideration quality, performance, and the time specified in the proposals for the performance of the contract."

C. After acceptance by Owner, Architect on behalf of Owner, will issue to the successful bidder, a written Notice To Proceed.

END OF SECTION 002113

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SECTION 00 41 00

BID PROPOSAL FORM
STIPULATED SUM

JOHNSTON COUNTY PUBLIC SCHOOLS
MULTIPLE PROJECTS – HVAC REPLACEMENT
CLEVELAND, FOUR OAKS, & SOUTH SMITHFIELD ELEMENTARY SCHOOLS

DATE: _____

The Undersigned, as Bidder, declares that he understands this bid package is broken into three separate and distinct projects, and has examined the site of each project and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Contract Documents relative thereto and he has taken special note that work shall be guaranteed for a period of one year after acceptance by Owner; and he has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder understands that he may submit pricing for any or all of the individual projects, and **JOHNSTON COUNTY PUBLIC SCHOOLS** reserves the right to select the successful contractor for any combination of these projects, or none at all, at JCPS' sole discretion.

The bidder proposes and agrees if this bid is accepted to contract with **JOHNSTON COUNTY PUBLIC SCHOOLS** for the furnishing of all materials, equipment, tools, means of transportation and labor necessary to complete the construction of the work described in these documents in full and complete accordance with the Contract Documents, plans, and specifications as prepared by CPL Architects & Engineers, and to the full and entire satisfaction of the Owner, with the understanding that no money will be allowed for extra work except as set forth in the Contract Documents for the sum of:

(bid forms for each school on following pages)

CLEVELAND ELEMENTARY SCHOOL BID FORM

BASE BID

_____Dollars ($_____)

ALLOWANCES

General Construction Work Base Bid to include a General Contingency Allowance as specified in Section 01 21 00 – Allowances and listed below:

General Contingency: $150,000.00

ALTERNATES

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" the total bid. If the alternate is left blank, then the Alternate would not change if the base bid if accepted.

The bidder agrees to construct the Alternate as described in the Contract documents for the following price. Acceptance of the alternate does not increase the contract time.

Alternate No. 1 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Pumps by B&G.

Add_____Dollars ($_____)

Alternate No. 2 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Pumps by Taco.

Add_____Dollars ($_____)

Alternate No. 3 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Valves and Actuators by Belimo.

Add_____Dollars ($_____)

Alternate No. 4 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Controls by Honeywell.

Add_____Dollars ($_____)

UNIT PRICES

1. Steel Bollard…… $_____per each
2. Fire Extinguisher…… $_____per each

TOTAL BID AMOUNT – Cleveland Elementary School

_____ ($_____)

The total bid amount includes alternated and allowances – does **NOT** include unit prices.

Principal SUB-BIDDERS: The undersigned further states that this bid is based on quotations received from the following subcontractors for the categories of work listed; he further agrees that if he is the successful Bidder, he will contract with the listed subcontractors for the performance of this work:

Mechanical Subcontractor: _____ License No: _____

Plumbing Subcontractor: _____ License No: _____

Electrical Subcontractor: _____ License No: _____

FOUR OAKS ELEMENTARY SCHOOL BID FORM

BASE BID

_____Dollars ($_____)

ALLOWANCES

General Construction Work Base Bid to include a General Contingency Allowance as specified in Section 01 21 00 – Allowances and listed below:

General Contingency: $250,000.00

ALTERNATES

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" the total bid. If the alternate is left blank, then the Alternate would not change if the base bid if accepted.

The bidder agrees to construct the Alternate as described in the Contract documents for the following price. Acceptance of the alternate does not increase the contract time.

Alternate No. 1 (Owner Preferred Alternate)
State the amount to be added to the Base Bid to provide Pumps by B&G.
Add_____Dollars ($_____)

Alternate No. 2 (Owner Preferred Alternate)
State the amount to be added to the Base Bid to provide Pumps by Taco.
Add_____Dollars ($_____)

Alternate No. 3 (Owner Preferred Alternate)
State the amount to be added to the Base Bid to provide Valves and Actuators by Belimo.
Add_____Dollars ($_____)

Alternate No. 4 (Owner Preferred Alternate)
State the amount to be added to the Base Bid to provide Controls by Honeywell.
Add_____Dollars ($_____)

Alternate No. 5 – Building 02 FCUs
State the amount to be added to the Base Bid to provide new Fand Coil Units in Building 02.
Add_____Dollars ($_____)

UNIT PRICES

1. Steel Bollard…… $_____per each
2. Fire Extinguisher…… $_____per each

TOTAL BID AMOUNT – Four Oaks Elementary School

_____ ($_____)

The total bid amount includes alternated and allowances – does **NOT** include unit prices.

Principal SUB-BIDDERS: The undersigned further states that this bid is based on quotations received from the following subcontractors for the categories of work listed; he further agrees that if he is the successful Bidder, he will contract with the listed subcontractors for the performance of this work:

Mechanical Subcontractor: _____ License No: _____

Plumbing Subcontractor: _____ License No: _____

Electrical Subcontractor: _____ License No: _____

SOUTH SMITHFIELD ELEMENTARY SCHOOL BID FORM

BASE BID

_____Dollars ($_____)

ALLOWANCES

General Construction Work Base Bid to include a General Contingency Allowance as specified in Section 01 21 00 – Allowances and listed below:

General Contingency: $150,000.00

ALTERNATES

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" the total bid. If the alternate is left blank, then the Alternate would not change if the base bid if accepted.

The bidder agrees to construct the Alternate as described in the Contract documents for the following price. Acceptance of the alternate does not increase the contract time.

Alternate No. 1 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Pumps by B&G.

Add_____Dollars ($_____)

Alternate No. 2 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Pumps by Taco.

Add_____Dollars ($_____)

Alternate No. 3 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Valves and Actuators by Belimo.

Add_____Dollars ($_____)

Alternate No. 4 (Owner Preferred Alternate)

State the amount to be added to the Base Bid to provide Controls by Honeywell.

Add_____Dollars ($_____)

UNIT PRICES

1. Steel Bollard…… $_____per each
2. Fire Extinguisher…… $_____per each

TOTAL BID AMOUNT – South Smithfield Elementary School

_____ ($_____)

The total bid amount includes alternated and allowances – does **NOT** include unit prices.

Principal SUB-BIDDERS: The undersigned further states that this bid is based on quotations received from the following subcontractors for the categories of work listed; he further agrees that if he is the successful Bidder, he will contract with the listed subcontractors for the performance of this work:

Mechanical Subcontractor: _____ License No: _____

Plumbing Subcontractor: _____ License No: _____

Electrical Subcontractor: _____ License No: _____

The Undersigned further agrees that in case of failure on his part to execute the said Contract and to furnish the bond within ten (10) consecutive calendar days after written notice being given of the award of the Contract, the check, cash, or bid bond accompanying this bid shall be paid into the funds of the Owner's account set aside for this project, as liquidated damages for such failure; otherwise the check, cash, or bid bond accompanying this proposal shall be returned to the Undersigned.

The Bidder acknowledges receipt of all Addenda as listed below and has taken them into account in preparation of his proposal.

Addendum No. 01 dated _____.

Addendum No. 02 dated _____.

Addendum No. 03 dated _____.

Respectfully submitted this _____ day of _____ 2025.

_____
(Name of Firm or Corporation making bid)

_____
By:

_____
Printed Name and Title: (Owner, Partner, President or Vice-President)

_____
Address:

_____
Email:

License # _____

(CORPORATE SEAL)

END OF SECTION

SECTION 004325
SUBSTITUTION FORM - DURING BID/PROCUREMENT

PART 1 GENERAL

1.01 PROJECT INFO:

PROJECT_____ PROJECT NUMBER_____
SUBSTITUTION REQUEST NO. _____DATE _____
SPECIFICATION TITLE_____ DIV. NUMBER_____
SECTION ___ ___ ___ PARAGRAPH _____

1.02 PROPOSED SUBSTITUTION:

A. Manufacturer: _____
B. Address:_____ Phone: _____
C. Trade Name: _____ Model Number: _____
D. Attachments (list each):
E. _____
_____
_____

THE UNDERSIGNED CERTIFIES:

1. Proposed Substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
2. Same warranty will be furnished for proposed substitution as for specified product.
3. Same maintenance service and source of replacement parts, as applicable, is available.
4. Proposed substitution will have no adverse affect on other trades and will not affect or delay progress schedule.
5. Proposed substitution does not affect dimensions and functional clearances.
6. Payment will be made for changes to the building design including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____
Signed by: _____
Firm: _____
Address: _____
_____
Phone: _____

A/E ACTION:

__ APPROVED __APPROVED AS NOTED __REJECTED __ REQUEST REC'D LATE

Signed_____ Date:_____

END OF SECTION 004325

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AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Johnston County Public Schools
Smithfield, NC

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

JCPS Four Oaks Elementary School HVAC Replacement
Four Oaks, NC

The Architect:
(Name, legal status, address and other information)

CPL Architects & Engineers, PC
Raleigh, NC

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum 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, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

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

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

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

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

Additions and Deletions Report for

AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 08:29:35 ET on 02/18/2025.

PAGE 1

Johnston County Public Schools
Smithfield, NC

...

JCPS Four Oaks Elementary School HVAC Replacement
Four Oaks, NC

...

CPL Architects & Engineers, PC
Raleigh, NC

PAGE 7

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with ~~a building information modeling exhibit,~~ AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with ~~a building information modeling exhibit,~~ AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

...

.4 ~~Building information modeling exhibit,~~ AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the ~~building information modeling exhibit~~ E203-2013 incorporated into this Agreement.)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:29:35 ET on 02/18/2025 under Order No. 3104239969 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

FRONT END SUBMISSION LOG

JCPS – FOUR OAKS ES – HVAC REPLACEMENT | R23.00325.00

Contractor Name: _____

SUBMISSIONS

Submission	Date Submitted	Date Approved	Remarks
Contract:			
Schedule of Values:			
Bonds:			
Insurance:			
Workers Comp:			
Auto Insurance:			
Safety Program:			
Schedule:			
Submittal Schedule:			
Emergency Contact:			
Substitution List:			
Subcontractor List:			
Project Manager:			
Superintendent:			

This log is to be used by the contractor to monitor and complete the required front-end submissions.

REQUEST FOR INFORMATION	RFI #:
	Date:

JCPS – FOUR OAKS ES – HVAC REPLACEMENT | R23.00325.00

Contractor Name: _____

To: _____ Firm: _____

From: _____

WE REQUEST YOUR ATTENTION (OR CONFIRMATION) REGARDING THE FOLLOWING:

Subject: _____

_____

Location: _____

_____

Information is Requested By: _____

MESSAGE: _____

Contractors Name: _____

By: _____ Date: _____

SUBCONTRACTOR LIST

JCPS – FOUR OAKS ES – HVAC REPLACEMENT | R23.00325.00

To: **CPL**
1111 Haynes St. Suite 100
Raleigh, NC 27604

From:
(Contractor) _____

_____

Contractors
No.: _____

Contract For: _____

List Subcontractors proposed for use on this Project as required by the Construction Documents. Attach supplemental sheets if necessary.

Section No.: _____ Section Title: _____
Firm Name: _____ Contact: _____
Address: _____

Section No.: _____ Section Title: _____
Firm Name: _____ Contact: _____
Address: _____

Section No.: _____ Section Title: _____
Firm Name: _____ Contact: _____
Address: _____

Section No.: _____ Section Title: _____
Firm Name: _____ Contact: _____
Address: _____

Section No.: _____ Section Title: _____

☐ Attachment(s)

Signed by: _____ Date: _____

Copies: ☐ Owner ☐ Consultants ☐ File
☐ ☐ ☐

ALLOWANCE DISBURSEMENT AUTHORIZATION

Owner _____
Architect/Engineer _____
Contractor _____
Field _____
Other _____
Other _____

JCPS – FOUR OAKS ES – HVAC REPLACEMENT | R23.00325.00

Allowance Disbursement No. _____ Initiation Date: _____

Contract For: _____

_____

To Contractor: _____

_____

Contract Date: _____

Not valid until signed by Owner, Architect/Engineer, and Contractor.

The Original Contract Allowance _____

Net Allowance Disbursements previously authorized _____

Charges to Contract Allowance as a result of this authorization _____

Current Contract Allowance Balance including this authorization _____

Owner: _____

Architect/
Engineer: _____
(CPL)

Contractor:

SUBSTITUTION REQUEST FORM

JCPS – FOUR OAKS ES – HVAC REPLACEMENT | R23.00325.00

To:
CPL
1111 Haynes St. Suite 100
Raleigh, NC 27604

From:
(Contractor) _____

_____

Re: _____ Substitution Request Number: _____

Contract For: _____

Specification Title: _____ Description: _____

Section Number: _____ Page: _____ Part: _____

Proposed Substitution: _____

MNFR: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: Address: Phone:

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

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect/Engineer: _____

Contractor: _____ Owner: _____

_____ Date Installed: _____

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

Savings to Owner for accepting substitution: _____ ($ _____)

Proposed substitution changes Contract Time: ☐ Yes; explain ☐ No ☐ Yes [Add] [Deduct] _____ days

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Reports ☐ _____

The Undersigned certifies:

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

Submitted By: _____

Signed By: _____

Firm: _____

Address _____

_____

Phone: _____

Attachments: _____

_____

_____

REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 013300.

☐ Substitution approved as noted - Make submittals in accordance with Spec. Section 013300.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed By: _____ Date: _____

Additional Comments: ☐ GC ☐ Subcontractor ☐ Supplier ☐ MNFRr ☐ Architect/Engineer

_____

_____

_____

SUBMITTAL COVER

(Attach to each submittal)

#
Submittal No. Contractor only

Architect Project Number:

Contractors Number:

Project Name:

Contractor:

Address:

Phone / Fax: ( )

Date returned:

TYPE OF SUBMITTAL

(Check one)

☐ Product Data ☐ Color Selection ☐ O&M Manual

☐ Shop Drawings ☐ Sample ☐ Record Document

☐ Other

DATE OF SUBMITTAL:

RESUBMITTED:

NUMBER OF ATTACHED:

SUBSTITUTION ☐ **YES** ☐ **NO**

See General Conditions

PRODUCT IDENTIFICATION

Specification Section No.:

Contract Dwg. No.:

Product Name:

Part/Paragraph:

Detail Reference:

Manufacturer:

CONTRACTOR APPROVAL

Identify that this submittal has been reviewed and approved by the Contractor in accordance with the General Conditions

By: _____ Date: _____

Deviation from Contract Documents:

Contractor Comments:

FOR USE BY CPL

SHOP DRAWING

☐ No Exception Taken ☐ Revise & Resubmit

☐ Furnish as Corrected ☐ Rejected

Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe satisfactory manner.

CPL

Date:_____ By: _____

Architect's Comments:

RECEIVED STAMP

SUPPLEMENTAL INSTRUCTION

PROJECT: _____ ASI NO.: _____

OWNER: _____ DATE: _____

CONTRACTOR: _____ ARCHITECT'S PROJECT NO.: _____

DESCRIPTION: _____ CONTRACT NO.: _____

CONTRACT DATE:

ATTACHMENT(S): _____

ACTION

☐ 1. *PROPOSAL REQUEST:* Submit an itemized quotation for changes in the Contract Sum and/or time required to implement the above proposed modifications to the Contract Documents. This is not authorization to proceed with the work.

☐ 2. *SUPPLEMENTAL INSTRUCTIONS:* Implement the above instructions without change to the Contract Sum and/or Time. Prior to proceeding, indicate acceptance below and return one copy to the Architect.

☐ 3. *CONSTRUCTION CHANGE DIRECTIVE:* Proceed with the above-described changes to the Contract Documents immediately. Submit final costs and/or change in Contract Time for inclusion in a subsequent Change Order.

Methods: ☐ Lump Sum ☐ Unit Price ☐ Time & Material Not-to-Exceed

Change in Contract Sum of _____

Change in Contract Time of _____ days

ISSUED:	ACCEPTED:	AUTHORIZED:
BY:_____	BY:_____	BY:_____
Architect Date	Contractor Date	Owner Date

☐ Owner ☐ Architect ☐ Structural ☐ Civil
☐ Contractor ☐ Field ☐ Mechanical/Electrical ☐ Other (Roofing)

SECTION 006000
PROJECT FORMS AND RELATED DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section lists the project forms used for administration of the project as well as documents used for administration and logistics

1.02 FORMS

A. The following forms are contained within the conditions of the contract section:
   1. FRONT END SUBMISSION LOG
   2. PROJECT REQUEST FOR INFORMATION (RFI) FORM
   3. SUBCONTRACTOR LIST
   4. ALLOWANCE DISBURSEMENT FORM
   5. SUBSTITUTION REQUEST FORM
   6. SUBMITTAL COVER
   7. INFORMATION BULLETIN

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

A. Front End Submission Log: This document is a checklist of the required submissions. Refer to Bidding Requirements, Section entitled “Instructions to Bidders” and Division 1, Specification Section entitled “SUBMITTAL PROCEDURES” for submission procedures.

B. Project Request For Information (RFI) Form: This form is to be used for information requests. The forms are filled out by any party to the contract and sent to the Architect/Engineer. The Architect/Engineer shall number RFI before processing.

C. Subcontractor List: This document is to be used identify subcontractors. The forms are filled out by each Prime Contractor for all proposed subcontractors and sent to the Architect/Engineer in accordance with. Division 1, section entitled “SUBMITTAL PROCEDURES”

D. Allowance Disbursement Form: the Architect/Engineer shall issue this document after all parties have agreed to the conditions of change to be charged to the Allowance Amount in accordance with Division 1, section entitled “ALLOWANCES”, if required.

E. Substitution Request Form: This document is to be used for a Contractor to propose substitutions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, section entitled “SUBMITTAL PROCEDURES” and “PRODUCT REQUIREMENTS”.

F. Submittal Cover: This document is to be used for submittal submissions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, section entitled “SUBMITTAL PROCEDURES”

G. Information Bulletin: The Architect/Engineer shall issue this document for 3 actions.
   1. PROPOSAL REQUEST: A quotations for changes in the Contract Sum and / or proposed modifications to the Contract Documents
   2. SUPPLEMENTAL INSTRUCTIONS: Instructions for changes to the Contract Documents without additional cost or time
   3. CONSTRUCTION CHANGE DIRECTIVE: A directive to immediately proceed with changes to the work of the contract and to submit final cost for inclusion into a Change Order

SECTION 006113
CONTRACTOR'S AFFIDAVIT AND PARTIAL RELEASE OF
CLAIMS AND LIENS FOR PROGRESS PAYMENT

STATE OF _____

COUNTY OF _____

I, _____, being duly sworn, state on personal knowledge that I am _____ (Title) of _____

(Contractor) and have authority to execute this Affidavit on behalf of the Contractor. I further state the following:

A. All the laborers, persons, firms and corporations having furnished services or materials for the construction of the **JCPS - FOES HVAC Replacement** have been paid in full for labor and materials furnished to date, except retention and unfounded change orders, and that upon completion of the work of each subcontractor or supplier, the Contractor will cause each such subcontractor and supplier to execute a Release and Waiver of Claim in the form required by the Contract Documents and shall further cause each such subcontractor and supplier to cancel any liens (if any) that may have been filed against the Project.

B. The work covered by this payment has been completed in accordance with the Contract Documents.

C. The Contractor hereby releases JOHNSTON COUNTY PUBLIC SCHOOLS from all lien rights, claims, or demands of any kind whatsoever which it now has against the construction of the Project arising of or in any way related to the furnishing of labor and materials on or before the date of this Affidavit, except for retainage and unfunded change orders.

D. To the best of the Contractor's knowledge and belief, no claims or claim of liens exist by or against any subcontractor or supplier who furnished materials or labor on the Project, and if any appear afterwards the Contractor shall hold JOHNSTON COUNTY PUBLIC SCHOOLS harmless on the account thereof. Contractor agrees to provide a lien removal bond at no cost to the Owner or its representatives within 15 days from request by the Owner or the Owner's representatives.

E. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien, plus all lien bonds, costs, interests, both prejudgment at a legal rate.

(CONTRACTOR)

BY: _____

Sworn to and subscribed before me

This _____ Day of ____ , 2025.

NOTARY PUBLIC _____

(Seal) My Commission Expires:_____

END OF SECTION 006113

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SECTION 006116
CONTRACTOR'S GENERAL WARRANTY

JOHNSTON COUNTY PUBLIC SCHOOLS
FOUR OAKS ELEMENTARY SCHOOL
FOUR OAKS, NORTH CAROLINA

.

The undersigned Contractor hereby warrants, in accordance with the applicable provisions and terms set forth in the Contract Documents, all materials and workmanship incorporated in the **Four Oaks Elementary School, FOUR OAKS, NC** against any and all defects due to faulty materials or workmanship or negligence for a period of 12 months, or such longer periods as set forth in the Contract Documents, from the effective date of this warranty. This Contractor further warrants all work incorporated in this project to remain leak-proof and watertight at all points for a period of 24 months from the effective date of this Warranty.

This Warranty shall be binding where defects occur due to normal usage conditions and does not cover willful or malicious damage, damages caused by acts of God or other casualty beyond the control of the Contractor.

This Warranty shall be in addition to other warranties and guarantees set forth in the Contract Documents and shall not act to constitute a waiver of additional protection of the Owner afforded, where applicable, by consumer protection and product liability provisions of law, and these stipulations shall not constitute waiver of any additional rights or remedies available to the Owner under the law.

Signed: _____

Name: _____

Title: _____

Date: _____

(Corporate Seal)

Subscribed and sworn before me

this_____ day of _____, 202__.

_____
(Notary Public)

END OF SECTION 006116

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SECTION 006119
ASBESTOS FREE AFFIDAVIT

JOHNSTON COUNTY PUBLIC SCHOOLS

FOR: FOUR OAKS ES - HVAC PROJECT
180 W HATCHER ST
FOUR OAKS, NC27524

THE UNDERSIGNED CONTRACTOR HEREBY WARRANTS THAT NO ASBESTOS-CONTAINING MATERIALS OF ANY KIND WERE USED IN THE CONSTRUCTION OF THE FOUR OAKS ELEMENTARY SCHOOL, FOR JOHNSTON COUNTY PUBLIC SCHOOLS, FOUR OAKS, NC.

THE UNDERSIGNED CONTRACTOR HEREBY WARRANTS THAT NO ASBESTOS-CONTAINING MATERIALS OF ANY KIND WERE USED IN THE HVAC REPLACEMENT PROJECT AT FOUR OAKS ELEMENTARY SCHOOL, FOR JOHNSTON COUNTY PUBLIC SCHOOLS, FOUR OAKS, NC.

Signed: _____

Name: _____

Title: _____

Date: _____

(Corporate Seal)

Subscribed and sworn before me this

_____ day of _____, 202__.

(Notary Public)

END OF SECTION 006119

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SECTION 007200
GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS ATTACHED FOLLOWING THIS PAGE.

RELATED REQUIREMENTS

2.01 SECTION 007300 - SUPPLEMENTARY GENERAL CONDITIONS.

END OF SECTION 007200

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

JCPS Four Oaks Elementary School HVAC Replacement
Four Oaks, NC

THE OWNER:
(Name, legal status and address)

Johnston County Public Schools
Smithfield, NC

THE ARCHITECT:
(Name, legal status and address)

CPL Architects & Engineers, PC
Raleigh, NC

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

The Specifications may describe (or the Drawings may show) the general placement required of materials or equipment, but the actual required placement may vary depending on the specific material or equipment used by the Contractor or the existing field conditions. The Contractor shall bear all direct and indirect costs associated with such variances.

Some Specifications may be written in a condensed outline form and omitted words shall be included by interference. If the Specifications identify a task, it shall mean the "Contractor shall furnish, install and complete" the identified task unless otherwise stated.

Reference to standard specifications, manuals or codes shall mean reference to the latest standard specification, manual or code in effect at the time of the execution of the Owner-Contractor Agreement, unless otherwise stated. When reference is made to a manufacturer, trade association, reference standard or similar source (such as ASTM, ASA, AISC, ACI, etc.) the standards or requirements of such entity shall be incorporated into the Specifications and have the force and effect as though they were set forth expressly. Upon entering into the Owner-Contractor Agreement, the Contractor acknowledges its familiarity with those references, codes, etc. The date of the referenced

standard shall be the latest edition in effect at the time of the execution of the Owner-Contractor Agreement unless otherwise stated.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of inconsistencies within or between parts of the Contract Documents, the Contractor shall (1) provide the better quality of Work or (2) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation. The terms and conditions of the Subparagraph 1.2.1, however shall not relieve the Contractor of any of the obligations set forth elsewhere in this Agreement. All work shall conform to the Contract Documents. No significant change there from shall be made without prior written authorization by the Owner. Where only part of the Work is indicated, similar parts shall be considered repetition. When any detail is shown and the components therefore are fully described, similar details shall be construed to require the same materials and construction. Items required by either the Drawings or the Specifications and not mentioned in the other shall be of like effect as if shown or mentioned in both. Should the Specifications and Drawings fail to particularly describe a product or material shown to be used in any place, the Contractor shall furnish the product that would normally be used in that place.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed nor to limit the scope of work performed by any trade or by any Subcontractor or supplier. Such separations shall not operate to make the Architect an arbiter to establish limits of work between Subcontractors or between Contractor and Subcontractor.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 Reference to "match existing" in Contract Documents refer to existing finishes, materials, details, and qualities which have been used in adjacent portions of existing facilities. Material designations or details not specifically shown shall either match existing or be similar in finish, material or quality to similar adjacent conditions.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Owner, Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Owner, Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3

Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities as necessary to complete the Project.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. Such order or stoppage by the Owner shall not constitute grounds for contract termination by the Contractor under Article 14 and shall not be the basis of Time Extensions by the Contractor under Article 8.3.

§ 2.5 Owner's Right to Carry Out the Work

§ 2.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

§ 2.5.2 The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner or Contractor (1) granted in the Contract Documents; (2) law; or (3) in equity.

§ 2.5.3 In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the Work. The owner assumes no responsibility for liability for the safety of the Project site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work; provided that the Owner shall be responsible for, and the Contractor shall upon discovery notify the Owner of, any unsafe condition created by the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

The Contractor shall rely on its own knowledge and its review and interpretation of the Contract Documents and data provided in entering into the Contract and not the representations of the Owner or other persons. The Contractor acknowledges that quantities provided in the Contract Documents are estimates only and Contractor shall not seek additional compensation or adjustment in price based on a variation in actual quantities.

Prior to execution of the Contract, the Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the

location, condition, layout, and nature of the Project site and surrounding areas, (ii) generally prevailing climatic conditions, (iii) anticipated labor supply and costs, and (iv) availability and cost of materials, tools, and equipment.

The location of existing features shown on plans is intended for general information only. The Contractor, alone, is responsible for accurate determination of the location of all structures, and shall not be entitled to any extra payment for discrepancies between the Work as shown in the Contract Documents and existing conditions.

The locations, depths and data as to underground conditions have been obtained from records, surface indications and data furnished by others. Information furnished is solely for the convenience of the Contractor without any warranty, expressed or implied as to its accuracy or completeness. The Contractor shall verify all existing conditions prior to commencing the Work. The Contractor shall make no claim against the Owner or Architect with respect to the accuracy or completeness of such information if the conditions found after commencement of the Work are different from those as indicated.

The Contractor shall be solely responsible for the conditions which develop during construction and in the event any structure is dislocated, or over strained, or damaged so as to affect its usefulness, the Contractor shall correct or repair any dislocations, over strains or damages caused.

The Contractor is responsible for restoration and/or repair of utilities, private property, buildings, pavement, walkways, roads, etc. damaged by its activities during the performance of its Work.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

The Contractor shall assume full responsibility for accuracy of measurements obtained at the site. No extra compensation will be allowed because of differences between actual measurements and dimensions indicated on the Drawings, nor for Contractor's failure to coordinate work with actual field measurements.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.5 The Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Owner. The Contractor shall report to the Architect whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The Contractor shall employ a licensed surveyor to locate and stake out the Work and establish necessary reference and bench marks. The contractor shall work from established bench marks and reference points, layout and correctly establish all lines, levels, grades and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

§ 3.3.5 Prohibitions: There shall be no use of tobacco products, alcohol or illegal drugs at the construction site. No weapons are permitted at the construction site. Contractor and its agents shall refrain from the use of profanity or dressing in any way that is disrespectful or harassing to legally protected groups, including but not limited to race, color, sex, age, disability, religion, national orientation or sexual orientation.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

.1 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

.2 Contractor shall confine construction equipment, the storage of materials and equipment and the operations of all workers to areas permitted by law, ordinances, permits or the Contract Documents, and shall not disturb the premises more than required for the proper performance of the Work and/or permitted by the Owner.

.3 Contractors and Subcontractors warrant that they have good title to all materials used in performing Work on this Contract.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

After the Contract has been executed, the Owner and Architect will consider requests for the substitution of products in place of those specified only if the Contractor satisfies the procedural requirements set forth in the General Requirements (Division 01) of the Specifications. By making requests for substitutions, the Contractor:

.1 Represents that is has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

.2 Represents that it will provide the same warranty for the substitution as it would have provided for the product specified;

.3 Certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that may subsequently be incurred by the Contractor; and

.4 Shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

§ 3.4.2.1 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed upon changes in the Drawings and Specifications resulting from such substitutions. The Owner may seek reimbursement pursuant to the procedures set forth in **§ 9.5.1.**

§ 3.4.2.2 The Contractor shall bear all expenses resulting from substitutions including the cost General Conditions as well as any structural, plumbing, mechanical and electrical trade costs made necessary by the substitution.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 The Owner shall have the right, but not the obligation, to require the Contractor to remove and replace, with a person acceptable to Owner, promptly after notice from Owner, any employee of Contractor or Subcontractor who: (1) has engaged in conduct on Owner's property that is contrary to the requirements of any applicable law, the Contract Documents, or any rule or directive of Owner relating to conduct on Owner's property; or (2) is incapable of fulfilling its responsibilities in connection with the Project.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

3.6.1 The Contractor shall provide the Owner with two (2) notarized invoices with an itemized listing and supporting data for all such taxes paid, and the Owner shall reimburse the Contractor for such payments. Supporting documentation shall be in conformance with requirements of the State in which the Project is located.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

.1 The Contractor shall promptly deliver copies of such documents to the Owner.

.2 If in connection with the Project, the Owner has obtained certain permits, licenses or agreements for the Project, the Owner will furnish copies of these documents to the Contractor. It is the Contractor's responsibility to comply with any conditions or limitations placed on the Project by these permits. The Contractor shall fully cooperate with the Owner in meeting the permit requirements and accommodations of regulatory inspections / directives.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to give such notices as applicable to the performance of the Work, the Contractor shall be liable for and shall indemnify and hold harmless the Owner against any and all resulting fines, penalties, judgments or damages, including reasonable attorney fees, imposed on or incurred by the parties indemnified, as a result of such failure by the Contractor

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.7.6 Upon completion of the Work, the Contractor shall deliver to the Architect original copies of all required final certificates of inspection, the Certificate of Occupancy, the other documents evidencing that inspections required by authorities having jurisdiction over the Work have been performed

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum 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, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** 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 Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

The Contractor's superintendent shall not be removed from this Project until the Project punch list has been completed and the Project has been accepted by the Owner. Unless approved otherwise by the Owner in advance, the Contractor's superintendent shall be assigned solely to this Project and shall not perform any duties or superintendence on any other Project until completion of this Project.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.1.1 The Construction Schedule shall be a Critical Path Method (CPM) type of schedule, consisting of: (1) a single critical path delineation and other sequencing, and early and late start, float, and completion dates for each activity; and (2) milestones, interrelationships, and restraints for all activities, including Owner-awarded contracts through the date of Project completion. The Construction Schedule must show all activities necessary for Substantial and Final Completion as defined in Section 9.8, Section 9.10, and elsewhere in the Contract Documents.

§ 3.10.1.2 When the Construction Schedule is complete, the Contractor, after consultation with all Subcontractors and material suppliers, shall confirm in writing to the Architect that the Construction Schedule is reasonable and achievable by the Contractor, subject to any extensions of time as provided for elsewhere in the Contract Documents. The Contractor shall thereafter give prompt specific notice to the Owner and the Architect of any change in the logic of the Construction Schedule or any part thereof, the removal of any restraints, or the reduction of any durations.

§ 3.10.1.3 Periodic meetings will be held at least monthly or at more frequent times, as required by the Work, to assess the state of the completion of the Project and to update the Construction Schedule as necessary. In advance of each such meeting, Contractor shall provide Owner a written status report identifying whether the Work is on schedule in accordance with the Construction Schedule or whether there are anticipated or potential delays to any critical path elements in the construction of the Work (in which event Contractor shall provide notice and an analysis as reasonably requested by Owner)

§ 3.10.1.4 The Construction Schedule shall be revised at least monthly or at more frequent times as required by conditions of the Work, and shall provide for expeditious and practicable execution of the Work consistent with the Contract Time. The Architect and Owner shall be provided copies of the Construction Schedule as periodically updated and in electronic format, as maintained by the Contractor.

§ 3.10.1.5 In the event that any updated Construction Schedule indicates a projected Substantial Completion date that is more than thirty (30) days after the required Substantial Completion date (as the same may be extended by Change Order for Excusable Delay), the Owner shall have the right to direct the Contractor to take corrective

measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, facilities, (3) rescheduling activities, and (4) other similar measures (hereinafter referred to collectively as "Recovery Measures"). Such Recovery Measures shall continue until the progress of the Work complies with the state of completion required by the Construction Schedule. The Owner's right to require Recovery Measures is solely for the purpose of ensuring the Contractor's compliance with the Construction Schedule.

.1 The Contractor shall not be entitled to seek and adjustment in the Contract Sum in connection with Recovery Measures required by the Owner, unless they are incurred by Contractor as directed in writing by Owner to mitigate or offset Excusable Delay.

.2 The Owner may exercise the rights furnished to the Owner under or pursuant to this Subparagraph 3.10.1.5 as frequently as is reasonably necessary to ensure that the Contractor's performance of the Work will comply with any milestone date or completion date set forth in the Construction Schedule.

§ 3.10.1.6 The Contractor is solely responsible for the timing, sequencing coordination, and supervision of the work in accordance with the approved Construction Schedule. Review or approval of the initial Construction Schedule and subsequent reviews of the Construction Schedule by the Architect and Owner do not operate to imply agreement by the Architect or Owner that the means and methods of planning of the Work utilized by the Contractor are adequate or will accomplish the Work in the time shown on the Construction Schedule. The Contractor shall take all actions necessary to ensure the Work's successful planning and execution within the stipulated Contract Time. Additionally, review or approval of the Construction Schedule by the Owner or its consultants shall not make the Owner or its consultants responsible for Contractor's scheduling obligations or the accuracy of the Construction Schedule prepared by the Contractor.

§ 3.10.1.7 The Contractor represents to the Owner that the initial Construction Schedule and all subsequent Construction Schedules (including updates and amendments) have been prepared in good faith and are accurate to the best of the Contractor's knowledge.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's review. The Architect's review shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a contract with the Contractor.

§ 3.10.4 The Owner shall have the reasonable right to direct postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operation of the Owner's premises or any tenants or invitees, thereof. The Contractor shall, upon the Owner's reasonable request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Subparagraph 3.10.5 may be grounds for an extension of the Contract Time, if permitted under Subparagraph 8.3.1, and an equitable adjustment in the Contract Sum if (1) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents, and (2) such rescheduling or postponement is required by the Owner.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the Architect's reviewed Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 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.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged. Contractor shall submit samples requiring color or finish selection in a single, coordinated submittal. The Architect will issue no color or finish schedule until all samples and other data necessary for making complete color selections for the project are received.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule reviewed by the Architect. The Architect shall have no responsibility to review any Shop Drawings, Product Data, Samples or similar submittals unless and until the Contractor has submitted and received back from the Architect approved reviewed submittal schedule as required under Section 3.10.2. In addition, it is not the Architect's responsibility to ensure that all required Shop Drawings, Product Data, Samples or similar submittals that are required to be submitted and reviewed under the Contract Documents are submitted by the Contractor. Submissions of Shop Drawings, Product Data, Samples or similar submittals is solely the Contractor's responsibility.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 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 reviewed and commented on by the Architect.

§ 3.12.8 The Work shall be in accordance with reviewed submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has indicted in writing that there is no exception to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued 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's review thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's action on a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, and take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.10.1 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

.1 Due to the site constraints, only materials and equipment that are to be used in the Work shall be brought to and stored on the Project site by the Contractor. After materials and equipment are no longer required for the Work, they shall be promptly removed from the Project site. Protection of materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and adjacent areas.

.2 The Contractor shall not permit any workers to use existing facilities at the Project site, including, without limitation, lavatories, entrances and parking areas other than those designated and approved by the Owner.

.3 The Contractor shall comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives, or require compliance with the existing requirements of the rules and regulations.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor without written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.14.3 All cutting and patching work shall be done by the Contractor (or through the appropriate Subcontractor). Patches in finish surfaces shall match the adjacent surfaces in material, finish, detail, and quality. Patches in fire rated construction or construction required to be smoke tight shall be made in conformance with assemblies designed and tested by agencies recognized by governing codes. Any UL rated fire safing materials, flanges, or other materials required by Code, the Contract Documents, or manufacturers installation instructions for devices penetrating the work affected shall be applied an installed by an approved firestop subcontractor or qualified personnel from the applicable trade.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall lawfully remove and dispose of waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, or if not specified in the Contract Documents, then within 48 hours of an Owner request, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by 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. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 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 3.18.1 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.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor to maintain the Project Schedule or for defects and deficiencies in the Work. The Owner may seek reimbursement pursuant to the procedures set forth in **§ 9.5.1.**

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work. All costs made necessary by such failure, including those of repeated procedures shall be at Contractor's sole expense, including reasonable compensation for Architect's services and expenses.

§ 4.2.7 The Architect will review the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with the most recently reviewed submittal schedule or, in the absence of a submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals 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, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's review of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct site visits to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

.1 The Contractor's request for information shall be prepared and submitted in accordance with the General Requirements (Division 01 of the Specifications) on the form included therein or as otherwise approved in advance. The Architect will return requests for information that do not conform to requirements of the Contract Documents.

.2 The Architect's response to a request for information (RFI), or issuance of a clarification or interpretation shall be considered an interpretation, clarification, supplemental information or an order for a minor change in the Work not involving an adjustment in Contract Sum or extension of Contract Time and not inconsistent with the intent of the Contract Documents, and shall be binding, unless indicated otherwise in the Architect's response to the RFI.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, but prior to the first Application for Payment, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

The listing required by this Section shall be submitted to the Architect no later than 30 days from the date of the Agreement. This list shall include the names of manufacturers, suppliers, and installers proposed for each of the products, equipment, and materials to be incorporated into the project.

The Contractor shall furnish upon request adequate data on any named entity on the list in order to permit the Architect and the Owner to conduct a proper evaluation. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents and all products furnished by the listed manufacturer must conform to such requirements.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.1 The division of the Specifications into sections is not intended to control the Contractor in dividing the work among subcontractors nor to limit the scope of work performed by any trade under a given section. The Architect will not undertake to settle any differences between the Contractor and its Subcontractors as to the responsibility for completing all Work in the Specifications. It shall be entirely the Contractor's responsibility to properly coordinate and complete all the Work described in the Specifications whether performed by the Contractor or its Subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, provided that the Owner shall not be under any obligation to compensate the Subcontractor with respect to amounts that the Owner has already paid to the Contractor for such Subcontractor's work.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

§ 5.4.4 Nothing in the Contract Documents shall be deemed to create any contractual relationship between any Subcontractor of any tier and the Owner, or between the General Contractor or Subcontractor of any tier and the Architect.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work.

Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 Unless otherwise agreed to in writing by the Owner and the Contractor, the combined overhead and profit that shall be included in the total cost (or credit) to the Owner for a Change in the Work shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces:
1. 15% on the first $25,000 of the change order direct cost of self-performed work,
2. 10% on the portion of the change order direct cost of self-performed work between $25,000 and $50,000 and
3. 7.5% on the portion of the change order direct cost of self-performed work between $50,000 and $200,000 and
4. 5% on the portion of the change order direct cost of self-performed work greater than $200,000.

.2 For the Contractor, for Work performed by the Contractor's Subcontractor five percent (5%) of the amount due the Subcontractor.

.3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7 and shall be itemized (including labor costs).

§ 7.2 Change Orders

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

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 A Change Order, when issued, shall be full compensation, or credit, for the extra Work performed, omitted, or substituted. It shall show on its face, any adjustment in time for completion of the Project as a result of the Change in the Work. Each Change Order shall include all costs related thereto, including all overhead, miscellaneous expenses, and incidentals.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

.5 **Calculation of overhead and profit shall be consistent with Section 7.1.4.**

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.1.4. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum and/or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and/or Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured in accordance with Section 7.1.4.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay

authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

In the event that the Owner, the Contractor or the Architect is delayed or hindered in or prevented from the performance of any act required by the Contract Documents by reason of a labor dispute, fire, failure of power, unusual delay in deliveries, adverse weather conditions not reasonably anticipatable, unavoidable casualties or other causes of a like nature beyond the Owner's, the Contractor's or the Architect's control, the Contractor (or its Subcontractors) shall not be entitled to any additional compensation.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15; however, The Contractor's Claims, if any, for any increase in Contract Time must be made in accordance with the time requirements of this Section. Claims for an increase in Contract Time must be made in writing to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims must be initiated within seven (7) days after the Contractor has notice of the delay (initial notice). Thereafter, the Contractor must provide full details and support documentation with regard to the cause of the delay within twenty-one (21) days of the initial notice of the delay. If either the initial notice or the supporting documentation is not submitted to the Initial Decision Maker with a copy to the Architect, if the Architect is not the Initial Decision maker, in writing within the time periods prescribed in this Section, the Claim for an increase in Contract Time shall be waived. If the cause for the delay is a continuing one then only one Claim is necessary. The Contractor's supporting documentation to the Initial Decision Maker and/or Architect shall include an estimate of cost, if any, and of the probable effect of the delay on the progress of the Work and the Project Schedule.

§ 8.3.3 Unless expressly provided otherwise in the Contract Documents, an extension of the Contract Time, to the extent permitted under Subparagraph 8.3.1 shall be the sole remedy of the contractor for any (1) delay in the commencement, prosecution, or completion of the Work, (2) hindrance or obstruction in the performance of the work, (3) loss of productivity, or (4) other similar claims (collectively referred to in this Subparagraph 8.3.3 as "Delays") whether or not such Delays are foreseeable unless a Delay is caused by acts of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner (an "Owner-Caused Delay"), in which case the Contractor shall also be entitled to an equitable adjustment of the Contract Sum provided that the Contractor provides to the Owner written notice of such Owner-Caused Delay within ten (10) days of the occurrence of the event giving rise to such Owner-Caused Delay or within ten (10) days after the Contractor first recognizes the condition giving rise to such Owner-Caused Delay, whichever is later.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

(Paragraph Deleted)

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.2.1 The Contractor and each Subcontractor shall prepare a trade payment breakdown for the work for which it is responsible, such breakdown being submitted on a uniform standardized form reasonably approved by the Architect and Owner (AIA G703). The form shall be divided in detail sufficient to exhibit area, floors, and/or sections of the Work, and/or by convenient units and shall be updated as required by either the Owner or the Architect as necessary to reflect (1) description of Work (listing labor and material separately), (2) total value, (3) percent of the work completed to date, (4) value of the work completed to date, (5) percent of previous amount billed, (6) previous amount billed, (7) current percent completed, and (8) value of Work completed to date. Any trade breakdown that unreasonably fails to include sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (including of normal retainage) to complete the Work.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

The form Application for Payment, duly notarized, shall be the most recent authorized edition of AIA Document G702, Application and Certificate for Payment, supported by the most recent authorized edition of AIA Document G703, Continuation Sheet.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 Each Application for Payment shall be submitted electronically and in four (4) hard copies and shall be accompanied by the following, in all form and substance reasonably satisfactory to the Owner; (1) a current conditional Contractor's waiver of claims and liens, and duly executed an acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material supplier in the requested progress payment, and the amount to be paid to the Contractor from such progress payment together with similar sworn statements from all such subcontractors and material suppliers; (2) duly executed unconditional waivers of claims and liens from all Subcontractors and, when appropriate, from material suppliers and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or information and materials required to comply with the requirements Contract Documents or reasonably requested by the Owner or the Architect or required by the Owner's title insurer.

§ 9.3.1.4 Until Substantial Completion, the Owner shall pay the Contractor ninety-five percent (95%) of the amount due the Contractor.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. Such payment by the Owner for materials, equipment, fixtures and supplies stored on or off the Site shall not relieve the Contractor of its responsibility to provide reasonable protection of said materials, equipment, fixtures and supplies until their incorporation into the Work.

§ 9.3.3 The Contractor warrants 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 Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.3.3.1 The Contractor further expressly undertakes to defend the Owner, against any actions, lawsuits, or proceedings brought against the Owner as a result of liens related to the Work unless the reason for the lien is the nonpayment by the Owner to the Contractor in accordance with the Contract Documents (referred to as "liens" in this Subparagraph). The Contractor hereby agrees to indemnify and hold the Owner harmless against any such liens or claims of liens and agrees to pay any final judgment or lien if the reason for the judgment or lien is the nonpayment by the Owner to Contractor in accordance with the Contract Documents.

§ 9.3.3.2 The Owner shall release any payments withheld due to a lien or claim of lien if the Contractor obtains security acceptable to the Owner or a lien discharge bond that is (1) issued by a surety acceptable to the Owner; (2) in form and substance satisfactory to the Owner, and (3) in an amount required by law to release such lien claim. By posting a lien discharge bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under Subparagraph 9.3.3.1 including without limitation, the duty to defend and indemnify the Owner. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a Separate Contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 repeated failure to carry out the Work in accordance with the Contract Documents; or

.8 any other reasonable grounds for objection or withholding as provided in the agreement or as permitted by law.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld. The Owner shall not be deemed in default by reason of withholding payment while any conditions described in 9.5.1 remain.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its option, issue joint checks to the Contractor and to any Subcontractor for material and/or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.2.1 The Contractor shall indemnify and hold the Owner harmless from laborers, mechanics and materialmen liens upon the Owner's properties or the premises upon which the work is located, arising out of the work performed or materials furnished by the Contractor or any of its Subcontractors or any material suppliers under the Contract.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4. The Owner shall have no obligation to pay or reimburse a Contractor for payments to material and equipment suppliers until materials and supplies have been delivered on site or to an offsite storage facility which is bonded and secured.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall

require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately, and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use, and shall require that: (1) the Work is operational and usable for the purposes intended; and (2) all required governmental permits, approvals and temporary or permanent certificates of occupancy have been properly and validly issued. Substantial completion shall not be withheld due to Owner's failure to occupy or use based on any reason that is not the responsibility of the Contractor under the Contract Documents or is caused by circumstances beyond Contractor's control

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections pursuant to Section 9.5.1.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion will not be issued until after the Architect and Owner have determined that: (1) the Work and all systems are operational and otherwise complete and ready for unobstructed, lawful use and occupancy by the Owner; (2) the governmental agency that issued the building permit has issued a certificate of occupancy; (3) all testing (including but not limited to TAB, Envelope, Commissioning, etc.) are completed and required corrections revealed by these tests are completed; (4) the Project has been accepted by each regulatory body

having jurisdiction, and (5) the only items of Work remaining to be completed are of a minor nature such as touch-up, adjustments, testing, corrections, and omissions to be remedied, as may appear on the final list made during inspection by the Architect and Owner.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect 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.

§ 9.9.3 Unless otherwise agreed upon, 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.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.1.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections. The Owner may seek reimbursement pursuant to Section 9.5.1.

§ 9.10.1.2 The final payment of retained amount due the Contractor on account of the Contract shall not become due until the Contractor has furnished to the Owner, through the Architect, completion documents as enumerated below, or as otherwise required in the Contract Documents.

.1 One (1) hard copy and one electronic Record Set of Drawings showing actual construction of all portions of the Work and incorporating all changes and amendments thereto, as redlined against the 100% Construction Drawings.

.2 Guarantees and Warranties required by specific Sections of the Specifications.

.3 Release and Waiver of Claims, conditioned upon Final Payment, by the General Contractor, Subcontractors, Sub-subcontractors and materials suppliers.

.4 All mechanical and electrical installation, operating and maintenance manuals called for under the Specifications.

.5 All test reports and certifications required under the mechanical and electrical specifications.

.6 All forms required to be completed by the Contractor by regulatory governmental agencies with two copies delivered to the Architect.

.7 Shop Drawing submittals in accordance with Article 3.

.8 A copy of the unconditional Occupancy Permit or Certificate of Compliance issued by the local Building Inspection Department have Jurisdiction, unless such is not issued for any reason that is not the responsibility of the Contractor under the Contract Documents or is caused by circumstances beyond Contractor's control.

.9 Manufacturer's current detailed installation instructions for fire dampers, ceiling radiation dampers, smoke dampers, and duct smoke detectors as applicable to the Project

.10 One (1) copy of the equipment operational and maintenance manuals.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and 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, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents;

.3 terms of special warranties required by the Contract Documents; or

.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a 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.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.2.1 In the event that review, inspection or other action by regulatory agencies or other parties results in the imposition of fines, fees, or other costs due to the failure of the Contractor to comply with said applicable laws, ordinance, rules, regulations and lawful orders, the Contractor shall hold harmless the Owner, owner's Consultants, the Architect, and Owner's separate contractors, if any, from all consequences arising from the Contractor's non-compliance.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contactor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below (and such insurance shall be from a company that is A rated or better by A.M Best Company) which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed.

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

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

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death or a person or property damage arising out of ownership, maintenance or use of a motor vehicle.

.7 Claims for bodily injury or property damage arising out of completed operations; and **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 (or as described in the Agreement or other corresponding Exhibit setting forth the specific insurance requirements) shall be written for not less than limits of liability specified by the Owner or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the
final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within not less than twenty (20) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.1.5 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in who or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.6 Insurance Requirements
Refer to Owner Contractor Agreement.

§ 11.1.7 PERFORMANCE BOND AND PAYMENT BOND
§ 11.1.7.1 The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the jurisdiction where the Project is located, in form and substance satisfactory to the Owner and, without limitation, complying with the following specific requirements:

.1 Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.

.2 Bonds shall be executed by a responsible surety licensed in the jurisdiction where the Project is located, with a Best's rating of no less than A/XII, and shall remain in effect for a period not less than two (2) years following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

.3 The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to the Contract Sum and all subsequent increases.

.4 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power-of-attorney indicating the monetary limit of such power.

.5 Every Bond under this Subparagraph 11.4.1 must display the Surety's Bond Number. A rider including the following provisions shall be attached to each Bond:

(i) The Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Any addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder, and notice to the Surety of such matters is hereby waived.

(ii) The Surety agrees that it is obligated under the bonds to any successor, grantee, or assignee of the Owner.

1. .6 Bonds shall be written on AIA Document 312.
2. .7 If the surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 11.4.1 Contractor shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to Owner.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a

duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

(Paragraphs Deleted)

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents,

any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 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.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that 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 Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.1.1 In all operations under the Contract, the Contractor agrees that it will comply with provisions of all State and Federal Laws (including OSHA) and all local ordinances which may affect such operations.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. 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. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal 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 Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 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 Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

(Paragraphs Deleted)

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

(Paragraphs Deleted)

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work,

repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.
- **.5** fails to implement measures that will bring the work into conformity with the approved Project Schedule.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

§ 14.4.4 The Contractor shall include in each of its subcontracts a clause, similar in effect to the provisions in Paragraph 14.4, allowing the Contractor to terminate the subcontract for its sole convenience, subject only to the payment obligations set forth in Paragraph 14.4.3.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. The Contractor shall accompany the Claim with a written analysis with a proposed revision to the Schedule illustrating the claimed influence of the basis for delay on the critical path of the Work and the applicable deadlines that may be impacted. Contractor will exercise reasonable efforts to mitigate the potential impact of any delay but shall be compensated for any costs associated therewith.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction. The time for performance of this Contract, as set forth in the Construction Schedule, shall include an allowance for delays due to reasonably anticipated adverse weather for the area where the Work is located. For the purpose of establishing that abnormal adverse weather conditions have caused a delay, and determining the extent of delay attributed to such weather conditions, the Contractor shall furnish with its claim, National Oceanic and Atmospheric Administration (NOAA) National Weather Service records of climatic conditions during the same time interval for the previous five (5) years for the locality of the Work; the Contractor's daily job site logs/daily construction reports showing weather, job activities, and the effect of weather on the progress of the Work; and an impact schedule showing the effects of the weather event on the critical path of the Contractor's Construction Schedule. Time extensions for weather delays and related impact do not entitle the Contractor to extended overhead recovery or to any other monetary compensation associated with that claim unless approved in writing by the Owner.

§ 15.1.6.3 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which have concurrent or interrelated effects on the progress of the Work.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

Additions and Deletions Report for
AIA® Document A201® – 2017

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JCPS Four Oaks Elementary School HVAC Replacement
Four Oaks, NC

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Johnston County Public Schools
Smithfield, NC

...

CPL Architects & Engineers, PC
Raleigh, NC

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ARTICLE 1 GENERAL PROVISIONS

...

The Specifications may describe (or the Drawings may show) the general placement required of materials or equipment, but the actual required placement may vary depending on the specific material or equipment used by the Contractor or the existing field conditions. The Contractor shall bear all direct and indirect costs associated with such variances.

...

Some Specifications may be written in a condensed outline form and omitted words shall be included by interference. If the Specifications identify a task, it shall mean the "Contractor shall furnish, install and complete" the identified task unless otherwise stated.

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Reference to standard specifications, manuals or codes shall mean reference to the latest standard specification, manual or code in effect at the time of the execution of the Owner-Contractor Agreement, unless otherwise stated. When reference is made to a manufacturer, trade association, reference standard or similar source (such as ASTM, ASA, AISC, ACI, etc.) the standards or requirements of such entity shall be incorporated into the Specifications and have the force and effect as though they were set forth expressly. Upon entering into the Owner-Contractor Agreement, the Contractor acknowledges its familiarity with those references, codes, etc. The date of the referenced

standard shall be the latest edition in effect at the time of the execution of the Owner-Contractor Agreement unless otherwise stated.

...

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of inconsistencies within or between parts of the Contract Documents, the Contractor shall (1) provide the better quality of Work or (2) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation. The terms and conditions of the Subparagraph 1.2.1, however shall not relieve the Contractor of any of the obligations set forth elsewhere in this Agreement. All work shall conform to the Contract Documents. No significant change there from shall be made without prior written authorization by the Owner. Where only part of the Work is indicated, similar parts shall be considered repetition. When any detail is shown and the components therefore are fully described, similar details shall be construed to require the same materials and construction. Items required by either the Drawings or the Specifications and not mentioned in the other shall be of like effect as if shown or mentioned in both. Should the Specifications and Drawings fail to particularly describe a product or material shown to be used in any place, the Contractor shall furnish the product that would normally be used in that place.

...

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be ~~performed by any trade.~~performed nor to limit the scope of work performed by any trade or by any Subcontractor or supplier. Such separations shall not operate to make the Architect an arbiter to establish limits of work between Subcontractors or between Contractor and Subcontractor.

...

§ 1.2.4 Reference to "match existing" in Contract Documents refer to existing finishes, materials, details, and qualities which have been used in adjacent portions of existing facilities. Material designations or details not specifically shown shall either match existing or be similar in finish, material or quality to similar adjacent conditions.

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§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Owner, Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

...

§ 1.5.2 The Owner, Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

...

The parties shall agree upon ~~written~~ protocols governing the transmission and use ~~of, and reliance on,~~ of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

...

Any use of, or reliance on, all or a portion of a building information model without agreement to ~~written~~ protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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§ 2.2.3 ~~After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.~~

...

~~§ 2.2.4~~ Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

...

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing ~~facilities.~~facilities as necessary to complete the Project.

...

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor ~~to whom the Contractor has no reasonable objection and~~ whose status under the Contract Documents shall be that of the Architect.

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If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. Such order or stoppage by the Owner shall not constitute grounds for contract termination by the Contractor under Article 14 and shall not be the basis of Time Extensions by the Contractor under Article 8.3.

...

§ 2.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

...

§ 2.5.2 The rights stated in this Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner or Contractor (1) granted in the Contract Documents; (2) law; or (3) in equity.

...

§ 2.5.3 In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the Work. The owner assumes no responsibility for liability for the safety of the Project site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work; provided that the Owner shall be responsible for, and the Contractor shall upon discovery notify the Owner of, any unsafe condition created by the Owner.

...

~~**§ 3.1.1** The~~ **§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

...

The Contractor shall rely on its own knowledge and its review and interpretation of the Contract Documents and data provided in entering into the Contract and not the representations of the Owner or other persons. The Contractor acknowledges that quantities provided in the Contract Documents are estimates only and Contractor shall not seek additional compensation or adjustment in price based on a variation in actual quantities.

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Prior to execution of the Contract, the Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, (ii) generally prevailing climatic conditions, (iii) anticipated labor supply and costs, and (iv) availability and cost of materials, tools, and equipment.

...

The location of existing features shown on plans is intended for general information only. The Contractor, alone, is responsible for accurate determination of the location of all structures, and shall not be entitled to any extra payment for discrepancies between the Work as shown in the Contract Documents and existing conditions.

...

The locations, depths and data as to underground conditions have been obtained from records, surface indications and data furnished by others. Information furnished is solely for the convenience of the Contractor without any warranty, expressed or implied as to its accuracy or completeness. The Contractor shall verify all existing conditions prior to commencing the Work. The Contractor shall make no claim against the Owner or Architect with respect to the accuracy or completeness of such information if the conditions found after commencement of the Work are different from those as indicated.

...

The Contractor shall be solely responsible for the conditions which develop during construction and in the event any structure is dislocated, or over strained, or damaged so as to affect its usefulness, the Contractor shall correct or repair any dislocations, over strains or damages caused.

...

The Contractor is responsible for restoration and/or repair of utilities, private property, buildings, pavement, walkways, roads, etc. damaged by its activities during the performance of its Work.

...

The Contractor shall assume full responsibility for accuracy of measurements obtained at the site. No extra compensation will be allowed because of differences between actual measurements and dimensions indicated on the Drawings, nor for Contractor's failure to coordinate work with actual field measurements.

...

§ 3.2.5 The Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Owner. The Contractor shall report to the Architect whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

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§ 3.3.4 The Contractor shall employ a licensed surveyor to locate and stake out the Work and establish necessary reference and bench marks. The contractor shall work from established bench marks and reference points, layout and correctly establish all lines, levels, grades and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

...

§ 3.3.5 Prohibitions: There shall be no use of tobacco products, alcohol or illegal drugs at the construction site. No weapons are permitted at the construction site. Contractor and its agents shall refrain from the use of profanity or dressing in any way that is disrespectful or harassing to legally protected groups, including but not limited to race, color, sex, age, disability, religion, national orientation or sexual orientation.

...

.1 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

...

.2 Contractor shall confine construction equipment, the storage of materials and equipment and the operations of all workers to areas permitted by law, ordinances, permits or the Contract Documents, and shall not disturb the premises more than required for the proper performance of the Work and/or permitted by the Owner.

...

.3 Contractors and Subcontractors warrant that they have good title to all materials used in performing Work on this Contract.

...

After the Contract has been executed, the Owner and Architect will consider requests for the substitution of products in place of those specified only if the Contractor satisfies the procedural requirements set forth in the General Requirements (Division 01) of the Specifications. By making requests for substitutions, the Contractor:

...

.1 Represents that is has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

...

.2 Represents that it will provide the same warranty for the substitution as it would have provided for the product specified;

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.3 Certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that may subsequently be incurred by the Contractor; and

...

.4 Shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

...

§ 3.4.2.1 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed upon changes in the Drawings and Specifications resulting from such substitutions. The Owner may seek reimbursement pursuant to the procedures set forth in **§ 9.5.1.**

...

§ 3.4.2.2 The Contractor shall bear all expenses resulting from substitutions including the cost General Conditions as well as any structural, plumbing, mechanical and electrical trade costs made necessary by the substitution.

...

§ 3.4.4 The Owner shall have the right, but not the obligation, to require the Contractor to remove and replace, with a person acceptable to Owner, promptly after notice from Owner, any employee of Contractor or Subcontractor who: (1) has engaged in conduct on Owner's property that is contrary to the requirements of any applicable law, the Contract Documents, or any rule or directive of Owner relating to conduct on Owner's property; or (2) is incapable of fulfilling its responsibilities in connection with the Project.

...

~~The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.~~**3.6.1** The Contractor shall provide the Owner with two (2) notarized invoices with an itemized listing and supporting data for all such taxes paid, and the Owner shall reimburse the Contractor for such payments. Supporting documentation shall be in conformance with requirements of the State in which the Project is located.

...

.1 The Contractor shall promptly deliver copies of such documents to the Owner.

...

.2 If in connection with the Project, the Owner has obtained certain permits, licenses or agreements for the Project, the Owner will furnish copies of these documents to the Contractor. It is the Contractor's responsibility to comply with any conditions or limitations placed on the Project by these permits. The Contractor shall fully cooperate with the Owner in meeting the permit requirements and accommodations of regulatory inspections / directives.

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§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor fails to give such notices as applicable to the performance of the Work, the Contractor shall be liable for and shall indemnify and hold harmless the Owner against any and all resulting fines, penalties, judgments or damages, including reasonable attorney fees, imposed on or incurred by the parties indemnified, as a result of such failure by the Contractor

...

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

...

§ 3.7.6 Upon completion of the Work, the Contractor shall deliver to the Architect original copies of all required final certificates of inspection, the Certificate of Occupancy, the other documents evidencing that inspections required by authorities having jurisdiction over the Work have been performed

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The Contractor's superintendent shall not be removed from this Project until the Project punch list has been completed and the Project has been accepted by the Owner. Unless approved otherwise by the Owner in advance, the Contractor's superintendent shall be assigned solely to this Project and shall not perform any duties or superintendence on any other Project until completion of this Project.

...

~~**§ 3.10.1** The Contractor, promptly~~ **§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

...

§ 3.10.1.1 The Construction Schedule shall be a Critical Path Method (CPM) type of schedule, consisting of: (1) a single critical path delineation and other sequencing, and early and late start, float, and completion dates for each activity; and (2) milestones, interrelationships, and restraints for all activities, including Owner-awarded contracts through the date of Project completion. The Construction Schedule must show all activities necessary for Substantial and Final Completion as defined in Section 9.8, Section 9.10, and elsewhere in the Contract Documents.

...

§ 3.10.1.2 When the Construction Schedule is complete, the Contractor, after consultation with all Subcontractors and material suppliers, shall confirm in writing to the Architect that the Construction Schedule is reasonable and achievable by the Contractor, subject to any extensions of time as provided for elsewhere in the Contract Documents. The Contractor shall thereafter give prompt specific notice to the Owner and the Architect of any change in the logic of the Construction Schedule or any part thereof, the removal of any restraints, or the reduction of any durations.

...

§ 3.10.1.3 Periodic meetings will be held at least monthly or at more frequent times, as required by the Work, to assess the state of the completion of the Project and to update the Construction Schedule as necessary. In advance of each such meeting, Contractor shall provide Owner a written status report identifying whether the Work is on schedule in accordance with the Construction Schedule or whether there are anticipated or potential delays to any critical path elements in the construction of the Work (in which event Contractor shall provide notice and an analysis as reasonably requested by Owner)

...

§ 3.10.1.4 The Construction Schedule shall be revised at least monthly or at more frequent times as required by conditions of the Work, and shall provide for expeditious and practicable execution of the Work consistent with the Contract Time. The Architect and Owner shall be provided copies of the Construction Schedule as periodically updated and in electronic format, as maintained by the Contractor.

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§ 3.10.1.5 In the event that any updated Construction Schedule indicates a projected Substantial Completion date that is more than thirty (30) days after the required Substantial Completion date (as the same may be extended by Change Order for Excusable Delay), the Owner shall have the right to direct the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, facilities, (3) rescheduling activities, and (4) other similar measures (hereinafter referred to collectively as "Recovery Measures"). Such Recovery Measures shall continue until the progress of the Work complies with the state of completion required by the Construction Schedule. The Owner's right to require Recovery Measures is solely for the purpose of ensuring the Contractor's compliance with the Construction Schedule.

...

.1 The Contractor shall not be entitled to seek and adjustment in the Contract Sum in connection with

...

Recovery Measures required by the Owner, unless they are incurred by Contractor as directed in

...

writing by Owner to mitigate or offset Excusable Delay.

...

.2 The Owner may exercise the rights furnished to the Owner under or pursuant to this Subparagraph

...

3.10.1.5 as frequently as is reasonably necessary to ensure that the Contractor's performance of the

...

Work will comply with any milestone date or completion date set forth in the Construction Schedule.

...

§ 3.10.1.6 The Contractor is solely responsible for the timing, sequencing coordination, and supervision of the work in accordance with the approved Construction Schedule. Review or approval of the initial Construction Schedule and subsequent reviews of the Construction Schedule by the Architect and Owner do not operate to imply agreement by the Architect or Owner that the means and methods of planning of the Work utilized by the Contractor are adequate or will accomplish the Work in the time shown on the Construction Schedule. The Contractor shall take all actions necessary to ensure the Work's successful planning and execution within the stipulated Contract Time. Additionally, review or approval of the Construction Schedule by the Owner or its consultants shall not make the Owner or its consultants responsible for Contractor's scheduling obligations or the accuracy of the Construction Schedule prepared by the Contractor.

...

§ 3.10.1.7 The Contractor represents to the Owner that the initial Construction Schedule and all subsequent Construction Schedules (including updates and amendments) have been prepared in good faith and are accurate to the best of the Contractor's knowledge.

...

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's ~~approval. The Architect's approval~~ review. The Architect's review shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

...

§ 3.10.3 The Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a contract with the Contractor.

...

§ ~~3.10.3~~ ~~The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.~~**3.10.4** The Owner shall have the reasonable right to direct postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operation of the Owner's premises or any tenants or invitees, thereof. The Contractor shall, upon the Owner's reasonable request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Subparagraph 3.10.5 may be grounds for an extension of the Contract Time, if permitted under Subparagraph 8.3.1, and an equitable adjustment in the Contract Sum if (1) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents, and (2) such rescheduling or postponement is required by the Owner.

...

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the ~~approved~~ Architect's reviewed Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

PAGE 21

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged. Contractor shall submit samples requiring color or finish selection in a single, coordinated submittal. The Architect will issue no color or finish schedule until all samples and other data necessary for making complete color selections for the project are received.

...

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule ~~approved by the Architect or, in the absence of an approved submittal schedule, 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.~~reviewed by the Architect. The Architect shall have no responsibility to review any Shop Drawings, Product Data, Samples or similar submittals unless and until the Contractor has submitted and received back from the Architect approved reviewed submittal schedule as required under Section 3.10.2. In addition, it is not the Architect's responsibility to ensure that all required Shop Drawings, Product Data, Samples or similar submittals that are required to be submitted and reviewed under the Contract Documents are submitted by the Contractor. Submissions of Shop Drawings, Product Data, Samples or similar submittals is solely the Contractor's responsibility.

...

§ 3.12.7 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~~ reviewed and commented on by the Architect.

...

§ 3.12.8 The Work shall be in accordance with ~~approved~~ reviewed submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's ~~approval~~ review of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has ~~given written approval~~ indicted in writing that there is no exception to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued 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's ~~approval~~ review thereof.

...

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's ~~approval of~~ action on a resubmission shall not apply to such revisions.

PAGE 22

~~§ 3.12.10.1~~ If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. ~~The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents.~~ The Contractor shall cause such services or certifications to be provided by ~~an appropriately~~ a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the ~~adequacy and accuracy~~ adequacy, accuracy and completeness of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor ~~the~~ all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will ~~review and approve or~~ review, and take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

...

~~§ 3.12.10.2~~ § 3.12.10.1 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

...

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals.

...

.1 Due to the site constraints, only materials and equipment that are to be used in the Work shall be brought to and stored on the Project site by the Contractor. After materials and equipment are no longer required for the Work, they shall be promptly removed from the Project site. Protection of materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and adjacent areas.

...

.2 The Contractor shall not permit any workers to use existing facilities at the Project site, including, without limitation, lavatories, entrances and parking areas other than those designated and approved by the Owner.

...

.3 The Contractor shall comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives, or require compliance with the existing requirements of the rules and regulations.

...

§ 3.14.2 ~~The Contractor~~ **§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor ~~except with~~ without written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

PAGE 23

§ 3.14.3 All cutting and patching work shall be done by the Contractor (or through the appropriate Subcontractor). Patches in finish surfaces shall match the adjacent surfaces in material, finish, detail, and quality. Patches in fire rated construction or construction required to be smoke tight shall be made in conformance with assemblies designed and tested by agencies recognized by governing codes. Any UL rated fire safing materials, flanges, or other materials required by Code, the Contract Documents, or manufacturers installation instructions for devices penetrating the work affected shall be applied an installed by an approved firestop subcontractor or qualified personnel from the applicable trade.

...

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall lawfully remove and dispose of waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

...

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, or if not specified in the Contract Documents, then within 48 hours of an Owner request, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

PAGE 24

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the ~~Owner, Contractor,~~ Owner and Architect. Consent shall not be unreasonably withheld.

...

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor to maintain the Project Schedule or for defects and deficiencies in the Work. The Owner may seek reimbursement pursuant to the procedures set forth in **§ 9.5.1.**

...

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work. All costs made necessary by such failure, including those of repeated procedures shall be at Contractor's sole expense, including reasonable compensation for Architect's services and expenses.

PAGE 25

§ 4.2.7 The Architect will review ~~and approve, or take other appropriate action upon,~~ the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken ~~in accordance~~ with the most recently reviewed submittal schedule ~~approved by the Architect~~ or, in the absence of ~~an approved~~ a submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals 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, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's ~~approval~~ review of a specific item shall not indicate approval of an assembly of which the item is a component.

...

§ 4.2.9 The Architect will conduct ~~inspections~~ site visits to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the

Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

...

.1 The Contractor's request for information shall be prepared and submitted in accordance with the General Requirements (Division 01 of the Specifications) on the form included therein or as otherwise approved in advance. The Architect will return requests for information that do not conform to requirements of the Contract Documents.

...

.2 The Architect's response to a request for information (RFI), or issuance of a clarification or interpretation shall be considered an interpretation, clarification, supplemental information or an order for a minor change in the Work not involving an adjustment in Contract Sum or extension of Contract Time and not inconsistent with the intent of the Contract Documents, and shall be binding, unless indicated otherwise in the Architect's response to the RFI.

PAGE 26

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, but prior to the first Application for Payment, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

...

The listing required by this Section shall be submitted to the Architect no later than 30 days from the date of the Agreement. This list shall include the names of manufacturers, suppliers, and installers proposed for each of the products, equipment, and materials to be incorporated into the project.

...

The Contractor shall furnish upon request adequate data on any named entity on the list in order to permit the Architect and the Owner to conduct a proper evaluation. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents and all products furnished by the listed manufacturer must conform to such requirements.

...

§ 5.3.1 The division of the Specifications into sections is not intended to control the Contractor in dividing the work among subcontractors nor to limit the scope of work performed by any trade under a given section. The Architect will not undertake to settle any differences between the Contractor and its Subcontractors as to the responsibility for completing all Work in the Specifications. It shall be entirely the Contractor's responsibility to properly coordinate and complete all the Work described in the Specifications whether performed by the Contractor or its Subcontractors.

PAGE 27

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the ~~subcontract.~~subcontract, provided that the Owner shall not be under any obligation to

compensate the Subcontractor with respect to amounts that the Owner has already paid to the Contractor for such Subcontractor's work.

...

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. ~~If~~

...

~~the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~ **§ 5.4.4** Nothing in the Contract Documents shall be deemed to create any contractual relationship between any Subcontractor of any tier and the Owner, or between the General Contractor or Subcontractor of any tier and the Architect.

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§ 7.1.4 Unless otherwise agreed to in writing by the Owner and the Contractor, the combined overhead and profit that shall be included in the total cost (or credit) to the Owner for a Change in the Work shall be based on the following schedule:

...

.1 For the Contractor, for Work performed by the Contractor's own forces:

1. 15% on the first $25,000 of the change order direct cost of self-performed work,
2. 10% on the portion of the change order direct cost of self-performed work between $25,000 and $50,000 and
3. 7.5% on the portion of the change order direct cost of self-performed work between $50,000 and $200,000 and
4. 5% on the portion of the change order direct cost of self-performed work greater than $200,000.

...

.2 For the Contractor, for Work performed by the Contractor's Subcontractor five percent (5%) of the amount due the Subcontractor.

...

.3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.

...

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.

...

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7 and shall be itemized (including labor costs).

PAGE 29

§ 7.2.2 A Change Order, when issued, shall be full compensation, or credit, for the extra Work performed, omitted, or substituted. It shall show on its face, any adjustment in time for completion of the Project as a result of the

Change in the Work. Each Change Order shall include all costs related thereto, including all overhead, miscellaneous expenses, and incidentals.

...

.5 Calculation of overhead and profit shall be consistent with Section 7.1.4.

...

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in ~~the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount.~~ Section 7.1.4. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

...

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum ~~or~~ and/or Contract Time.

PAGE 30

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum ~~and~~ and/or Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

...

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured ~~on the basis of net increase, if any, with respect to that change.~~in accordance with Section 7.1.4.

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In the event that the Owner, the Contractor or the Architect is delayed or hindered in or prevented from the performance of any act required by the Contract Documents by reason of a labor dispute, fire, failure of power, unusual delay in deliveries, adverse weather conditions not reasonably anticipatable, unavoidable casualties or other causes of a like nature beyond the Owner's, the Contractor's or the Architect's control, the Contractor (or its Subcontractors) shall not be entitled to any additional compensation.

...

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article ~~15.~~15; however, The Contractor's Claims, if any, for any increase in Contract Time must be made in accordance with the time requirements of this Section. Claims for an increase in Contract Time must be made in writing to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims must be initiated within seven (7) days after the Contractor has notice of the delay (initial notice). Thereafter, the Contractor must provide full details and support documentation with regard to the cause of the delay within twenty-one (21) days of the initial notice of the delay. If either the initial notice or the supporting documentation is not submitted to the Initial Decision Maker with a copy to the Architect, if the Architect is not the

Initial Decision maker, in writing within the time periods prescribed in this Section, the Claim for an increase in Contract Time shall be waived. If the cause for the delay is a continuing one then only one Claim is necessary. The Contractor's supporting documentation to the Initial Decision Maker and/or Architect shall include an estimate of cost, if any, and of the probable effect of the delay on the progress of the Work and the Project Schedule.

...

§ 8.3.3 ~~This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.~~Unless expressly provided otherwise in the Contract Documents, an extension of the Contract Time, to the extent permitted under Subparagraph 8.3.1 shall be the sole remedy of the contractor for any (1) delay in the commencement, prosecution, or completion of the Work, (2) hindrance or obstruction in the performance of the work, (3) loss of productivity, or (4) other similar claims (collectively referred to in this Subparagraph 8.3.3 as "Delays") whether or not such Delays are foreseeable unless a Delay is caused by acts of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner (an "Owner-Caused Delay"), in which case the Contractor shall also be entitled to an equitable adjustment of the Contract Sum provided that the Contractor provides to the Owner written notice of such Owner-Caused Delay within ten (10) days of the occurrence of the event giving rise to such Owner-Caused Delay or within ten (10) days after the Contractor first recognizes the condition giving rise to such Owner-Caused Delay, whichever is later.

...

~~**§ 9.2 Schedule of Values**~~

...

§ 9.2 Schedule of Values

...

~~Where the Contract~~ Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

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§ 9.2.1 The Contractor and each Subcontractor shall prepare a trade payment breakdown for the work for which it is responsible, such breakdown being submitted on a uniform standardized form reasonably approved by the Architect and Owner (AIA G703). The form shall be divided in detail sufficient to exhibit area, floors, and/or sections of the Work, and/or by convenient units and shall be updated as required by either the Owner or the Architect as necessary to reflect (1) description of Work (listing labor and material separately), (2) total value, (3) percent of the work completed to date, (4) value of the work completed to date, (5) percent of previous amount billed, (6) previous amount billed, (7) current percent completed, and (8) value of Work completed to date. Any trade breakdown that unreasonably fails to include sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (including of normal retainage) to complete the Work.

...

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be ~~notarized, if required,~~ notarized and

supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

...

The form Application for Payment, duly notarized, shall be the most recent authorized edition of AIA Document G702, Application and Certificate for Payment, supported by the most recent authorized edition of AIA Document G703, Continuation Sheet.

...

~~**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend~~ **§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

...

§ 9.3.1.3 Each Application for Payment shall be submitted electronically and in four (4) hard copies and shall be accompanied by the following, in all form and substance reasonably satisfactory to the Owner; (1) a current conditional Contractor's waiver of claims and liens, and duly executed an acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any Subcontractor and material supplier in the requested progress payment, and the amount to be paid to the Contractor from such progress payment together with similar sworn statements from all such subcontractors and material suppliers; (2) duly executed unconditional waivers of claims and liens from all Subcontractors and, when appropriate, from material suppliers and lower tier Subcontractors establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or information and materials required to comply with the requirements Contract Documents or reasonably requested by the Owner or the Architect or required by the Owner's title insurer.

...

§ 9.3.1.4 Until Substantial Completion, the Owner shall pay the Contractor ninety-five percent (95%) of the amount due the Contractor.

...

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. Such payment by the Owner for materials, equipment, fixtures and supplies stored on or off the Site shall not relieve the Contractor of its responsibility to provide reasonable protection of said materials, equipment, fixtures and supplies until their incorporation into the Work.

PAGE 33

~~**§ 9.3.3** The Contractor warrants~~ **§ 9.3.3** The Contractor warrants 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 Certificates for Payment have been previously issued

and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

...

§ 9.3.3.1 The Contractor further expressly undertakes to defend the Owner, against any actions, lawsuits, or proceedings brought against the Owner as a result of liens related to the Work unless the reason for the lien is the nonpayment by the Owner to the Contractor in accordance with the Contract Documents (referred to as "liens" in this Subparagraph). The Contractor hereby agrees to indemnify and hold the Owner harmless against any such liens or claims of liens and agrees to pay any final judgment or lien if the reason for the judgment or lien is the nonpayment by the Owner to Contractor in accordance with the Contract Documents.

...

§ 9.3.3.2 The Owner shall release any payments withheld due to a lien or claim of lien if the Contractor obtains security acceptable to the Owner or a lien discharge bond that is (1) issued by a surety acceptable to the Owner; (2) in form and substance satisfactory to the Owner, and (3) in an amount required by law to release such lien claim. By posting a lien discharge bond or other acceptable security, however, the Contractor shall not be relieved of any responsibilities or obligations under Subparagraph 9.3.3.1 including without limitation, the duty to defend and indemnify the Owner. The cost of any premiums incurred in connection with such bonds and security shall be the responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

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.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;~~or~~

...

.7 repeated failure to carry out the Work in accordance with the Contract ~~Documents.~~ Documents; or

...

~~§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.~~.8 any other reasonable grounds for objection or withholding as provided in the agreement or as permitted by law.

...

§ ~~9.5.3 When the~~ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld. The Owner shall not be deemed in default by reason of withholding payment while any conditions described in 9.5.1 remain.

...

§ ~~9.5.4~~ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its ~~sole~~ option, issue joint checks to the Contractor and to any Subcontractor ~~or supplier~~ for material and/or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the ~~Contractor shall~~ Architect will reflect such payment on ~~its next Application~~ the next Certificate for Payment.

...

§ 9.6.2.1 The Contractor shall indemnify and hold the Owner harmless from laborers, mechanics and materialmen liens upon the Owner's properties or the premises upon which the work is located, arising out of the work performed or materials furnished by the Contractor or any of its Subcontractors or any material suppliers under the Contract.

...

§ 9.6.5 The Contractor's payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4. The Owner shall have no obligation to pay or reimburse a Contractor for payments to material and equipment suppliers until materials and supplies have been delivered on site or to an offsite storage facility which is bonded and secured.

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If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended ~~appropriately~~ appropriately, and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and ~~start-up, plus interest as provided for in the Contract Documents.~~start-up.

...

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended ~~use.~~use, and shall require that: (1) the Work is operational and usable for the purposes intended; and (2) all required governmental permits, approvals and temporary or permanent certificates of occupancy have been properly and validly issued. Substantial completion shall not be withheld due to Owner's failure to occupy or use based on any reason that is not the responsibility of the Contractor under the Contract Documents or is caused by circumstances beyond Contractor's control

...

.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections pursuant to Section 9.5.1.

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§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion will not be issued until after the Architect and Owner have determined that: (1) the Work and all systems are operational and otherwise complete and ready for unobstructed, lawful use and occupancy by the Owner; (2) the governmental agency that issued the building permit has issued a certificate of occupancy; (3) all testing (including but not limited to TAB, Envelope, Commissioning, etc.) are completed and required corrections revealed by these tests are completed; (4) the Project has been accepted by each regulatory body having jurisdiction, and (5) the only items of Work remaining to be completed are of a minor nature such as touch-up, adjustments, testing, corrections, and omissions to be remedied, as may appear on the final list made during inspection by the Architect and Owner.

...

§ 9.10.1.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections. The Owner may seek reimbursement pursuant to Section 9.5.1.

...

§ 9.10.1.2 The final payment of retained amount due the Contractor on account of the Contract shall not become due until the Contractor has furnished to the Owner, through the Architect, completion documents as enumerated below, or as otherwise required in the Contract Documents.

...

.1 One (1) hard copy and one electronic Record Set of Drawings showing actual construction of all

...

portions of the Work and incorporating all changes and amendments thereto, as redlined against

...

the 100% Construction Drawings.

...

.2 Guarantees and Warranties required by specific Sections of the Specifications.

...

.3 Release and Waiver of Claims, conditioned upon Final Payment, by the General Contractor,

...

Subcontractors, Sub-subcontractors and materials suppliers.

...

.4 All mechanical and electrical installation, operating and maintenance manuals called for under the

...

Specifications.

...

.5 All test reports and certifications required under the mechanical and electrical specifications.

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.6All forms required to be completed by the Contractor by regulatory governmental agencies with two

...

copies delivered to the Architect.

...

.7 Shop Drawing submittals in accordance with Article 3.

...

.8 A copy of the unconditional Occupancy Permit or Certificate of Compliance issued by the local

...

Building Inspection Department have Jurisdiction, unless such is not issued for any reason that is

...

not the responsibility of the Contractor under the Contract Documents or is caused by

...

circumstances beyond Contractor's control.

...

.9 Manufacturer's current detailed installation instructions for fire dampers, ceiling radiation dampers,

...

smoke dampers, and duct smoke detectors as applicable to the Project

...

.10 One (1) copy of the equipment operational and maintenance manuals.

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§ ~~10.2.2~~ ~~The~~ **§ 10.2.2** The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

...

§ 10.2.2.1 In the event that review, inspection or other action by regulatory agencies or other parties results in the imposition of fines, fees, or other costs due to the failure of the Contractor to comply with said applicable laws, ordinance, rules, regulations and lawful orders, the Contractor shall hold harmless the Owner, owner's Consultants, the Architect, and Owner's separate contractors, if any, from all consequences arising from the Contractor's

...

non-compliance.

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§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or

substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. ~~By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.~~

...

§ 11.1.1 The ~~Contractor shall purchase and maintain insurance of the types~~ Contactor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below (and such insurance shall be from a company that is A rated or better by A.M Best Company) which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

...

~~and limits~~ **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed.

...

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

...

~~of liability, containing~~ **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

...

.4 Claims for damages insured by usual personal injury liability coverage;

...

~~the endorsements,~~ **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

PAGE 40

.6 Claims for damages because of bodily injury, death or a person or property damage arising out of ownership, maintenance or use of a motor vehicle.

...

~~andsubject to the terms and conditions,~~ **.7** Claims for bodily injury or property damage arising out of completed operations; and **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

...

§ 11.1.2 The insurance required by Section 11.1.1 (or as described in the Agreement or ~~elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described~~ other corresponding Exhibit setting forth the specific insurance requirements) shall be written for not less than limits of liability specified by the Owner or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

...

~~§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.~~**11.1.3** Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the

...

~~§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.~~ final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

...

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within ~~three (3)~~ not less than twenty (20) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

...

§ 11.1.5 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in who or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

...

§ 11.1.6 Insurance Requirements

...

Refer to Owner Contractor Agreement.

...

§ 11.1.7 PERFORMANCE BOND AND PAYMENT BOND

...

§ 11.1.7.1 The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the jurisdiction where the Project is located, in form and substance satisfactory to the Owner and, without limitation, complying with the following specific requirements:

...

.1 Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.

...

.2 Bonds shall be executed by a responsible surety licensed in the jurisdiction where the Project is located, with a Best's rating of no less than A/XII, and shall remain in effect for a period not less than two (2) years following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.

...

.3 The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to the Contract Sum and all subsequent increases.

...

.4 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power-of-attorney indicating the monetary limit of such power.

...

.5 Every Bond under this Subparagraph 11.4.1 must display the Surety's Bond Number. A rider including the following provisions shall be attached to each Bond:

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(i) The Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Any addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder, and notice to the Surety of such matters is hereby waived.

...

(ii) The Surety agrees that it is obligated under the bonds to any successor, grantee, or assignee

of the Owner.

1. .6 Bonds shall be written on AIA Document 312.
2. .7 If the surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 11.4.1 Contractor shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to Owner.

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~~§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance~~

...

~~The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

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~~§ 13.1~~ § 13.1 Governing Law

...

§ **13.1.1** In all operations under the Contract, the Contractor agrees that it will comply with provisions of all State and Federal Laws (including OSHA) and all local ordinances which may affect such operations.

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~~§ 13.5 Interest~~

...

~~Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~

...

~~**.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or~~

...

~~**.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.~~

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§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work ~~executed,~~

~~as well as reasonable overhead and profit on Work not executed,~~ executed and costs incurred by reason of such termination.

...

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful ~~orders of a public authority;~~ orders of a public authority; or

...

.5 fails to implement measures that will bring the work into conformity with the approved Project

...

Schedule.

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~~§ 14.4.3~~ ~~In case~~ **§ 14.4.3** In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

...

§ 14.4.4 The Contractor shall include in each of its subcontracts a clause, similar in effect to the provisions in Paragraph 14.4, allowing the Contractor to terminate the subcontract for its sole convenience, subject only to the payment obligations set forth in Paragraph 14.4.3.

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§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. The Contractor shall accompany the Claim with a written analysis with a proposed revision to the Schedule illustrating the claimed influence of the basis for delay on the critical path of the Work and the applicable deadlines that may be impacted. Contractor will exercise reasonable efforts to mitigate the potential impact of any delay but shall be compensated for any costs associated therewith.

...

~~§ 15.1.6.2~~ ~~If adverse~~ **§ 15.1.6.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction. The time for performance of this Contract, as set forth in the Construction Schedule, shall include an allowance for delays due to reasonably anticipated adverse weather for the area where the Work is located. For the purpose of establishing that abnormal adverse weather conditions have caused a delay, and determining the extent of delay attributed to such weather conditions, the Contractor shall furnish with its claim, National Oceanic and Atmospheric Administration (NOAA) National Weather Service records of climatic conditions during the same time interval for the previous five (5) years for the locality of the Work; the Contractor's daily job site logs/daily construction reports showing weather, job activities, and the effect of weather on the progress of the Work; and an impact schedule showing the effects of the weather event on the critical path of the Contractor's Construction Schedule. Time extensions for weather delays and related impact do not entitle the Contractor to extended overhead recovery or to any other monetary compensation associated with that claim unless approved in writing by the Owner.

...

§ 15.1.6.3 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which have concurrent or interrelated effects on the progress of the Work.

PAGE Error! Bookmark not defined.

~~§ 15.4 Arbitration~~

...

~~§ 15.4.1~~ ~~If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~

...

~~§ 15.4.1.1~~ ~~A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

...

~~§ 15.4.2~~ ~~The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

...

~~§ 15.4.3~~ ~~The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

...

~~§ 15.4.4 Consolidation or Joinder~~

...

~~§ 15.4.4.1~~ ~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).~~

...

~~**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.~~

...

~~**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:30:14 ET on 02/18/2025 under Order No. 3104239969 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

SECTION 007300
SUPPLEMENTARY GENERAL CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 007200 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 MODIFICATIONS TO GENERAL CONDITIONS

A. TIME OF COMPLETION
   1. The Contractor shall commence work to be performed under this Contract on a date to be specified in written order from the Designer/Owner and shall fully complete all work hereunder within four hundred fifty seven (457) consecutive calendar days from the Notice to Proceed (expected to be May 1, 2025) with Substantial Completion by August 1, 2026 and Final Completion on September 1, 2026 (substantial & final completion dates are based on calendar days after NTP, dates are subject to change dependent on issue date of the NTP).

B. LIQUIDATED DAMAGES
   1. For each day in excess of the above number of days, the Contractor shall pay the Owner the amount of Two hundred and fifty Dollars ($250) each day beyond Substantial Completion and the amount of Five hundred Dollars ($500) each day beyond Final Completion as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner should the Contractor fail to complete the Work within the time specified.

C. DELAYS AND EXTENSIONS OF TIME
   1. If the Contractor is delayed at any time in the progress of his work by any act or negligence of the Owner, his employees or his separate contractor, by changes ordered in the work; by abnormal weather conditions; by any causes beyond the Contractor's control or by other causes deemed justifiable by Owner, then the contract time may be reasonably extended in a written order from the Owner upon written request from the contractor within ten days following the cause for delay. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents.

D. PRE-BID CONFERENCE
   1. Meeting: On Wednesday February 26, 2025, a non-mandatory pre-bid meeting will be held at JCPS Facilities located at 601 W Market St, Smithfield, NC 27577 at 10:00 am for all interested parties. Immediately following the pre-bid meeting we will tour each project site.

E. PROJECT EQUIPMENT
   1. Noting the essence of time as essential, JCPS will pre-purchase all Air Handler Units and Fan Coil Units, but not Chillers, chillers will be ordered, paid for, and warrantied by Contractor.

F. PROJECT STORAGE
   1. The contractor shall recieve all equipment, even those pre-purchased by JCPS, and store equipment in a bonded warehouse prior to installation.

G. OCCUPIED CAMPUS
   1. At all times during school operation, air handlers must remain operational. During summer and any long breaks when school is not in session, contractor to keep conditioned air moving through school to mitigate possibility of bateria/mold growth. Additional requirements for working on occupied campus in 011000 - Summary.

H. PERMITSAYMENTS
   1. The contractor shall be responsible for filing for permits and any fees associated or required, including but not limited to building permit, utility impact fees, and/or temporary utilities.

I. UTILITIES
   1. Contractor may use existing utilities and facilities at no additional costs. Owner will provide multiple parking spaces at building.

J. USE OF SITE
   1. Refer to time of completion for work schedule information. Refer to requirements for use of site in occupied campus' in 011000 - Summary.

K. NO SMOKING POLICY
   1. The building is a smoke free facility. The use of tobacco products on school property is strictly forbidden.

L. BID BOND
   1. Contractor shall furnish a Bid Bond. Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).
   2. Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the oblige upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later than seven (7) days after expiration of the holding period stated in the Notice to Bidders.

M. PERFORMANCE AND PAYMENT BONDS
   1. Contractor shall furnish a Performance Bond and Payment Bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications (Forms 307 & 308). An authorized agent of the bonding company who is licensed to do business in North Carolina shall countersign all bonds.

N. MINORITY BUSINESS PARTICIPATION
   1. Refer to attached Minority Business Requirements

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 007300

PERFORMANCE BOND

IT IS HEREBY AGREED that (Insert full name and address of Contractor)

as Principal, hereinafter called Contractor, and, (Insert full name and address of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto the

as Obligee, hereinafter called Owner, in the amount of _____ _____ Dollars ($), for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these obligations.

WHEREAS, Contractor has by written agreement dated _____, 20___, entered into a contract with Owner for the construction of (Insert the name of the Project)

in accordance with Drawings and Specifications prepared by (Insert full name and address of Architect/Engineer)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect. The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and declared by Owner to be in default, under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

1) Complete the Contract in accordance with its terms and conditions, or

2) Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph)

sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this bond must be instituted before the expiration of any applicable statute of limitations under the Contract.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

Signed and sealed this _____ day of _____ 20_____.

PRINCIPAL

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

SURETY

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

R1726188

LABOR AND MATERIAL PAYMENT BOND

THIS BOND IS ISSUED SIMULTANEOUSLY WITH PERFORMANCE BOND IN FAVOR OF THE OWNER CONDITIONED ON THE FULL AND FAITHFUL PERFORMANCE OF THE CONTRACT

IT IS HEREBY AGREED that (Insert full name and address of Contractor)

as Principal, hereinafter called "Principal," and, (Insert full name and address of Surety)

as Surety, hereinafter called "Surety," are held and firmly bound unto the

as Obligee, hereinafter called Owner, for the use and benefit of claimants as hereinbelow defined, in the amount of _____ for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these obligations.

WHEREAS, Principal has by written agreement dated _____, 20_____,
entered into a contract with Owner for the construction of (Insert the name of the Project)

in accordance with Drawings and Specifications prepared by (Insert full name and address of Architect/Engineer)

which contract is by reference made a part hereof, and is hereinafter referred to as the "Contract."

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety (90) days, after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail; postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which

legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

b) After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

Signed and sealed this _____ day of _____ 20 _____.

PRINCIPAL

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

SURETY

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

R1726188

Bid Bond

_____ , as Principal, and _____

_____, as Surety, who is

duly licensed to act as Surety in North Carolina through the _____,

as Obligee, in the penal sum of _____

DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

SIGNED, sealed and dated this _____ day of _____, 20_____.

WHEREAS, the said Principal is herewith submitting Proposal for:

_____

and the Principal desires to file this Bid Bond in lieu of making the cash deposit as required by G. S. 143-129:

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the Principal shall be awarded the Contract for which the bid is submitted and shall execute the Contract and give bond for the faithful performance thereof within ten days after the award of same to the Principal, then this obligation shall be null and void; but if the Principal fails to so execute such Contract and give Performance Bond as required by G. S. 143-129, the Surety shall upon demand, forthwith pay to the Obligee the amount set forth in the first paragraph hereof; and provided further, that the bid may be withdrawn as provided by G. S. 143-129.1.

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____SEAL)

END OF SECTION

SECTION 00 90 00.04
INSURANCE CERTIFICATES (BLANK)

PLACE HOLDER FOR ATTACHING SHEET

END OF SECTION

SECTION 00 90 00.05
POWER OF ATTORNEY (BLANK)

PLACE HOLDER FOR ATTACHING SHEET

END OF SECTION

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of $300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
   a. Black, that is, a person having origins in any of the black racial groups in Africa;
   b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
   c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
   d. American Indian, that is, a person having origins in any of the original peoples of North America; or
   e. Female

2. Minority Business - means a business:
   a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
   b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".

4. Public Entity - means State and all public subdivisions and local governmental units.

5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.

7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.

9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.

10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

   The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:
   a. Identify those areas of work for which there are minority businesses, as requested.
   b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
   c. Assist in the determination of technical assistance needed by minority business contractors.

   In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:
   (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
   (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
   (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
   (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
   (5) The HUB Office also oversees the minority business program by:
      a. Monitoring compliance with the program requirements.
      b. Assisting in the implementation of training and technical assistance programs.
      c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
      d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office
   The State Construction Office will be responsible for the following:

   a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
      (1) Project description and location;
      (2) Locations where bidding documents may be reviewed;
      (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
      (4) Date, time and location of the bid opening.
      (5) Date, time and location of prebid conference, if scheduled.

   b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
d. Reviewing of minority business requirements at Preconstruction conference**.**
e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
f. Provide statistical data and required reports to the HUB Office.
g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

3. Owner
Before awarding a contract, owner shall do the following:

a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
b. Attend the scheduled prebid conference.
c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
    1. A description of the work for which the bid is being solicited.
    2. The date, time, and location where bids are to be submitted.
    3. The name of the individual within the owner's organization who will be available to answer questions about the project.
    4. Where bid documents may be reviewed.
    5. Any special requirements that may exist.
d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment**.**
i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

e. During construction phase of the project, review "MBE Documentation for Contract Payment" – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime biding, construction manager at risk and alternative contracting methods, contractor(s) will:

a. Attend the scheduled prebid conference.
b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
   (1) A description of the work for which the subbid is being solicited.
   (2) The date, time and location where subbids are to be submitted.
   (3) The name of the individual within the company who will be available to answer questions about the project.
   (4) Where bid documents may be reviewed.
   (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

   If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
e. Identify on the bid**,** the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" – (Appendix E), for designer's review.
j. During the construction of a project, at any time**,** if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing**,** of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities
While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION 4: DISPUTE PROCEDURES
It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION 5: These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: www.nc-sco.com

SECTION 6: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: http://www.nc-sco.com

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

(1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

(8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

(10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be ($)_____.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of_____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ❑ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ❑ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ❑ **10** - **(20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID# _____ Amount of Bid $ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

SEAL

Signature: _____

Title: _____

State of _____, County of _____
Subscribed and sworn to before me this _____ day of _____ 20____
Notary Public _____
My commission expires _____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

***Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires _____

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.02 DESCRIPTION OF WORK

A. The intent of this Bid request is to obtain an offer to perform work to complete a major phased renovation which includes the removal and replacement of HVAC equipment at Four Oaks Elementary School. Four Oaks is currently served by multiple boilers and chilled water systems as well as constant volume air handling units that have poor zone control. A replacement of three air handling units was completed in 2024. The scope of this project includes the replacement of the remaining existing constant volume air handling units with new indoor variable volume air handling units and the associated distribution and variable air volume terminals with hot water reheat. The replacement of the air distribution systems associated with the air handling units replaced in 2024 will be included in this project. The existing boiler plants and distribution are to be removed in their entirety. A new high efficiency boiler plant and distribution is to be provided. The chilled water systems will be consolidated into one chilled water plant. The HVAC building management system is to be replaced in its entirety. The air handling units and new fan coil units are to be furnished by the Owner. Receipt, storage and installation of the AHU’s and FCU’s is to be by the mechanical contractor. The scope of work includes architectural and electrical work as well.

1.03 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Owner intends to occupy a certain portion of the Project prior to the completion date for conduct of normal operations.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
   1. Owner occupancy.

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

C. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days written notice to Owner and authorities having jurisdiction.
   3. Provide de-humidified air moving through building at times where existing HVAC equipment is offline and high humidity weather is present, in order to limit or inhibit the growth of mold/bacteria.
   4. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

SECTION 011400
WORK RESTRICTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Notice to Bidders and Standard General Conditions of the Construction Contract, including Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

1.02 WORK SEQUENCE

A. Work shall begin after the NTP. Work shall not disrupt service to Owner's Facility.

1.03 WORK RESTRICTION

A. Behavior policy: All construction personnel shall be respectful of all state employees and visitors of the project site. Any incidents of disrespect, verbal abuse, threatening statements, unwelcome comments, unwelcome interaction or any form of harassment from any construction personnel toward any state employee or visitor is strictly prohibited. Any such act shall constitute sufficient cause for JCPS to remove any individual permanently from the project and property. In addition, any of the contractor(s) project personnel who ignore or refuse to take action on any requirements of the contract documents; ignore or refuse to take immediate action to correct any endangerment to the health and safety of the public; as solely determined by JCPS; then those actions shall be sufficient cause for JCPS to permanently remove those individuals from the project and property. If in the sole determination of JCPS, it would be in the best interest of the project and JCPS to have any of the contractor(s) personnel removed from the project then the contractor shall do so upon request. Such actions taken shall not constitute grounds for a delay claim. JCPS will not be responsible for any delays caused to the project due to any individual being removed from the project.

B. Use of the Premises: Parking is limited on site and will be coordinated during construction.

C. OSHA Compliance
   1. It is the intent of JCPS that all projects be designed in such a manner that they can be constructed and built in utilizing work practices in accordance with OSHA regulations. All Contractors and Subcontractors shall meet all requirements specified in 29 CFR 1910 and 1926, along with the Association of General Contractors Accident Prevention Manual.
   2. Contractors are referred to resources including, but not limited to, OSHA standards 1910 and 1926, and the Association of General Contractors Accident Prevention Manual. Also, each project will have a designated safety manager.
   3. The Contractor must designate, in writing, a safety manager for each project.
   4. It shall be the Contractor’s responsibility to:
      a. Provide a safe and healthful workplace free from recognized hazards to minimize the likelihood of accident or injury to all personnel.
      b. Comply with OSHA standards 1910 and 1926, and any other applicable environmental health and safety regulations.
   5. Comply with the requirements of the Association of General Contractors Accident
      a. Provide adequate work-area protection to protect the safety and well-being of faculty, staff, and visitors.
      b. Maintain an accurate list of chemicals used during construction, which must be made available to campus or other requesting personnel.
      c. Establish and maintain an effective safety and health program involving all levels of the contracting organization, including managers, supervisors, and employees. A person designated as being responsible for safety must be present on site at all times work is in progress.
         1) Assure that a “competent person” as defined by OSHA is present during all projects that involve trenching or use of scaffolding.

D. Contractor Compliance
   1. Contractor shall provide documentation for all individuals on the job site to ensure the Lunsford Act/Criminal Background Check is provided.
   2. Contractor shall be required to adhere to all Board of Education policies affecting the campus.

E.

1.04 BUILDING ACCESS:

A. The Building may be fully occupied during construction. Contractor shall coordinate all Construction Activities with the Owner. Contractor shall at all times provide de-humidified air moving through the space to limit or eliminate mold/bacterial growth.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011400

SECTION 012100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contingency allowance.

1.02 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by Change Order.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.03 ALLOWANCES SCHEDULE

A. Contingency Allowance: Include the stipulated sum/price of $250,000 for use upon Owner's instructions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012100

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SECTION 012200
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.02 RELATED REQUIREMENTS

A. Document 002113 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.

1.03 COSTS INCLUDED

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

1.04 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

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

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

D. Measurement Devices:
   1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
   2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
   3. Metering Devices: Inspected, tested and certified by the applicable state department within the past year.

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

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

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

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

I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.06 PAYMENT

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

B. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

1.07 DEFECT ASSESSMENT

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

B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:
   1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.

C. The authority of Owner to assess the defect and identify payment adjustment is final.

1.08 SCHEDULE OF UNIT PRICES

A. **Item: No. 1: Steel Bollard.** Price to include all necesary materials and labor to install one steel bollard per details in contract documents.

B. **Item: No. 2: Fire Extinguisher.** Price to include all necessary materials and labor to install one bracket mounted Fire Extinguisher.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012200

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Submission procedures.

1.02 RELATED REQUIREMENTS

A. Document 00 41 00 - Bid Form: List of alternates on the Bid Form.

B. Document 00 52 00 - Agreement Form: Incorporating monetary value of accepted Alternates.

1.03 ACCEPTANCE OF ALTERNATES

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

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

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 01 – (Owner Preferred):
   1. Provide Pumps by Manufacturer: B & G, no substitutions.

B. Alternate No. 02 – (Owner Preferred):
   1. Provide Pumps by Manufacturer: Taco, no substitutions.

C. Alternate No. 03 – (Owner Preferred):
   1. Provide Valves and Actuators by Manufacturer: Belimo, no substitutions.

D. Alternate No. 04 – (Owner Preferred):
   1. Provide Controls by Manufacturer: Honeywell, no substitutions.

E. Alternate No. 05 – Building 02 FCUs.
   1. Provide price to replace all existing FCU’s in Building 02 with new.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Owner will consider requests for substitutions only if submitted at least 7 days prior to the date for receipt of bids.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.04 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION 012500

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SECTION 012900
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment. In the event of a conflict between administrative and procedural requirements in this section and the Owner-Contractor Agreement or ESSER General Conditions, the requirements of the Owner-Contractor Agreement or ESSER General Conditions shall take precedence.

1.02 SCHEDULE OF VALUES

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

B. Coordination: Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
   1. Application for Payment forms with continuation sheets. (AIA G702 and G703)
   2. Submittal schedule.
   3. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

C. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Forms filled out by hand will not be accepted.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Change Orders (numbers) that affect value.
      d. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
         1) Labor.
         2) Materials.
         3) Equipment.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
   4. The following line items must be included on the continuation sheet.
      a. Project Bonds and Insurances
      b. Mobilization
      c. Shop Drawings
      d. Project Meetings
      e. Temporary Heat (where applicable)
      f. Progress Cleaning
      g. Lawn and Tree Watering (where applicable to establish new lawns and trees)
      h. Punch List
      i. Final Cleaning
      j. Close Out documents and Warranties
   5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Submit draft of AIA Document G703 Continuation Sheets.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.03 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment **five** days prior to due date for review by Architect. (Work to be projected out to the end of the pay period).

C. Application for Payment Forms: Use **[AIA Document G702 and AIA Document G703] [AIA Document G702/CMa and AIA Document G703]** as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. The OWNER shall retain five percent (5%) of the amount due on each Application for both the work completed and materials stored, unless stated otherwise in Owner Contractor Agreement. The OWNER reserves the right to retain a greater percentage in the event the CONTRACTOR fails to make satisfactory progress or in the event there is other specific cause for greater withholding.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

F. Transmittal: **Email** signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. If required, include waivers of lien and similar attachments.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede submittal of first Application for Payment include the following:
1. List of Substitutions
2. Contractor or Notice to Proceed.
3. Performance and Payment Bonds.
4. Liability, Auto, and Umbrella Insurance.
5. Worker Compensation certificates.
6. Proposed schedule of values for approval.

I. Initial Application for Payment: Administrative actions and submittals that must coincide with submittal of first Application for Payment include the following:
1. Approved Schedule of values.
2. List of subcontractors.
3. Contractors Safety Program.
4. Contractor's construction schedule (preliminary if not final).
5. Products list (preliminary if not final).
6. Submittal schedule (preliminary if not final).
    a. First Payment WILL NOT be processed without a Submittal Schedule.
7. Emergency Contacts List.
8. Certified Payroll.
9. Schedule of unit prices.
10. List of Contractor's staff assignments.
11. List of Contractor's principal consultants.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Administrative actions and submittals that shall precede or coincide with this application include:
    a. Occupancy permits and similar approvals
    b. List of incomplete Work, recognized as exceptions to Architect’s Certificate of Substantial Completion
    c. Record Drawings and Specifications
    d. Operations and Maintenance Manuals
    e. Maintenance Instructions and Training
    f. Start-up performance reports
    g. Test/adjust/balance records
    h. Warranties (guarantees) and maintenance agreements
    i. Final cleaning
    j. Change-over information related to Owner’s occupancy, use, operation and maintenance
    k. Application for reduction of retainage and consent of surety
    l. Advice on shifting insurance coverages

2. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
3. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Ensure that incomplete Work is not accepted and will be completed without undue delay.
2. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
3. Evidence of completion of all Project closeout requirements as specified in 01 70 00.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION 012900

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

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

F. Number of copies of submittals.

G. Requests for Interpretation (RFI) procedures.

H. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Construction Contracts are finalized.

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

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

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

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

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

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

5. Major subcontractors.

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

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

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

3.04 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.05 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.

3. Warranties.
4. Bonds.
5. Other types as indicated.

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

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
   1. PDF's are to be bookmarked with appropriate sections.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. Provide space for Contractor and Architect review stamps.
   9. When revised for resubmission, identify all changes made since previous submission.

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

3.09 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt, but will take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
         2) A corrected submittal shall be included in the closeout documents.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
         1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 013000

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Submit updated schedule with each Application for Payment.

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 013216

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

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

B. This specification describes the procedures for submission of submittals and shop drawings using Newforma Info Exchange.
   1. The Contractor will be required to use the Newforma Info Exchange for the transfer of Submittals, Shop Drawings and RFI's. The contractor will be given a login and password free of charge. For more information follow the procedure below.
      a. Information and instructions for use are available for review by the contractor by contacting CPL. The Contractor is to provide an email address for the file to be sent. A PDF file will be emailed to the requesting contractor.
      b. In leiu of Newforma Info Exchange, Procore may be used, at contractor's expense.

C. Related Requirements:
   1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Section 01 30 00 "Administrative Requirements" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
   3. Section 01 32 16 "Construction Progress Schedule" for submitting schedules and reports, including Contractor's construction schedule.
   4. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
   5. Section 01 78 00 "Closeout Submittals" for submitting closeout submittals and maintenance material submittals.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.03 SUBMITTAL GENERAL ADMINISTRATIVE REQUIREMENTS

A. The Contractor shall prepare a Submittal Log containing the information required to be submitted under the Submittal article from each respective Specification Section. With each item listed the Contractor shall provide anticipated dates for submission to the Architect. The Architect will review and accept or request that corrections be made for subsequent acceptance. This acceptance will constitute an approval for the submittal, shop drawings and sample submissions to commence. **No Submittals or Shop Drawings will be reviewed by the Architect until an approved Submittal Schedule is in place.**

B. The contractor shall prepare expected submittals in Newforma that correspond to all submittals listed on the submittal schedule at the time of submission of the submittal log. These expected submittals are to follow the naming conventions laid out in section "1.5 Submittal Schedule" and "1.6 Submittal Identification"

C. The Contractor is responsible for all costs for creating electronic files for the submittal process. The Architect will not provide this service.
   1. The Submittal Cover Sheet located in Specification Section 006000 Project Forms shall be used for all Submittals.
      a. An electronic form of the submittal cover is available from the Architect.
   2. The Submittal Cover sheet when scanned to a .PDF shall be the first page viewed in the individual file.
      a. Each product submitted within a specification section shall have a Submittal Cover sheet attached. Combined submittals with one cover page will not be accepted
      b. Each Submittal Cover sheet shall be filled in completely. **Files that are sent with the Submittal Cover Sheet missing or not filled in correctly will not be reviewed**. The Architect will send a notice that the submittal is missing information. If the Contractor fails to correct or provide the proper submittal within 15 days, notice will be provided, and the submittal will be REJECTED.
   3. The Contractor(s) will be provided with a link to upload files to the Newforma Info Exchange. The site address and a “log in” will be provided to the Contractor(s) free of charge.
   4. A read only Record Submittal Log and RFI Log will be available from the Newforma Info Exchange for the Contractors reference in checking the status of the submittals and shop drawings.

D. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittals of different types of submittals from related section for parts of the work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received. Delays associated with the above are the not the Architects responsibility and rests solely with the Contractor.

E. Architect's Digital Data Files: For Projects where Project Building Information Modeling Protocol is NOT executed. Provide digital PDF’s only.
   1. Document Transfer Agreement - For Projects where Architect’s work files are not a deliverable: The Contractor shall execute an Electronic Document Transfer Agreement for all electronic transfers of files, other than PDFs. The contractor must provide acknowledgement, accept the information regarding drawings, ownership and Limitations of Liability. Agreement is found with Project Forms.
      a. The following plot files will by furnished for each appropriate discipline:
         1) Floor plans.
         2) Reflected ceiling plans.

1.04 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Submit a preliminary if not final Submittal Schedule for approval a minimum of 15 days after award of contract. Failure to submit a submittal schedule within the required time frame will result in the refusal by the Architect to review any submittals. Delays associated with failure to receive the Submittal Schedule are the not the Architects responsibly and rest solely with the Contractor.

B. The information is required to be submitted under the Submittal article from each respective Specification Section. With each item listed the Contractor shall provide anticipated dates for submission to the Architect. The Architect will review and accept or request that corrections be made for subsequent acceptance. This acceptance will constitute a review for the submittal, shop drawings and sample submissions may commence. No Submittals or Shop Drawings will be reviewed by the Architect until an approved Submittal Schedule is in place.
   1. The Submittal Schedule shall be coordinated with the overall Project Schedule to ensure that submittals are submitted and reviewed so as not to delay the Project Schedule.
   2. The Architect will not be responsible for ensuring that all required Shop Drawings, Product Data, Samples or similar submittals that are required to be submitted and reviewed under the Contract Documents are submitted by the Contractor. Submissions of Shop Drawings, Product Data, Samples or similar submittals are the Contractor's sole responsibility. Delays associated with the contractor's failure to provide the required submittals are the Contractors responsibility.
   3. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   4. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 30 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   5. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
   6. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal Category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's final release or approval.

1.05 SUBMITTAL IDENTIFICATION

A. Submittal Cover Sheet: Attach one cover sheet for each product, shop drawing or sample. DO NOT combine submittals together with one cover sheet for multiple items. They will not be reviewed.

B. Submittal Information: Include the following information in each submittal. Use the submittal cover form found in specification section 060000 Project Forms. An electronic form can be sent to the contractor upon request
   1. Contractor, Address, Phone/fax and or Email
   2. Contractors Submittal Number.
   3. Architects Project Number.
   4. Project Name (if not filled in by the Architect)
   5. Type of submittal being sent (select box)
   6. Product Identification including the following: Provide one submittal cover sheet for each product within a specification section
      a. Specification Section Number
      b. Contract Drawing Number

c. Product Name
d. Specification Reference: Part/Paragraph
e. Detail Reference
f. Manufacturer

7. Contractors Approval: The contractor must acknowledge that they have reviewed the submittal for conformance with the Contract Documents and must sign and date the approval.
8. Deviation from the Contract Documents: Where the submittal may not meet all of the requirements of the specified item. The contractor must indicate how the submitted item differs from the specified item.
9. Contractor Comments: Any additional comments by the contractor should be indicated in this space. (Provide an attachment sheet for any other information required that will not fit on the cover sheet.)

C. Deviations and Additional Information: On each individual submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information, revisions, line by line comparison and other information requested by Architect [and Construction Manager]. Indicate by highlighting on each submittal or noting on attached separate sheet. Identify options requiring selection by Architect.

D. File Naming (for uploading): Each submittal or shop drawing file uploaded to the project on the Newforma Info Exchange, shall have in the file name, the specification section number followed by the submittal number, the submittal abbreviation and the specification section name. For re-submissions an R1 would be added following submittal number. The file name must include the following information:

Example:

081416	001	PD	Flush Wood Door
Spec Section	Submittal No.	Submittal Abbrv	Specification Name

File to Read: 081416-001 PD - Flush Wood Doors

Re-submission to Read:081416-001-R1-Flush Wood Doors

Submittal Abbr. required to be used in the file name on submittals are as follows:

CD	Coordination Drawings
CERT	Certifications
CLC	Calculations
DD	Design Data
EJ	Engineer's Judgement
LEED	LEED or PD/LEED
O&M	Operation and Maintenance Manuals
PD	Product Data
PHOTO	Photo
QD	Qualification Data
RPT	Report
SAMP	Sample
SCH	Schedule
SEL	Make a Selection
SD	Shop Drawing(s)

STDY	Study
TR	Test Results
WAR	Warranty

E. When uploading submittals or RFI's to the Newforma Info Exchange, complete the online transmittal. The information required is derived from the contractor's submittal cover sheet or RFI. Instructions using the Newforma Info Exchange are available from CPL. These instructions can be emailed to the contractor.

1.06 SUBMITTAL DATA AND TESTING REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. Each product within a specification section shall have a separate submittal cover.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable. Send full submittals for each product. Partial submittals will not be reviewed until all required submittal information is received. The architect will not be responsible for project delays due to the contractor's failure to submit the required submittal information in a complete package.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare project-specific information for each shop drawing. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data [unless submittal based on Architect's digital data drawing files is otherwise permitted].
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Description any conflicts with other trades.
      h. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package. If samples are delivered with product data, only the samples will be reviewed. The Product Data must be uploaded to the Newforma Info Exchange. A duplicate submittal cover sheet is to be uploaded to the Newforma Info exchange as a record of sample delivery.
    a. The Product Data is to be loaded concurrent with the delivery of samples. Samples may be delivered/given to the Architect. In the remarks column of the transmittal place “given to the Architect”
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
    g. In addition to all hard copy and physical samples submitted, duplicate digital submittal is to be produced for review, record and tracking purposes through Newforma Info Exchange. Include same information as above as well as a high resolution, color, digital image of all samples with labeled information clearly visible for each physical sample.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit [one] or Insert number full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect [, through Construction Manager,] will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit [three] or Insert number sets of Samples. Architect [and Construction Manager] will retain [two] or Insert number Sample sets; remainder will be returned. [Mark up and retain one returned Sample set as a project record Sample.]
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least [three] or Insert number sets of paired units that show approximate limits of variations.

D. Information requirements for each submittal: Where submittal is requiring Schedules, Product Data, Qualification Data, Design Data, Certificates and Tests use the following protocol.
   1. Schedules: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   2. Product Data. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
      a. Manufacturer and product name, and model number if applicable.
      b. Number and name of room or space.
      c. Location within room or space.
   3. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
   4. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
   5. Certificates:
      a. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
      b. Insert definition of Contractor certificates here if required by individual Specification Sections. See the Evaluations.
      c. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
      d. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
      e. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
      f. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
      g. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
      h. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
      i. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
      j. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
      k. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
   6. Test and Research Reports:
      a. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.

b. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
c. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
d. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
e. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
f. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1) Name of evaluation organization.
2) Date of evaluation.
3) Time period when report is in effect.
4) Product and manufacturers' names.
5) Description of product.
6) Test procedures and results.
7) Limitations of use.

E. Submit the following submittals: Within 15 days of contract award.
1. Submittal Schedule including dates of anticipated review and approval.
a. No submittals will be reviewed without an approved Submittal Schedule in place.
2. Subcontractor List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
a. Name, address, telephone number and email address of entities performing subcontract or supplying products.
b. Number and title of related Specification Section(s) covered by subcontract.
3. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
4. Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

F. Submit with in the first 30 days after Contract Award
1. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014329 "Special Inspections."
2. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
3. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

G. Submit Field Test Reports during construction within 15 days of the testing date and as follows:
1. Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance

with requirements in the Contract Documents.

H. Submit a minimum 30 days prior to Project Closeout:
   1. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
   2. Maintenance Data: Comply with requirements specified in Division 01 Section 017823 "Operation and Maintenance Data."

1.07 SUBMITTAL PROCESSING

A. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.

B. The architect will not be responsible for project delays due to the contractor’s failure to submit the required submittal information in time to allow for review based on the stipulated review time and to meet the project schedule.

C. Initial Review: Allow 14 Calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

D. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

E. Re-submittal Review: Allow 14 Calendar days for review of each re-submittal.

F. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 Calendar days for initial review of each submittal.

G. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 Calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

H. Where submittal are required to be approved that are part of an assembly or for items such as finishes where color selections are required. The submittal will be retained until all of the information related to these systems and color selections is provided and accepted.

I. Products with multiple submittals may be held until all necessary information has been submitted for architect to make a complete review. Submittals dependent on coordinating information from related or dependent products; or products with critical interface with other products may be held until all information is submitted for architect to make a complete review and coordinate all required information. (example door frames will not be reviewed without door hardware)

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with reviewed notation from Architect’s [and Construction Manager's] action stamp.

K. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

1.08 SUBMITTAL PROCEDURES

A. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses,

contact information of architects and owners, and other information specified.

B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

C. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

D. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

E. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

F. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

G. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

H. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

I. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

J. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

K. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

L. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

M. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

N. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

O. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads.

Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

1.09 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractors Approval: Provide Contractor's approval signature and date on the Submittal Cover sheet certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1.10 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will respond to each submittal indicating one of the following actions required:

1. **No Exceptions Taken:** Architect takes no exception to the submittal. This part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
2. **Furnish as Corrected:** No exceptions taken except what is identified by the Architect. The part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance. Furnish any additional related information as requested.
3. **Revise and Re-Submit:** Revise the submittal based on the Architects comments and resubmit the submittal. Do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    a. Do not permit submittals marked “Revise and Resubmit” to be used at the Project Site, or elsewhere where Work is in progress.
4. **Rejected:** The submittal is rejected. See Architects comments on why submittal was rejected.
    a. Submittal has not been reviewed by the Contractor and so noted.
    b. Submittal has been prepared without due regard for information called for or logically implied by the Contract Documents.
    c. Information is not sufficiently complete or accurate to verify that work represented is in accordance with the Contract Documents.
    d. Do not permit submittals marked “Rejected” to be used at the Project Site, or elsewhere where Work is in progress.
5. **No Action Taken:** The submittal is not required and will not be reviewed.

B. Submittals by Newforma Info Exchange: Architect [and Construction Manager] will indicate, on Newforma Info Exchange, the appropriate action.

C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. The Architects action will be noted in the Newforma Info Exchange.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. The Architects action will be noted in the Newforma Info Exchange and noted as a partial review until a full submittal can be received.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for re-submittal without review.

F. Submittals not required by the Contract Documents will not be reviewed and will receive no action.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 013300

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Control of installation.

E. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 012100 - Allowances: Allowance for payment of testing services.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Contractor's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.

1.05 REFERENCES AND STANDARDS

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

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

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

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

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

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

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ services of an independent testing agency to perform specified testing and inspection unless otherwise notedof services included in allowance.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TESTING AND INSPECTION

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

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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

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

3.03 DEFECT ASSESSMENT

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

END OF SECTION 014000

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SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Temporary electric power and light.
   3. Sanitary facilities, including drinking water.

C. Support facilities include, but are not limited to, the following:
   1. Field offices and storage containers.
   2. Temporary roads and paving.
   3. Temporary project identification sign and project signage.
   4. Waste disposal services and dumpsters.
   5. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Barricades, warning signs, and lights.
   2. Security enclosure and lockup.
   3. Enclosure fence for the work site.

E. Related Sections:
   1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.02 INFORMATIONAL SUBMITTALS

A. Temporary Utilities: The contractor shall submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of the date established for submittal of the Contractor's Construction Schedule, the contractor shall submit a schedule indicating implementation and termination of each temporary utility for which the Contractor is responsible.

C. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

D. Erosion and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent

1.03 DEFINITIONS

A. Temporary Facilities: Construction, fixtures, fittings, and other built items required to accomplish the work but which are not incorporated into the finished work.

B. Temporary Utilities: A type of temporary facility, primary sources of electric power, water, natural gas supply, etc., obtained from public utilities, other main distribution systems, or temporary sources constructed for the project, but not including the fixtures and equipment served.

C. Temporary Services: Activities required during construction, which do not directly accomplish the work.

1.04 QUALITY ASSURANCE

A. Regulations: The contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
   1. Building code requirements.

2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department and rescue squad rules.
5. Environmental protection regulations.

B. Standards: The Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

C. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.

D. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

E. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.05 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
   1. **Water and Sewer Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.**
   2. **Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.**

B. Cost or use charges for temporary facilities are not chargeable to the Owner or the Architect. The Architect will not accept a prime contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.

C. Other entities using temporary services and facilities include, but are not limited to, the following:
   1. Other nonprime contractors.
   2. The Owner's work forces.
   3. Occupants of the Project.
   4. The Architect.
   5. Testing agencies.
   6. Personnel of government agencies.

1.06 PROJECT CONDITIONS

A. Temporary Utilities: The contractor shall prepare a schedule indicating dates for implementation and termination of each temporary utility for which the Contractor is responsible. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide **[concrete] or [galvanized-steel]** bases for supporting posts.

B. General: The contractor shall provide new materials. If acceptable to the Architect, undamaged, previously used materials in serviceable condition may be used. Provide materials suitable for use intended.

C. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."
   1. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
   2. For fences and vision barriers, provide minimum 3/8-inch- thick exterior plywood.
   3. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch thick exterior plywood.

D. Water: Provide potable water approved by local health authorities.

2.02 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: (if needed for the Owner, Architect or Const Mgr.) Of sufficient size to accommodate needs of Owner, Architect **[Construction Manager],** and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 15 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
   3. Drinking water and private toilet.
   4. Coffee machine and supplies.
   5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.03 EQUIPMENT

A. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

B. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.

B. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

C. The contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

D. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

E. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged.
   1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to the municipal system as directed by sewer department officials.
   3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

F. Sanitary Facilities: The General Contractor will provide temporary toilets for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
   2. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

G. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
   1. Connect temporary service to Owner's existing power source, as directed by Owner.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

3. Locate field offices, storage trailers, sanitary facilities, and other temporary construction and support facilities for easy access.
4. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Temporary Parking: Parking at most sites is limited to the staging areas and the areas adjacent to the work area. Parking on the street or in owners designated lots is prohibited unless approved by Owner.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   a. See example project Identification sign following this section.
2. Warning and regulatory signage provide as required to protect from hazards and as required by authorities having jurisdiction.
3. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
4. Maintain and touch up signs, so they are legible.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to **requirements of EPA Construction General Permit** authorities having jurisdiction whichever is more stringent.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Enclosure Fence: When excavation begins the contractor will install an enclosure fence with lockable entrance gates. Install in a manner that will prevent the public and animals from easily entering the site, except by the entrance gates.
1. Provide open-mesh, 6’ high chain link fence with posts.

2. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
3. Provide min. 2 double swing access gates and man gates. Each gate is to have a chain and padlock.
4. Provide (2) keys for each lock to the Owner.
5. Remove fence upon completion of all exterior activities or sooner if directed by Architect**.**

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors for each site. Unauthorized signs are not permitted.
1. For construction traffic control/flow at entrances/exits, as designated by the Owner.
2. For warning signs as required
3. Per OSHA standards as necessary
4. For trailer identification
5. For “No Smoking” safe work site at multiple locations.

G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

H. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Coordinate with the installation and release of material to minimize the opportunity for theft and vandalism.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

D. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transportation, handling, storage and protection.

B. Product option requirements.

C. Substitution limitations.

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

E. These provisions apply to all products and equipment whether purchased as part of the contract, or pre-purchased by Owner.

1.02 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2021.

1.03 SUBMITTALS

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

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

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. Use of products having any of the following characteristics is not permitted:

1. Containing lead, cadmium, or asbestos.

C. Motors: Refer to Section 21 05 13 - Common Motor Requirements for HVAC Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

D. Motors: Refer to Section 230513 - Common Motor Requirements for HVAC Equipment-CPL, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

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

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

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

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

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

1.02 REFERENCE STANDARDS

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

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

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

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

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

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

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

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

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

3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

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

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

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

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

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction, unless otherwise noted.

D. 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.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft

surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION 017000

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

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

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

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

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
1. Prebid meeting.
2. Preconstruction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

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SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Include manufacturer's printed operation and maintenance instructions.

F. Include sequence of operation by controls manufacturer.

G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

H. Provide control diagrams by controls manufacturer as installed.

I. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

J. Include test and balancing reports.

K. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Provide a PDF copy, properly bookmarked as well.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

END OF SECTION 017800

SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

C. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. HVAC System, including:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Ductwork and accessories.
   4. Terminal units.
   5. Control system.

C. Integrated Automation.

D. Electrical Systems:
   1. Power quality.
   2. Lighting controls other than manual switches.

E. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 202 - The Commissioning Process Requirements for New Buildings and New Systems; 2024.

B. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Current Edition.

1.04 SUBMITTALS

A. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.

5. Factory test reports.
6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Startup Plans and Reports.

D. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority will prepare the Commissioning Plan.
1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
2. Re-submit anticipated startup dates whenever revised, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority and Engineer.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority and Engineer within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
   1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion and approval of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
   5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see

if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.

10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. Randomly test at least 30 percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
4. If 10 percent of the units in the first sample fail, test another 30 percent of the remaining identical units.

5. If 10 percent of the units in the second sample fail, test all remaining identical units.
6. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION 019113

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SECTION 024100
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 312200 - Grading: Rough and fine grading.

H. Section 312323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION SCOPE

A. Remove gypsum board ceilings in existing mechanical rooms, as noted on Demo Drawings.

B. Remove existing ACT Ceilings as noted on Demo Drawings.

C. Remove existing Chiller Yard Masonry Walls as noted on Demo Drawings.

D. Cap and abandon the 10,000 gallon fuel storage tank and associated piping to existing boiler room. Follow all contract documents and local codes and regulations.

E. All control devices and actuators are to be salvaged by Mechanical Contractor to be handed over to Owner.

F. Remove other items indicated, for salvage, relocation, and recycling.

G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 312200.

3.02 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 permits from authority having jurisdiction.
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 to remain in place and not 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.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify 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. Separate areas in which demolition is being conducted from areas that remain occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.

C. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.

D. 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 to remain in operation, and 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, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification. Unless otherwise noted on drawings.

E. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site; comply with requirements of Section 017419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete reinforcement.

C. Joint devices associated with concrete work.

D. Miscellaneous concrete elements, including equipment pads.

E. Concrete curing.

F. Concrete repair materials.

1.02 RELATED REQUIREMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI 301 - Specifications for Concrete Construction; 2020.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting; 2020.

G. ACI 306R - Guide to Cold Weather Concreting; 2016.

H. ACI 308R - Guide to External Curing of Concrete; 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

J. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022a.

P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

U. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

V. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

W. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

X. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

Y. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.

Z. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

AA. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.

BB. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

CC. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports: Submit report for each test or series of tests specified.

E. Reinforcement Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices

F. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Steel.

2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: 6x6-W2.9xW2.9.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Calcined Pozzolan: ASTM C618, Class N.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. General: Concrete supplier(s) permitted to select and use chemical admixtures indicated in this Section in concrete mix designs to enhance the placement, workability, and other characteristics of the wet concrete properties. Concrete supplier(s) shall review project schedule and coordinate the use of accelerators, retarders, etc. as necessary to facilitate concrete placement in accordance with Hot Weather and/or Cold Weather concreting practice guidelines. Concrete contractor shall also review compatability of all admixtures selected for use in each individual mix design submitted.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Accelerating Admixture: ASTM C494/C494M Type C.

2.05 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
   1. Products:
      a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.
      b. Kaufman Products Inc; SureBond: www.kaufmanproducts.net/#sle.
      c. Kaufman Products Inc; SureWeld: www.kaufmanproducts.net/#sle.

d. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
e. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.

B. Epoxy Bonding System:
1. Complying with ASTM C881/C881M and of Type required for specific application.
2. Products:
a. Adhesives Technology Corporation; Crackbond LR-321 SV, Crackbond LR-321 LV, Crackbond 2100 LPL, Crackbond 2100 MV, Ultrabond 1, Ultrabond 2, or Ultrabond HS-1CC: www.atcepoxy.com/#sle.
b. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.
c. Euclid Chemical Company; DURALFLEX GEL: www.euclidchemical.com/#sle.
d. Euclid Chemical Company; DURALFLEX LV: www.euclidchemical.com/#sle.
e. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: www.euclidchemical.com/#sle.
f. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: www.specchemllc.com/#sle.
g. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com/#sle.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
1. Material: ASTM D1751, cellulose fiber.
2. Material: ASTM D1752, sponge rubber (Type I).

2.06 CURING MATERIALS

A. Resin Curing Compound: Solvent-based liquid, membrane-forming.
1. For use on exterior slabs. When slab will be painted, sealed, topped, or receive other applied finish, completely remove curing compound after curing is complete and before finish coatings are applied.
2. Comply with ASTM C309, Types 1 and 1D, Classes A and B.
3. VOC Content: Less than 350 g/L.
4. Products:
a. Euclid Chemical Company: KUREZ DR-100: www.euclidchemical.com/#sle.
b. Euclid Chemical Company: KUREZ DR-VOX: www.euclidchemical.com/#sle.
c. Euclid Chemical Company: Tammscure WB: www.euclidchemical.com/#sle..

B. Moisture-Retaining Sheet: ASTM C171.
1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete: Slab-on-Grade (interior). (Exposure Category F0)
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,500 pounds per square inch.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Cement Content: Minimum 590 pounds per cubic yard.
4. Water-Cement Ratio: Maximum 45 percent by weight.
5. Total Air Content: 2 percent (+/- one percent), determined in accordance with ASTM C173/C173M.
6. Maximum Slump: 3 1/2 inches (+/- one inch.)
7. Maximum Aggregate Size: 3/4 inch.

D. Normal Weight Concrete: Exterior Slabs. (Exposure Category F3)

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 5,000 pounds per square inch.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Cement Content: Minimum 660 pounds per cubic yard.
4. Water-Cement Ratio: Maximum 40 percent by weight.
5. Total Air Content: 5.5 percent (+/- one percent) determined in accordance with ASTM C173/C173M.
6. Maximum Slump: 3 1/2 inches (+/- one inch.)
7. Maximum Aggregate Size: 3/4 inch.

2.08 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent. Coat contact surfaces of forms with form-release agent before placing reinforcement.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

F. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

G. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.

M. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
2. Use latex bonding agent only for non-load-bearing applications.

3.03 INSTALLING REINFORCEMENT, ANCHOR RODS, AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
   2. Allow six hours between completion of reinforcement installation and placement of concrete for special inspection.

B. Bend steel reinforcement in accordance with ACI 318.
   1. Do not heat steel reinforcement for bending. Bend or straighten bars cold.
   2. Do not bend partially embedded steel reinforcement, except as approved.

C. Clean reinforcement of dirt, grease, scale, loose rust, oil, paint and other foreign matter prior to installation.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

E. Splicing of Reinforcement: Conform to ACI 318 Chapter 25 for wired lap splices and embedment lengths.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire reinforcement in maximum possible lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Splice laps with tie wire.

H. "Wet Sticking", "Hooking-up" or "Walking-in" of any reinforcement will not be permitted.

I. Maintain required concrete cover dimensions indicated. Coordinate placement of conduit and inserts with reinforcement. Protect installed reinforcement from damage or displacement prior to and during concrete placement.

J. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

K. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303. Misplaced or damaged anchor rods shall be subject to re-engineering fees.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchors in concrete structures as indicated.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day

design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R. Verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed and corrections made.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Place concrete for floor slabs in accordance with ACI 302.1R. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.06 JOINTING

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness or a minimum of 1-inch as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting

action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3. Spacing of joints shall not exceed 30 times (24 times for exposed concrete floor surface) the thickness of the slab nor 15 feet on center. All panels should be square or nearly so. Joints shall typically isolate columns and run between columns, with intermediate joints located at equal spaces between column lines.
4. Joints produced using conventional processes shall be made within 4 or 12 hours after the slab in that area has been finished- within 4 hours in hot weather and within 12 hours in cold weather.
5. Joints produced using early-entry dry-cut saws shall be made within 1 or 4 hours after the slab in that area has been finished- within 1 hour in hot weather and within 4 hours in cold weather.
6. Hand tooled joints shall be done immediately following edging, or at the same time.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/8 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal.

3.09 CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.

E. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water-fog spray or saturated burlap.
   a. Spraying: Spray water over floor slab areas and maintain wet.
2. Final Curing: Begin after initial curing but before surface is dry.
   a. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 50 cubic yards or less of each class of concrete placed.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.11 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 PROTECTION

A. Do not permit wheeled traffic over unprotected concrete floor surface for first seven days after pour and not until concrete has attained a minimum compressive strength of 3500 psi.

END OF SECTION 033000

SECTION 033511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Maintain ambient temperature of 50 degrees F minimum.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

C. Manufacturer Warranty: Provide two-year manufacturer warranty for Owner commencing on the Date of Substantial Completion.

D. Installer Warranty: Provide two-year manufacturer warranty for Owner commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS - SOLVENT BASED STAIN MATERIALS

A. Stain: Acetone-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

1. Formula One Liquid Dye Concentrate as manufactured by the L.M. Scofield Company or by approved equal.
2. Stains shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 LIQUID FLOOR TREATMENT

A. Penetrating Liquid Floor Densifiers for Polished Concrete Finish: Clear, waterborne solution of inorganic materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Liquid Densifier: Formula One Lithium Densifier MP L.M. Scofield Company.by the L.M. Scofield Company or approved equal.
2. Liquid floor treatments shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.03 WATER-BORNE ACRYYLIC PENETRATING SEALER

A. Water-borne acrylic penetrating sealer to be equal to Formula One Guard-W as manufactured by the L.M. Scofield Company.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 WAXING

A. Prepare surfaces according to manufacturer's written instructions.

B. Apply two coats and burnish between coats to match the selected field sample panel.

3.05 PROTECTION OF INSTALLED WORK

A. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION 033511

SECTION 040511
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry: Installation of mortar.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022a.

D. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

E. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2023.

F. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

G. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used.

C. Product Data: Submit full range of manufacturer color for Architect's selection.

D. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.

B. Mortar Color: Above Grade:As selected by Architect

C. Below Grade: Natural gray

D. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior Masonry Veneer: Type S.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type S.
   2. Color: As selected by Architect.
   3. Manufacturers:
      a. Amerimix; www.amerimix.com.
      b. Paragon Building Products; www.paragonbp.us.
      c. Sika USA; www.sikausa.com.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Fine.
   2. Manufacturers:
      a. Amerimix; www.amerimix.com.
      b. Paragon Building Products; www.paragonbp.us.
      c. Sika USA; www.sikausa.com.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.
   2. Manufacturers: Per mortar manufacturer approved list.

D. Water: Clean and potable.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install mortar to requirements of section(s) in which masonry is specified.

B. Do not displace reinforcement while placing grout.

3.02 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.

2. Limit height of masonry to 16 inches above each pour.
3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:
1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
2. Place grout for spanning elements in single, continuous pour.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 014000 - Quality Requirements.

END OF SECTION 040511

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SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Facing brick.
C. Reinforcement and anchorage.
D. Flashings.
E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
B. Section 040511 - Masonry Mortaring and Grouting.
C. Section 055000 - Metal Fabrications: Loose steel lintels.
D. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
E. Section 072500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
F. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2019.
C. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
D. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).
F. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
G. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
H. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Solid block: Locate below grade for brick ledge.
      b. Exposed Faces: Manufacturer's standard color and texture.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type 1, See Construction Documents.
   1. Basis of Design:
      a. Palmetto Brick; Matching existing.
   2. Color and texture: See Construction Documents..
   3. Nominal size: As indicated on drawings.
   4. Special shapes: Molded units as required by conditions indicated.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar: As specified in Section 040511.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com/#sle.
   2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
   3. WIRE-BONDwww.wirebond.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
   5. See structural for necessary product perfiormance.

B. Reinforcing Steel: size as indicated on structural drawings; galvanized finish.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.

2.05 FLASHINGS

A. Combination Non-Asphaltic Flashing Materials - Stainless Steel:

1. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
    a. Manufacturers:
        1) Hohmann & Barnard, Inc: www.h-b.com/#sle.
        2) WIRE-BOND: www.wirebond.com/#sle.
        3) York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com/#sle.

B. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
    1. Manufacturers:
        a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
        b. Mortar Net Solutions: www.mortarnet.com/#sle.
        c. York Manufacturing, Inc: www.yorkmfg.com/#sle.

C. Termination Bars: Stainless steel; compatible with membrane and adhesives.
    1. Manufacturers:
        a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
        b. Mortar Net Solutions: www.mortarnet.com/#sle.
        c. York Manufacturing, Inc; Termination Bar: www.yorkmfg.com/#sle.
        d. Substitutions: See Section 016000 - Product Requirements.

D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
    1. Manufacturers:
        a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
        b. Mortar Net Solutions: www.mortarnet.com/#sle.
        c. York Manufacturing, Inc: www.yorkmfg.com/#sle.
        d. Substitutions: See Section 016000 - Product Requirements.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
    1. Manufacturers:
        a. Blok-Lok Limited: www.blok-lok.com/#sle.
        b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
        c. WIRE-BOND: www.wirebond.com/#sle.
        d. Substitutions: See Section 016000 - Product Requirements.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
    1. Manufacturers:
        a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
        b. WIRE-BOND: www.wirebond.com/#sle.
        c. York Manufacturing, Inc: www.yorkmfg.com/#sle.
        d. Substitutions: See Section 016000 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
    1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
        a. Manufacturers:
            1) Advanced Building Products Inc: www.advancedbuildingproducts.com/#sle.
            2) Mortar Net Solutions: www.mortarnet.com/#sle.
            3) York Manufacturing, Inc: www.yorkmfg.com/#sle.

D. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

E. Weeps:
   1. Type: Extruded propylene with honeycomb design.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
      b. Blok-Lok Limited: www.blok-lok.com/#sle.
      c. CavClear/Archovations, Inc: www.cavclear.com/#sle.
      d. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      e. Mortar Net Solutions: www.mortarnet.com/#sle.
      f. WIRE-BOND: www.wirebond.com/#sle.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running Bond and Stacked Bond
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond(s): Running Bond, Stacked Bond, Soldier Course, and Rowlock
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 32 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors in masonry back-up to bond veneer at maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch minimum or install manufactured end dam to form watertight pan at non-masonry construction.
   2. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
   4. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   5. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

3.12 LINTELS

A. Install loose steel lintels over openings as indicated on A401.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.15 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.16 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

3.17 PARGING

A. Dampen masonry walls prior to parging.

B. Scarify each parging coat to ensure full bond to subsequent coat.

C. Parge masonry walls in two uniform coats of mortar to a total thickness of 3/4 inch.

D. Steel trowel surface smooth and flat with a maximum surface variation of 1/8 inch per foot.

E. Strike top edge of parging at 45 degrees.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042000

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in ceiling and roof and exterior wall construction.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

D. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   2. Thermal Resistance: R-value of 19.
   3. Products:
      a. CertainTeed Corporation; _____: www.certainteed.com/#sle.
      b. Johns Manville; _____: www.jm.com/#sle.
      c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall, roof, and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to turning project over to Owner.

END OF SECTION 072100

SECTION 072400
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating, Class PB.

1.02 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).

C. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2022.

D. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2015 (Reapproved 2020).

E. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

G. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2018.

H. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

I. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2021.

J. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2022).

K. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2015, with Editorial Revision (2022).

L. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2023, with Errata.

M. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.

N. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

1.04 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.

1.06 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

PART 2 PRODUCTS

2.01 EXTERIOR INSULATION AND FINISH SYSTEM

A. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

B. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

C. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

D. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.

E. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

F. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

G. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

H. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

I. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

2.02 MATERIALS

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
   1. Where different requirements appear in either document, comply with the most stringent.
   2. Neither of these documents supercedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

3.02 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

C. On wall surfaces, install boards horizontally. On horizontal surfaces, install boards _____ .

D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

E. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.

F. Rasp irregularities off surface of installed insulation board.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.04 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION 072400

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 27 26- Fluid Applied Membrane Air Barrier: sealants required in conjunction with Ari barriers.

B. Section 078400 - Firestopping: Firestopping sealants.

C. Section 088000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.
   5. Substrates for which use of primer is required.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. 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.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver to manufacturer sufficient samples for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

B. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
   1. Repair failed portions of joints.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
   2. Pecora Corporation: www.pecora.com/#sle.
   3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   4. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 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. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. 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. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      c. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where installation of sealant is specified in another section.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.

D. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 016116.

B. Colors: match adjacent color .

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Color: To be selected by Architect from manufacturer's full range.
   6. Cure Type: Single component, neutral moisture curing..
   7. Manufacturers:
      a. Momentive Performance Materials, Inc/GE Silicones: www.siliconeforbuilding.com/#sle.
      b. Pecora Corporation:
      c. Sika Corporation: www.usa-sika.com/#sle.
      d. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: As selected by Architect from Manufacturer's range.
   2. Manufacturers:
      a. Momentive Performance Materials, Inc/GE Silicones: www.siliconeforbuilding.com/#sle.
      b. Pecora Corporation: www.pecora.com/#sle.
      c. Sika Corporation: www.usa-sika.com/#sle.
      d. Tremco Sealants; www.ttremcosealants.com
      e. Substitutions: See Section 016000 - Product Requirements.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 20-35 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufaturer full range.
   4. Manufacturers:
      a. Pecora Corporation: www.pecora.com/#sle.
      b. Sika Corporation: www.usa-sika.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

1. Color: To be selected by Architect from manufacturer's standard range.
2. Manufacturers:
   a. Pecora Corporation: www.pecora.com/#sle.
   b. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
   2. Manufacturers:
      a. Nomaco, Inc: www.nomaco.com/#sle.
      b. Tremco Sealants; www.tremcosealants.com
      c. Substitutions: See Section 016000 - Product Requirements.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. 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. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. 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.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 079200

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Gypsum wallboard.

C. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

E. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

G. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

I. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Marino: www.marinoware.com/#sle.
3. SCAFCO Corporation: www.scafco.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: C-shaped with knurled or embossed faces.
2. Runners: U shaped, sized to match studs.

C. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Common: Office, Admin Areas and General Use: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Non wet- walls in toilet and locker areas. Score of 10, when tested in accordance with ASTM D3273.
3. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 5/8 inch.
4. Mold Resistant Paper Faced Products:

C. Impact Resistant Wallboard:
1. Application: High traffic corridors and public areas, Gymnasiums, , and activity areas .
2. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Type: Fire-resistance-rated Type X, UL or WH listed.
5. Thickness: 5/8 inch.
6. Edges: Tapered.

D. Backing Board For Wet Areas:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
2. Splayed Corner Beads with Paper Face: 135 degree outside corner.
3. Expansion Joints:
   a. Type: V-shaped metal with factory-installed protective tape.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

C. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

C. Blocking: Install wood blocking for support of:
1. Wall-mounted cabinets.
2. Plumbing fixtures.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

C. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 1: areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.

END OF SECTION 092116

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SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 by 6 inches in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

C. Installer: Company specializing in performing work of this section with minimum five years of documented experience.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 EXTRA MATERIALS

A. Furnish 100 sq. ft. of extra panels of each type and size of acoustical panel to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; ____: www.armstrongceilings.com/#sle.
   2. Certainteed Architectural; ____: www.certainteed.com/ceilings-and-walls/#sle.

3. USG Corporation; ____: www.usg.com/ceilings/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1:360.

B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:

2.03 ACOUSTICAL UNITS

A. Acoustical Panels, Type 1: Armstrong, Ultima (1910), with the following characteristics:
1. Application(s): Existing Acoustic Ceiling Panels, incase of damage during construction, this spec section covers replacement tiles..
2. Classification: Type IV, Form 2, Pattern E, Fire Class A.
3. Size: 24 by 24 inches.
4. Thickness: 3/4 inch.
5. Composition: Mineral Fiber.
6. Light Reflectance: 0.90 percent, determined in accordance with ASTM E1264.
7. NRC: 0.70, determined in accordance with ASTM E1264.
8. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
9. Panel Edge: Square.
10. Surface Color: White.
11. Surface Finish: Textured.
12. Suspension System: Exposed grid.

B. Acoustical Panels, Type 2: Armstrong, Health Zone Ultima (1935), with the following characteristics:
1. Classification: ASTM E1264 Type IV, Form 2, Pattern E, Fire Class A.
2. Size: 24 by 24 inches.
3. Thickness: 3/4 inch.
4. Composition: Mineral Fiber.
5. Light Reflectance: 0.86 percent, determined in accordance with ASTM E1264.
6. NRC Range: 0.70, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
8. Panel Edge: Square.
9. Surface Color: White.
10. Surface Finish: Light Texture
11. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System, Type 1:
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Basis of Design:
   a. Manufacturer to be same as manufacturer of ceiling panel to be installed.
3. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
4. Profile: Tee; 15/16 inch face width.
5. Finish: Baked enamel.
6. Color: White.

7. Accessories: Stabilizer bars, clips, splices, and perimeter molderings required for suspended grid system.
8. Support Channels and Hangers: Primed steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
9. Perimeter Wall Angles:
   a. 7/8 inch.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Protect installed work from damage and marring of finishes. Remove and replace components that become damaged.

C. Clean surfaces.

END OF SECTION 095100

SECTION 096500
RESILIENT FLOORING AND BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans.

D. Verification Samples: Submit two samples, 4 by 6 inches in size illustrating color and pattern for each resilient flooring product specified.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Wall Base: 20 linear feet for every 500 linear feet or fraction thereof, of each type and color.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base RB-1:

1. Manufacturers: Provide Basis-of-Design Product as listed in Finish Schedule or comparable product by one of the following:
   a. Burke Flooring.
   b. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
   c. Roppe Corporation.
2. Height: 4 inches
3. Length: Roll not less than 120 feet, or 8 foot sections for millwork wall base.
4. Color: To be selected by Architect from manufacturer's full range.
5. Accessories: Premolded external corners.

2.02 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 090561.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 090561.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

F. Install flooring in recessed floor access covers, maintaining floor pattern.

G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Internal corners shall be job-formed. At external corners, use premolded units from same lot as coils. For millwork wallbase, miter all corners.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

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SECTION 099113
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, including the following:

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. Floors, unless specifically indicated.
   5. Glass.
   6. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

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

1.06 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.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints:
   1. Basis of Design; Sherwin Williams.
   2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   3. PPG Paints: www.ppgpaints.com/#sle.
   4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

B. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly 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: As indicated in Color Schedule.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete and primed metal.
   1. Top Coats: Shop primed (doors and frames, concrete fiber board)
      a. Waterbased Alkyd Urethane Semi-Gloss

2.04 PRIMERS / FILLERS

A. Block Filler: Provide the following unless other primer/block filler is required or recommended by manufacturer of top coats.
   1. Sherwin-Williams; Prep-Rite Interior/Exterior Latex Block Filler; B25W25 - Basis of Design.

2.05 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. 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.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are within limits of manufacturer's install requirements.

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.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099113

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SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, 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, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit two 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.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.05 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.

1.06 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 used in any individual system from the same manufacturer; no exceptions.

B. Paints: Provide Basis-of-Design Product as listed in Finish Schedule or comparable product by one of the folowing:
1. Diamond Vogel Paints: www.diamondvogel.com/#sle.
2. PPG Paints.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

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 materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. 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. Colors: To be selected from manufacturer's full range of available colors.

2.03 PAINT SYSTEMS - INTERIOR

A. 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, aluminum, and acoustical ceilings.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
      a. Basis-of-Design Products:
         1) Sherwin-WilliamsPro Industrial Waterbased Catalyzed Epoxy Semigloss.

2.04 PRIMERS / FILLERS

A. Block Filler:
   1. Sherwin-Williams; Prep-Rite Interior/Exterior Latex Block Filler, B25W25 - Basis of Design.

B. Other Approved Fillers:
   1. Provided by top coat manufacturer.

2.05 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. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

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 or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

G. Galvanized Surfaces:

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. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099123

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.04 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business: www.ansul.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Potter-Roemer: www.potterroemer.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 5 pound.
   3. Finish: Baked polyester powder coat, color as selected.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Secure rigidly in place.
C. Place extinguishers on wall brackets.
D. Verify that the extinguisher operating instructions face outward.

END OF SECTION 104400

SECTION 220500
COMMON WORK RESULTS FOR PLUMBING

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. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Provide: To supply, furnish, install and connect, ready for safe and regular operation of the system or equipment.

G. Install: To erect, mount and connect complete, with related accessories.

H. Supply, Furnish: To purchase, procure, acquire and deliever complete, with related accessories.

I. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

J. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate all plumbing piping and equipment with all other trades, including HVAC, electrical, structural and Architectural ceiling elevations.

PART 1 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Eclipse, Inc.
      d. Epco Sales, Inc.
      e. Hart Industries, International, Inc.
      f. Watts Industries, Inc.; Water Products Div.
      g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig (1035-kPa) minimum working pressure as required to suit system pressures.
   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Epco Sales, Inc.
      d. Watts Industries, Inc.; Water Products Div.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
   1. Manufacturers:
      a. Perfection Corp.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America.

2.05 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.

c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.06 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.07 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.08 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 1 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
      f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
      g. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw or spring clips.
      h. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
      i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.05 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
   3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Use 3000-psi (20.7-MPa, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.08 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220500

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SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Ball valves.

B. Globe valves.

1.03 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 220719 - Plumbing Piping Insulation.

D. Section 221005 - Plumbing Piping.

1.04 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. WOG: Water, oil, and gas.

1.05 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

F. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

G. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

H. AWWA C606 - Grooved and Shouldered Joints; 2022.

I. MSS SP-67 - Butterfly Valves; 2022.

J. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

K. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

L. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

M. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

O. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

P. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.09 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Handle large valves with sling, modified to avoid damage to exposed parts.

B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Conbraco Industries Inc.; Apollo Valves.
   2. Crane Co.; Crane Valve Group; Crane Valves.
   3. Hammond Valve
   4. Milwaukee Valve Company
   5. NIBCO INC.
   6. Red-White Valve Corporation
   7. Watts Regulator Co.; a division of Watts Water Technologies. Inc.

2.02 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, _____.
   2. Dead-End: Single-flange butterfly (lug) type.

3. Throttling: Provide angle, ball, or butterfly.
4. Swing Check (Pump Outlet):
   a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
   b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
   a. 2 inch and Smaller: Threaded ends.
   b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

2.03 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Solder Joint Connections: ASME B16.18.
3. Grooved End Connections: AWWA C606.

F. General ASME Compliance:
1. Solder-joint Connections: ASME B16.18.
2. Building Services Piping Valves: ASME B31.9.

2.04 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim (1/2" - 1"):
1. Comply with MSS SP-110.
2. WSP Rating: 125 psi.
3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread.
6. Seats: PTFE.
7. Stem: Bronze, blowout proof.
8. Ball: Chrome plated brass.
9. Operator: Provide lockable handle and stem extension.
10. Manufacturers:
    a. Apollo Valves; _____: www.apollovalves.com/#sle.
    b. Watts
    c. Nibco - Equal to T-585-70-UL-L
    d. Viega LLC; _____: www.viega.us/#sle.

C. Two Piece, Regular Port with Bronze Trim (1-1/4" - 3"):
   1. Comply with MSS SP-110.
   2. WSP Rating: 250 psi.
   3. Body: Bronze.
   4. End Connections: Pipe threaded.
   5. Seats: PTFE.
   6. Stem: Bronze, Blow out proof
   7. Ball: Chrome plated brass.
   8. Operator: Provide lockable handle.

2.05 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug Style; Bi-directional dead-end service without use of downstream flange:
   1. Class 125 or Class 150 flanges.
   2. Comply with MSS SP-67, Type I.
   3. Lug Style, Service Pressure Ratings:
      a. 100 psi for sizes 14 to 24 inch.
      b. 150 psi for sizes 2 to 12 inch.
      c. Vacuum down to 29.9 in-Hg.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Stem: One or two-piece stainless steel.
   6. Seat: EPDM.
   7. Disc: Stainless steel.
   8. Finish: Epoxy coated.
   9. Operator: Gear operator with handwheel over direct-mount actuator base.

2.06 BRONZE, SWING CHECK VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:
   1. Pressure and Temperature Rating: MSS SP-80, Type 3.
   2. Design: Y-pattern, horizontal or vertical flow.
   3. WOG Rating: 200 psi.
   4. Body: Bronze, ASTM B62.
   5. End Connections: Threaded.
   6. Disc: Bronze.
   7. Manufacturers:
      a. Apollo Valves; _____: www.apollovalves.com/#sle.
      b. Jomar Valves, a division of Jomar Group; _____: www.jomarvalve.com/#sle.

2.07 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
   1. Comply with MSS SP-71, Type I.
   2. Description:
      a. CWP Rating: 200 psi.
      b. Design: Clear or full waterway.
      c. Body: ASTM A126, gray iron with bolted bonnet.
      d. Ends: Flanged as indicated.
      e. Trim: Bronze.
      f. Gasket: Asbestos free.
      g. Closer Control: Factory installed, exterior lever, and weight.
   3. Manufacturers:

a. Apollo Valves; _____: www.apollovalves.com/#sle.
b. Flomatic Valves; 90LS/92LS Swing Check Valve: www.flomatic.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.
3. Orient plate-type into horizontal or vertical position, between flanges.

END OF SECTION 220523

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SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.03 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.04 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.06 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry Inc.

1.07 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ACSE/SEI7.
   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, systems contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.08 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.09 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

C. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Secure fasteners according to manufacturer's recommended torque settings.

H. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 220529

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SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.03 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.04 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

2.02 TAGS

2.03 STENCILS

A. Manufacturers:
   1. Brady Corporation; _____: www.bradycorp.com/#sle.
   2. Kolbi Pipe Marker Co.; _____: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products; _____: www.seton.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:
   1. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

C. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products; _____: www.seton.com/#sle.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Color code as follows:
   1. Combustible Fluids: Brown with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 099123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Use tags on piping 3/4 inch diameter and smaller.

H. Install labels and/or tags on all pipes as follows:
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 220553

SECTION 229000
NATURAL GAS PIPING

NATURAL GAS PIPING

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. Pipes, tubes, and fittings.
   2. Piping specialties.
   3. Piping and tubing joining materials.
   4. Valves.
   5. Pressure regulators.
   6. Concrete bases.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
   2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 SUBMITTALS

A. Product Data: For each type of the following:
   1. Piping specialties.
   2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
   3. Pressure regulators. Indicate pressure ratings and capacities.
   4. Dielectric fittings.

B. Welding certificates.

C. Field quality-control reports.

D. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.08 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.09 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 1 PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, and adhesive.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.02 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
   1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
   2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
   3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
   4. Corrugated stainless-steel tubing with polymer coating.
   5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).

6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches ((1830 mm).)

B. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.03 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

2.04 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig (862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig (862 kPa).
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.

7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Valve Boxes:
1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.05 PRESSURE REGULATORS

A. General Requirements:
1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.

4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. Hart Industries International, Inc.
      d. Jomar International Ltd.
      e. Matco-Norca, Inc.
      f. McDonald, A. Y. Mfg. Co.
      g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      h. Wilkins; a Zurn company.
   2. Description:
      a. Standard: ASSE 1079.
      b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
      c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. Matco-Norca, Inc.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Wilkins; a Zurn company.
   2. Description:
      a. Standard: ASSE 1079.
      b. Factory-fabricated, bolted, companion-flange assembly.
      c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
      d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.07 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 1 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.03 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
   1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
   2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of

1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
   a. Exception: Tubing passing through partitions or walls does not require striker barriers.
5. Prohibited Locations:
   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install anode for metallic valves in underground PE piping.

3.05 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.06 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping.

B. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).

3.07 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.08 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.09 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    c. Topcoat: Exterior alkyd enamel semigloss.
    d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex semigloss.
    d. Color: Gray.
2. Alkyd System: MPI INT 5.1E.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd semigloss.
    d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 KPA) AND LESS THAN 5 PSIG (34.5 KPA)

A. Aboveground, branch piping NPS 1 (DN 25 and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

C. Underground, below building, piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Valves in branch piping for single appliance shall be the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 229000

SECTION 230000
GENERAL PROVISIONS FOR MECHANICAL WORK

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.

B. Requirements of this Section apply to work in every Section of Division 23 equally as if incorporated therein.

1.02 WORK INCLUDED

A. Work included in Division 23 - Mechanical: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for Mechanical Work covered by all sections within this Division.

1.03 SCOPE

A. Division of the Specification into sections is for the purpose of simplification alone. Responsibility for the work of various trades shall rest with the Contractor. Various sections of this Division are related to each other as well as the mechanical drawings. Examine all drawings and read all applicable parts of the project manual in order to ensure complete execution of all work in this Division, coordinating where required with other trades in order to avoid conflicts.

B. These specifications and accompanying drawings are intended to cover the furnishing of all labor, materials, equipment and services necessary for the complete installation and acceptable performance of the mechanical systems. Small items of material, equipment and appurtenances not mentioned in detail or shown on the drawings, but necessary for complete and operating systems shall be provided by this contractor without additional charge to the Owner and shall be included under this contract.

C. In general, specifications establish the quality of material, equipment and workmanship. The contract documents are intended to secure for the Owner, a first-class installation in every respect. Labor shall be performed by skilled mechanics, and the entire facility, when delivered to the Owner, shall be ready for satisfactory and efficient operation.

D. The Contractor shall carefully examine the drawings and specifications before accepting the contract. He shall call attention to any changes or additions which, in his opinion, are necessary to make possible the fulfillment of any guarantee called for by these specifications; failing which, it shall be deemed that he has accepted full responsibility for all such guarantees.

E. The contractor shall put his work in place as fast as is reasonably possible. He shall, at all times, keep a competent foreman in charge of the work, to make decisions necessary for the diligent advancement of the work. The Contractor shall facilitate the inspection of the work by the Owner's Representative.

F. The Contractor shall coordinate all work in the building in order to facilitate intelligent execution of the work. He shall also remove any rubbish as expeditiously as possible.

G. Materials or products specified herein and/or indicated on the drawings by trade’s names, manufacturer's names, model number or catalog numbers establish the quality of materials or products to be furnished. Model numbers are to be confirmed by the manufacturer to provide required capacities and material to meet the specifications and design intent. In no instance shall an obsolete, incomplete or inaccurate trade name, manufacturer name, model number or catalog number indicated on the drawings, result in additional charges to the owner.

H. Points of connection or continuation of work under this contract are so marked on drawings or herein specified. In case of any doubt as to the required exact location of such points, the Owner's Representative shall decide and direct.

I. The plumbing contractor shall provide water services to within two (2) feet of HVAC equipment requiring same, and shall terminate service with a shutoff valve. The mechanical contractor shall make the final connection to the equipment.

1.04 REFERENCE STANDARDS, CODES AND REGULATIONS

A. Requirements of Regulatory Agencies:
   1. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with any State or local laws, ordinances, rules and regulations, the UL and NFPA regulations. The Contractor shall make all changes required by the enforcing authorities. Where alterations to and / or deviations from the Contract Documents are required by the authorities having jurisdiction, report the requirements to the Engineer and secure acceptance before work is started. All such changes shall be made in a manner acceptable to the Engineer and shall be made without cost to the Owner.
   2. When drawings or specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Installation shall be made in compliance with all applicable regulations, and utility company rules, all of which shall be considered a part of this specification and shall take precedence in the order of listing.
   3. It is not the intent of drawings or specifications to repeat requirements of codes except where necessary for completeness in individual sections.

B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Division, in addition to other standards which may be specified in individual sections:
   1. Associated Air Balance Council
   2. Air Diffuser Balance Council
   3. Air Moving and Conditioning Association
   4. American Gas Association
   5. American National Standards Institute
   6. Air Conditioning and Refrigeration Institute
   7. American Society of Heating, Refrigeration and Air Conditioning Engineers
   8. American Society of Mechanical Engineers
   9. American Society for Testing and Materials
   10. Cast Iron Soil Pipe Institute
   11. ETL Testing Laboratories
   12. Factory Mutual Engineering and Research Corporation
   13. National Standard Plumbing Code
   14. National Electrical Manufacturer's Association
   15. National Fire Protection Association
   16. National Board of Fire Underwriters
   17. National Electric Code
   18. Occupational Safety and Health Administration
   19. Plumbing Drainage Institute
   20. Sheet Metal & Air Conditioning Contractors National Association
   21. Underwriters Laboratories, Inc.

C. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Contractor shall secure and obtain all approvals, permits, licenses and inspections and pay all legal and proper fees and charges in this connection, before commencing work in order to avoid delays during construction. He shall deliver the official records of the granting of the permits, etc., to the Owner's Representative.

1.05 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

B. Supply all equipment and accessories new and free from defects.

C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section with all applicable national, state and local codes.

D. All items of a given type shall be the product of same manufacturer.

1.06 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
   1. Specifications, in general, describe quality and character of materials and equipment.
   2. Specifications are of simplified form and include incomplete sentences.
   3. Words or phrases such as "The Contractor shall", "shall be", "furnish", "provide", "a", "an", "the", and "all" may have been omitted for brevity.

B. Drawings: Mechanical drawings under this contract are made a part of these specifications. Deviations from these specifications as noted below must have the approval of the Engineer or Construction Manager without an increase in contract price.
   1. The drawings shall be considered as being diagrammatic and for bidding purposes only. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The attention of the contractor is called to the fact that while these drawings are generally to scale and are made as accurately as the scale will permit, all critical dimensions shall be determined in the field. They are not to be considered as erection drawings.
   2. The drawings do not indicate every fitting, elbow, offset, valve, etc. which is required to complete the job. Contractor shall prepare field erection drawings as required for the use of his mechanics to insure proper installation.
   3. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions.
   4. Before proceeding with work check and verify all dimensions in field.
   5. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
   6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
   7. For exact locations of building elements, refer to dimensional Architectural/Structural drawings.

C. Description of systems: Provide all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawings and field coordinated drawings.
   1. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

D. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

E. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for his interpretation and decision as early as possible, including during bidding period.
   1. Do not proceed with work without Engineer's decision.

1.07 EQUIPMENT MANUFACTURERS

A. The first named manufacturer is used as the basis of design. Other named manufacturers are identified as equivalent manufacturers, not equivalent products. Naming other manufacturers does not necessarily imply conformance of any specific product with the written specifications.

B. The contractor is required to verify that equipment and material to be used on the project meets the requirements of the specifications and will physically fit the available space, clearance and service requirements of the particular piece of equipment and include all pertinent information when he submits material for acceptance. Contractor shall also be responsible for and bear the cost of any modifications to openings available or anticipated as being available for rigging equipment to its final installation place. This shall include openings in exterior envelope, walls and roofs, interior walls, corridors, passage ways or door openings. Any on site dismantling and any reassembly of equipment made necessary by impediment to the rigging of said equipment shall be the sole responsibility of the contractor.

C. Contract document indicates power and physical requirements based on the equipment manufacturer's data as first named. If equipment requiring more system capacity is furnished, the contractor shall be responsible for the cost associated with modifying the design and installation of associated services, including any redesign costs associated with the engineer's review.

1.08 DEFINITIONS

A. "Provide": To supply, furnish, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

B. "Install": To erect, mount and connect complete with related accessories.

C. "Supply", "Furnish": To purchase, procure, acquire and deliver complete with related accessories.

D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

E. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

F. "Wiring": Raceway, fittings, wire, boxes and related items.

G. "Concealed": Items referred to as hidden from normal sight, embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

H. "Exposed": Not installed underground or "concealed" as defined above.

I. "Indicated", "Shown", or "Noted": As indicated, shown or noted on drawings or specifications.

J. "Directed": Directed by Engineer.

K. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product.

L. "Reviewed", "Satisfactory", or "Directed": As reviewed, satisfactory, or directed by or to Engineer.

M. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

N. "Control or Actuating Devices": Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

O. "Remove": Dismantle, demolish and take away from the site and dispose of in accordance with all applicable rules and regulations or, should the Owner so require, deliver to a location as designated by the Owner for the use of the Owner, at no additional cost to the Owner.

P. "Replace": Remove existing and provide an equivalent product or material as specified.

Q. "Extract (and Reinstall) ": Carefully disassemble, dismantle existing, save or store where directed by the Owner, in such a manner as to preserve the existing condition and reinstall as indicated on the drawings or as described in the specifications.

R. Where any device or piece of equipment is referred to in the singular number, such reference shall be deemed to apply to as many devices as are required to complete the installation.

1.09 JOB CONDITIONS

A. This contractor shall investigate all conditions affecting his work and shall provide such offsets, fittings, valves, sheet metal work, etc., as may be required to meet conditions at the building.

B. The contractor shall verify all measurements at the building site and shall be responsible for the correctness of same before ordering materials or before starting work of any Section.
   1. Report to Architect, in writing, conditions which will prevent proper provision of this work.
   2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.
   3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.

C. Piping and ductwork shall be concealed or run behind furring in finished spaces unless otherwise noted to be run exposed.

D. Horizontal piping and ductwork not run below slabs on grade shall be run as close as possible to underside of roof or floor slab above and parallel to building lines. Maintain maximum headroom in all areas.

E. Determine possible interference between trades before the work is fabricated or installed. The contractor must coordinate his work to insure that erection will proceed without such interference. Coordination is of paramount importance and no request for additional payment will be considered where such request is based upon interference between trades.

F. Connections to Existing Work:
   1. Install new work and connect to existing work with minimum of interference to existing facilities.
   2. Temporary shutdowns of existing services:
   3. At no additional charges
      a. At times not to interfere with normal operation of existing facilities.
      b. Only with written consent of Owner.
   4. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
   5. Restore existing disturbed work to original condition.

G. Removal, extraction and relocation of existing work.
   1. The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site. Rubbish and debris shall be removed from the site daily unless otherwise directed so as to not allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas specified by the Owner.
   2. Title to all materials and equipment to be demolished, excepting Owner salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.
   3. The Owner reserves the "Right of First Refusal" on all material for salvage. Material for salvage shall be stored as approved by the Owner. Salvage materials shall be removed from the site before completion of the Contract. Material for salvage shall not be sold on the site.
   4. Property of the Owner: Salvaged items remaining the property of the Owner shall be removed in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment and relocated by the contractor at no cost, to the Owners designated storage facility on the site. Containers shall be properly identified

as to contents.

5. Damaged Items: Items damaged during removal or storage shall be repaired or replaced to match existing.
6. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing conditions.
7. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits, and/or ducts.
8. Provide new material and equipment required for relocated equipment.
9. Plug or cap active piping or ductwork behind or below finish.
10. Do not leave long dead-end branches.
    a. Cap or plug as close as possible to active line.
11. Remove unused piping, ductwork and equipment.
12. Dispose of unusable piping, ductwork and material.

1.10 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping or ductwork:
   1. Prohibited, except as noted, in:
      a. Electric rooms and closets.
      b. Telephone rooms and closets.
      c. Elevator machine rooms.
      d. Electric switchboard room.
   2. Prohibited, except as noted, over or within 5 ft. of:
      a. Transformers.
      b. Substations.
      c. Switchboards.
      d. Motor control centers.
      e. Standby power plant.
      f. Bus ducts.
      g. Electrical panels.
   3. Drip pans under piping:
      a. Only where unavoidable and approved.
      b. 18 gauge galvanized steel.
         1) With bituminous paint coating.
      c. Reinforced and supported.
      d. Watertight.
      e. With 1-1/4 inch drain outlet piped to floor drain or service sink.

1.11 TEMPORARY FACILITIES

A. Temporary facilities are not included within this Section.

1.12 SPECIAL TOOLS

A. Furnish to Owner at completion of work:
   1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of the Division.
   2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.
   3. One pressure grease gun for each type of grease required.
      a. With adapters to fit all lubricating fittings on equipment.
      b. Include lubricant for lubricated plug valves.

1.13 PRODUCT DELIVERY, HANDING AND STORAGE

A. Provide adequate and secure storage facilities for materials and equipment during the progress of the work.

B. Contractor shall be responsible for the condition of all materials and equipment employed in the mechanical installation until final acceptance by the Owner. Protect same from any cause whatsoever.

C. Where necessary, ship in crated sections of size to permit passing through available space.

D. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.

E. Handle and ship in accordance with manufacturer's recommendations.

F. Provide protective coverings during construction.

G. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Engineer.

H. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.

I. Include packing and shipping lists.

J. Adhere to special requirements as specified in individual sections.

1.14 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.

B. Provide temporary storage facilities for materials and equipment.

C. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
   1. Remove from site and provide new, duplicate, material, equipment, or apparatus in replacement of that rejected.

D. Cover motors and other moving machinery to protect from dirt and water during construction. Rotate moving equipment, shafts, bearings, motors etc. to prevent corrosion and to circulate lubricants.

E. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.
   1. Contractor shall be responsible for the replacement of all damaged or defective work, materials or equipment. Do not install sensitive or delicate equipment until major construction work is completed.
   2. Remove replaced parts from premises.

F. Make good any damage to the work caused by floods, storms, accidents, acts of God, acts of negligence, strikes, violence or theft up to time of final acceptance by the Owner.

G. Do not leave any mechanical work in a hazardous condition, even temporarily.

1.15 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representative of the Engineer.

B. Advise Architect and Engineer that work is ready for review at following times:
   1. Prior to backfilling buried work.
   2. Prior to concealment of work in walls and above ceilings.
   3. When all requirements of Contract have been completed.

C. Neither backfill nor conceal work without Engineer's consent.

D. Maintain on job a set of Specifications and Drawings for use by Engineer's representatives.

1.16 SCHEDULE OF WORK

A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.

B. In scheduling, anticipate means of installing equipment through available openings in structure.

C. Confirm in writing to Architect and Engineer, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems.
   1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
   2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.

D. Arrange with Owner schedule for work in each area.

E. Unless otherwise directed by Owner, perform work during normal working hours.

F. Work delays:
   1. In case noisy work interferes with Owner's operations, Owner may require work to be stopped and performed at some other time, or after normal working hours.

1.17 ACCESS TO MECHANICAL WORK

A. Access doors in walls and ceilings.

B. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.

C. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

D. Furnish to the general contractor all access doors necessary for access through inaccessible wall or ceiling construction, for installation by the general contractor. Information on the size and location of the subject access doors is to be communicated in writing to the general contractors during the bidding period.

1.18 CONCRETE FOR MECHANICAL WORK

A. Concrete for Mechanical Work
   1. Basins and curbs for mechanical equipment.
   2. Mechanical equipment foundations and housekeeping pads.
   3. Inertia bases for isolation of mechanical work.
   4. Rough grouting in and around mechanical work.
   5. Patching concrete cut to accommodate mechanical work.

B. Quality control testing for concrete is required as work of this section.

C. Concrete Work Codes and Standards:
   1. Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards; whichever is the most stringent in its application to work in each instance.
      a. ACI 301: "Specifications for Structural Concrete for Buildings"
      b. ACI 311: "Recommended Practice for Concrete Inspection"
      c. ACI 318: "Building Code Requirements for Reinforced Concrete"
      d. ACI 347R: "Recommended Practice for Concrete Form work"
      e. ACI 304R: "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"
      f. Concrete Reinforcing Steel Institute's, "Manual of Standard Practice"

D. Submittals: Shop Drawings, Mechanical Concrete Work: Submit shop drawings for structural type concrete work, showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.

E. Laboratory Test Reports, Mechanical Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).

1.19 NOISE REDUCTION

A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.
   1. To extent of adjustments to specified and installed equipment and appurtenances.

B. Correct noise problems caused by failure to install work in accordance with Contract Documents.
   1. Include labor and materials required as result of such failure.

1.20 CUTTING AND PATCHING

A. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified.

B. Do not cut or drill structural members without consent of Architect.

1.21 COORDINATION DRAWINGS

A. Layout Shop Drawings Required:
   1. Prepare layout shop drawings for all areas; minimum 3/8 inch scale.
   2. Individual coordinated trade layout drawings are to be prepared for all areas.
   3. General Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
      a. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
   4. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by Contractor.
   5. All changes shall be clearly marked on each submitted layout drawing.
   6. Drawings shall show work of all trades including but not limited to'
      a. Ductwork.
      b. Piping: All Trades.
      c. Mechanical Equipment.
      d. Electrical Equipment.
      e. Main Electrical conduits and bus ducts.
      f. Equipment supports and suspension devices.
      g. Structural and architectural constraints.
      h. Show location of:
         1) Valves
         2) Piping specialties
         3) Dampers
         4) Access Doors
         5) Control and electrical panels
         6) Disconnect switches
   7. Drawings shall indicate coordination with work in other Divisions that must be incorporated in mechanical spaces, including, but not limited to:
      a. Elevator equipment.
      b. Cable trays not furnished under Division 16.
      c. Computer equipment.

8. Submission of drawings:
    a. Prepare reproducible drawings.
    b. Submit to other trades for review of space allocated to all trades.
    c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades.
    d. Review revisions and other trades.
    e. Submit one reproducible and one blueline print to Engineer for review.
9. Final prepared drawings shall show that other trades affected have made reviews and signed, by each trade, at completions of coordination.
    a. General Contractor
    b. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
10. No layout shop drawing will be reviewed without stamped and signed coordination assurance by General Contractor.

B. Shop Drawings:
1. Layout drawings of mechanical equipment rooms and penthouses showing all related equipment and equipment clearances required by other trades.
2. Layout drawings of areas in which it may be necessary to deviate substantially from layout shown on the drawings. Minor transitions in ductwork, if required due to job conditions, need not be submitted as long as the duct area is maintained. Show major relocation of ductwork and major changes in size of ducts. Coordinate shop drawings with all trades prior to ductwork fabrication.
3. Details of intermediate structural steel members required to span main structural steel for the support of ductwork.
4. Method of attachment of duct hangers to building construction.
5. Duct material, gage, type of joints and duct reinforcing for each size range, including sketches or SMACNA plate numbers for joints, method of fabrication and reinforcing.

1.22 GUARANTEE

A. Furnish guarantee covering all work in accordance with general requirements of the contract for minimum period of one year. This guarantee shall exist for a period of one (1) year from the date of final acceptance of the work and shall apply to defects in materials and to defective workmanship of any kind.

B. For factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice, obtain such guarantees and replace any such equipment that proves defective during the life of these guarantees.

C. Guarantee all work for which materials are furnished, fabricated or field erected by the contractor, all factory-assembled equipment for which no specific manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guaranteed equipment.

D. In the event of failure of any work, equipment or device during the life of the guarantee, repair or replace the equipment or defective work. Remove, replace or restore, at no cost to the Owner, any part of the structure or building which may be damaged either as the direct result of the defective work or in the course of the contractor's making replacement of the defective work or materials. Work shall be done at a time and in a manner as to cause no undue inconvenience to the Owner. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.

E. This guarantee also applies to services including Instructions, Adjusting, Testing, Noise, Balancing, etc.

F. Additional equipment and material guarantees and warrantees may be indicated in other sections. In all cases, the more stringent guarantee or warrantee shall be provided.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT QUALITY

A. Material and equipment furnished under this Division of specification shall be new. Defective or inferior materials must be replaced by contractor at no cost to Owner regardless of the stage of construction. Inferior material shall be defined as material or equipment of a quality or performance less than that specified as determined by the Owner's Representative.

B. Provide each item of equipment with manufacturer's identification tag which is readily accessible and clearly shows model and size.

2.02 ACCESS TO MECHANICAL WORK

A. Access Doors:
   1. General: Where walls and ceilings must be penetrated for access to mechanical work, access doors shall be provided. Furnish adequate size for intended and necessary access. Furnish doors with UL Fire Rating to match wall or ceiling construction. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Tests:
   1. Perform as specified in individual sections, and as required by authorities having jurisdiction.
   2. Duration as noted.

B. Provide required labor, material, equipment, and connections.

C. Furnish written report and certification those tests have been satisfactorily completed.

D. Repair or replace defective work, as directed.

E. Pay for restoring or replacing damaged work due to tests as directed.

F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.02 ACCESS TO MECHANICAL WORK

A. Coordinate installation and placement of access doors and panels with contractor for general construction.

B. Remove or replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 230000

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SECTION 230002
MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work Included in This Section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Motors.
   2. Factory-wired equipment (FWE).
   3. Factory-wired control panels (FWCP).
   4. Motor controllers where provided as part of mechanical equipment.
   5. Motor controllers where supplied under Division 23 - Mechanical Work.
   6. Disconnects and safety switches for mechanical equipment.
   7. Fuses for equipment provided, and starters and disconnect switches.
   8. Emergency Pushbutton Operator Station.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 23 - HVAC Instrumentation and Controls, Motors.

B. Installation and Power Wiring of Motor Controllers.

1.03 REFERENCE STANDARDS

A. Published specifications standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
   1. ANSI - American National Standards Institute.
   2. NEMA - National Electrical Manufacturer's Association.
   3. IEEE - Institute of Electrical and Electronic Engineers.

1.04 QUALITY ASSURANCE

A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

B. Supply all equipment and accessories new and free from defects.

C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.03 of this Section and with all applicable National, State and local codes.

D. All items of a given-type shall be the products of the same manufacturer.

1.05 DIVISION OF WORK

A. This section delineates the work required to be performed by Contractors under Division 23 and Division 26.

1.06 WORK REQUIRED UNDER DIVISION 23

A. Furnish motors, manual and combination starters, pushbutton devices, contactors, disconnect switches, electric thermostats, low voltage transformers, Emergency Break Glass Stations and other electrical devices required for equipment furnished.

B. Install all items in piping and ductwork such as control valves, aquastats, ductstats, etc.

C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring, boiler wiring, Emergency Break Glass Stations, and mounting of control devices, etc., shall be included under Division 23. All external wiring shall be in conduit. (Unless specifically shown to be provided by the Electrical Contractor)

D. The Electrical Contractor, under Division 26, shall furnish and install all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be

responsible for proper direction of rotation for all three phase equipment. The Electrical Contractor shall mount all starters, disconnects.

E. Wiring required under Division 23 shall comply with the specifications as described in Division 26.

F. The Plumbing Contractor, under Division 22, shall provide water and natural gas services to within two (2) feet of HVAC equipment requiring same and terminating with shut-off valves. The HVAC Contractor, under Division 23, shall make final connections to equipment.

G. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to furnish units)

1.07 SUBMITTALS

A. Shop Drawings: Complete wiring diagrams of all power and control connections (standard diagrams will not be accepted). Deliver 2 copies of approved wiring diagrams to the Electric Contractor for installation of wiring and connections required under the Electric Contract.

B. Product Data for Motor Controllers and Disconnect Switches: Manufacturer's catalog sheets, specifications and installation instructions. Submit enclosure type coordinated for service and location. Submit simultaneously with product data required for motors. Identify each controller for use with corresponding motor. Submit shop drawings and product data in accordance with project requirements.

C. All warranties shall be delivered as part of the close-out submission.

D. A receipt shall be delivered as part of the close-out submission that states all required spare parts have been delivered to the owner. This receipt must be signed and dated by the owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Motor Controllers and Disconnects
   1. Square D
   2. Allen-Bradley
   3. General Electric
   4. Cutler-Hammer

2.02 MOTOR CONTROLLERS

A. General: All starters shall be correctly sized to motor connected thereto. Provide one (1) additional auxiliary contact over and above that normally furnished, at least two (2) required. Provide overload heaters for each phase. Coordinate starters and controllers with the temperature control Contractor and sequence of operations.

B. Minimum Size: The minimum allowable size of single or three phase magnetic motor controller is NEMA size 0.

C. Enclosures: Unless otherwise indicated furnish NEMA 1 enclosures, except where installed outdoors furnish NEMA 3R enclosures.

D. Control Power: Furnish control power transformer (maximum control voltage 120 volts) mounted within each magnetic motor controller enclosure.

E. Pilot Lights: Furnish pilot lights of the neon lamp type mounted in the controller enclosure, green for running, red for not running.

2.03 MOTOR CONTROLLER TYPES:

A. Type A (Full Voltage, Manual, Non-Magnetic):
   1. Allen-Bradley Co. Bulletin 609 (or Bulletin 600 - single phase, 1 HP or less only).
   2. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).

3. Cutler-Hammer. B100 (or MS - single phase, 1 HP or less only).

B. Type A2 (2 Speed, 2 Winding, Full Voltage, Manual, Non-Magnetic):
1. Allen-Bradley Co. Bulletin 609TS (or Bulletin 600 - single phase, 1 HP or less only).
2. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).
3. Square D Co. Class 2512, Type M (or Class 2512, Type F - single phase, 1 HP or less only).

C. Type B (Full Voltage Magnetic):
1. Allen-Bradley Co. Bulletin 709.
2. General Electric Co. CR-206.
3. Square D Co. Class 8536.
4. Cutler-Hammer. ECN05.

D. Type B-COM (Combination Full Voltage Magnetic/Safety Switch):
1. Allen-Bradley Co. Bulletin 712.
2. General Electric Co. CR-208.
3. Square D Co. Class 8538.
4. Cutler-Hammer. ECN16.

E. Type B2 (2 Speed, 2 Winding, Full Voltage, Magnetic):
1. Allen-Bradley Co. Bulletin 715.
2. General Electric Co. CR209.
3. Square D Co. Class 8810.
4. Cutler-Hammer. ECN33.

F. Type C (Automatic, Reduced Voltage, Magnetic):
1. Allen-Bradley Co. Bulletin 746.
2. General Electric Co. CR-231.
3. Square D Co. Class 8606.
4. Cutler-Hammer. ECA42.

G. Type C-COM (Combination Automatic, Reduced Voltage, Magnetic/ Safety Switch):
1. Allen-Bradley Co. Bulletin 746C.
2. Square D Co. Class 8606.
3. Cutler-Hammer. ECA43.

H. Type D (Part Winding, Magnetic):
1. Allen-Bradley Co. Bulletin 736.
2. General Electric Co. CR-230.
3. Square D Co. Class 8640.
4. Cutler-Hammer. ECA45.

2.04 REMOTE PUSH BUTTON STATIONS

A. Start-Stop with pilot light in NEMA 1 enclosure unless otherwise indicated.
1. Allen-Bradley Co. Bulletin 800S.
2. General Electric Co. CR-2943.
3. Square D Co. Class 9001.
4. Cutler-Hammer. Class 10250.

2.05 SAFETY SWITCHES

A. General Electric Co. Type TH; Square D Co. Heavy Duty Series; Cutler-Hammer HD Series; with the following:

1. Fused switches equipped with fuseholders to accept only the fuses specified in Section 16181 (U.L. Class RK-1, RK-5, L).
2. NEMA 1 enclosure unless otherwise indicated on drawing or required. 3R for devices installed outdoors.
3. Switch rated 240V for 120V, 208V, 240V, circuits; 600 V for 277V, 480V circuits.
4. Switch rated 600V for 277V, 480V circuits.
5. Solid neutral bus when neutral or grounding conductor is included with circuit.
6. Current rating and number of poles as indicated on drawings.

2.06 NAMEPLATES

A. Phenolic Type: Standard phenolic nameplates with 3/8" minimum size lettering engraved thereon.

B. Embossed Aluminum: Standard stamped or embossed aluminum tags: Tech Products, Inc., Seton Name Plate Corp.

2.07 EMERGENCY PUSHBUTTON OPERATOR STATION

A. Acceptable Manufacturer: Square D or equal.

B. Switch Style: Class 9001, NEMA 4 rated emergency mushroom head pushbutton.

C. Voltage: 120VAC, 60Hz as required.

D. Contacts: 20A, 2-NO/2-NC contact.

E. Operation: Manual.

F. Normal position: Operator out.

G. Activated position: Operator in.

H. Reset: Manual, turn to release.

I. Enclosure: NEMA 4.

2.08 CUSTOM LEGEND PLATE

A. "EMERGENCY BOILER SHUTOFF"

PART 3 - EXECUTION

3.01 GENERAL

A. Equipment shall be connected in a neat and skillful manner. Equipment deliver with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions by the Mechanical Contractor furnishing the equipment.

B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18" long.

C. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.

D. All electrical work required in the Mechanical Contract shall conform to the applicable requirements of Division 26 of these Specifications.

E. The Heating, Ventilating, and Air Conditioning Contractor shall assign all Electrical Work required under his contract to the approved Automatic Temperature Control Contractor, who shall perform this work with qualified electricians employed by that Contractor.

F. The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.

G. Install heaters correlated with full load current of motors provided.

H. Set overload devices to suit motors provided.

3.02 INSTALLATION

A. Control Wiring:
   1. Provide control wiring and connections.
   2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).

B. Nameplates: Rivet or bolt the nameplate on the cover of NEMA 1 enclosures. Rivet or bolt and gasket the nameplate on cover of NEMA 3R or NEMA 12 enclosures. Provide phenolic or embossed aluminum nameplates as follows:
   1. On each remote control station, indicating motor controlled.
   2. On each interlock circuit switch, indicating purpose of switch.

C. Emergency Pushbutton Operator Station: Wire all switches in series with boiler control branch circuits.

3.03 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (SYSTEMS UNDER 250 VOLTS)

A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.

B. Single Phase Motors Less than 1/2 HP - Automatically Operated: Type A.

C. Single Phase Motors 1/2 to 5 HP - Automatically Operated: Type B.

D. Three Phase Squirrel Cage Motors Less than 7-1/2 HP: Type B (B-COM when indicated on drawings).

E. Three Phase Squirrel Cage Motors 7-1/2 HP and Larger: Type C (C-COM when indicated on drawings).

F. Three Phase Hermetically Sealed Compressor Motors Less than 7-1/2 HP: Type B.

G. Three Phase Hermetically Sealed Compressor Motors 7-1/2 HP and Larger: Type D.

3.04 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (277/480 VOLT SYSTEM)

A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.

B. Single Phase Motors Less than 1 HP - Automatically Operated: Type A.

C. Single Phase Motors 1 to 5 HP - Automatically Operated: Type B.

D. Three Phase Squirrel Cage Motors Less than 15 HP: Type B (B-COM when indicated on drawings).

E. Three Phase Squirrel Cage Motors 15 HP and Larger: Type C (C-COM when indicated on drawings).

F. Three Phase Hermetically Sealed Compressor Motors Less than 15 HP: Type B.

G. Three Phase Hermetically Sealed Compressor Motors 15 HP and Larger: Type D.

3.05 TYPES OF MOTOR CONTROLLERS REQUIRED FOR 2 SPEED MOTORS (SYSTEMS UNDER 250 VOLTS)

A. Single Phase Motors Less than 5 HP - Manually Operated: Type A2.

B. Single Phase Motors Less than 1/2 HP - Automatically Operated: Type A2.

C. Single Phase Motors 1/2 to 5 HP - Automatically Operated: Type B2.

D. Three Phase Squirrel Cage Motors Less than 7-1/2 HP: Type B2.

3.06 TYPES OF MOTOR CONTROLLERS REQUIRED FOR 2 SPEED MOTORS (277/480 VOLT SYSTEM)

A. Single Phase Motors Less than 5 HP - Manually Operated: Type A2.

B. Single Phase Motors Less than 1 HP - Automatically Operated: Type A2.

C. Single Phase Motors 1 to 5 HP - Automatically Operated: Type B2.

D. Three Phase Squirrel Cage Motors Less than 15 HP: Type B2.

3.07 DISCONNECTS

A. Motor Controllers: Provide safety switch for all motor controllers. Provide combination type starter-disconnect unless otherwise noted on drawings.

B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.

C. Provide safety switches for all factory packaged equipment.

D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.

E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc

3.08 EMERGENCY PUSHBUTTON OPERATOR STATION

A. Provide Emergency Pushbutton Operator Station at each boiler room exit to de-energize the primary control circuit and to close the main fuel valves to stop the flow of fuel to the burner during an emergency.

B. Review plans for locations.

C. Provide all conduit and wiring for interlock of each boiler.

END OF SECTION 230002

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

C. NEMA MG 1 - Motors and Generators; 2021.

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

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.

B. Leeson Electric Corporation: www.leeson.com/#sle.

C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.

2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

C. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 262913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

M. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.06 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Provide ECM's where specified in the documents with the specified characteristics.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 230513

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SECTION 230516
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B. Design Data: Indicate selection calculations.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Maintenance Data: Include adjustment instructions.

E. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with UL (DIR) requirements.

2.02 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:
   1. The Metraflex Company; _____: www.metraflex.com/#sle.
   2. Approved equal..

B. Inner Hose: Bronze.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi up to 12 inch.

E. Maximum Service Temperature: 450 degrees F.

F. End Connections: Flanged.

G. Size: Use pipe sized units.

H. Maximum offset: 3/4 inch on each side of installed center line.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 125 psi up to 2 inch.

D. Maximum Service Temperature: 450 degrees F.

E. End Connections: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.04 EXPANSION JOINTS - COMPENSATORS

A. Type: Two-ply 304 stainless steel bellows with carbon steel shroud.

B. Maximum Working Pressure: 200 psi.

C. Maximum Working Temperatures: 400 degrees F.

D. Maximum Compression: 1/2 inch.

E. Maximum Extension: 5/32 inch.

F. End Connections: Female copper sweat.

G. Application: Copper piping up to 3 inches in size or steel piping up to 4 inches in size.

2.05 EXPANSION JOINTS - HOSE AND BRAID

A. Manufacturers:
   1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.

C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure

D. Maximum Working Pressure: 150 psi at 800 degrees F.

E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment
   1. Selected Product to Accommodate:
      a. Angular Rotation: 15 degrees.
      b. Force developed by 1.5 times specified maximum allowable operating pressure.
   2. Provide necessary accessories including, but not limited to, swivel joints.

2.06 ACCESSORIES

A. Pipe Alignment Guides:
   1. Manufacturers:
      a. The Metraflex Company; PGQ Glide Riser Guide: www.metraflex.com/#sle.
      b. Approved equal..
   2. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION 230516

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SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

1.02 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.03 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations:
   1. Do not penetrate building structural members.

E. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber in compliance with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 230517

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Filter gauges.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc: www.omega.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

C. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

2. Omega Engineering, Inc: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs adjacent to pressure gauges and pressure gauge taps.

END OF SECTION 230519

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. Ball valves.
C. Butterfly valves.
D. Check valves.
E. Chainwheels.

1.02 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Nonrising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. SWP: Steam working pressure.
I. TFE: Tetrafluoroethylene.
J. WOG: Water, oil, and gas.

1.03 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
I. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
L. AWWA C606 - Grooved and Shouldered Joints; 2022.
M. MSS SP-45 - Drain and Bypass Connections; 2020.
N. MSS SP-67 - Butterfly Valves; 2022.
O. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.
P. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

R. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

S. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.

T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 SUBMITTALS

A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Secure check valves in either the closed position or open position.
   5. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.

C. Exercise the following precautions for handling:
   1. Handle large valves with sling, modified to avoid damage to exposed parts.
   2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Throttling (Hydronic): Butterfly and Ball.
   2. Isolation (Shutoff): Butterfly and Ball.
   3. Swing Check (Pump Outlet):
      a. 2 NPS and Smaller: Bronze with bronze disc.
      b. 2-1/2 NPS and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.
   4. Dead-End: Butterfly, single-flange (lug) type.

B. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 NPS and Smaller: Threaded ends.

b. 2-1/2 NPS and Larger: Grooved ends or flanged.
2. Copper Tube:
a. 2 NPS and Smaller: Threaded ends (Exception: Solder-joint valve-ends).

C. Chilled Water Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
a. Threaded ends.
b. Ball: Full port, two piece, stainless steel trim.
c. Swing Check: Bronze disc, Class.
2. 2-1/2 NPS and Larger, Iron Valves:
a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.
b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.
c. Swing Check: Metal seats, Class 125.
d. Grooved-End Check: 3 NPS to 12 NPS, 300 CWP.

D. Heating Hot Water Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
a. Threaded ends.
b. Ball: Full port, two piece, stainless steel trim.
c. Swing Check: Bronze disc, Class 125.
2. 2-1/2 NPS and Larger, Iron Valves:
a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.
b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.
c. Swing Check: Metal seats, Class 125.
d. Grooved-End Swing Check: 3 NPS to 12 NPS, 300 CWP.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: Extended neck.
3. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.

2.04 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug Style: Bi-directional dead-end service without use of downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig and 200 psig.
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.

2.05 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa), 300 psig (2070 kPa): 8 NPS (50 DN) or smaller, and 200 psig (1389 kPa): 10 NPS (250 DN) or larger.
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.06 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-68.
2. Class 150: CWP Rating: 285 psig and Class 300: CWP Rating: 720 psig at 100 degrees F.
3. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
4. Seat: Metal or reinforced PTFE.
5. Offset stem: Stainless steel.
6. Disc: Carbon steel.

2.07 BRONZE, SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).
   1. Comply with MSS SP-80, Type 3.
   2. Body Design: Horizontal flow.
   3. Body Material: Bronze, ASTM B62.
   4. Ends: Threaded.
   5. Disc: Bronze.

2.08 IRON, FLANGED END SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) with Metal Seats.
   1. Comply with MSS SP-71, Type I.
   2. Design: Clear or full waterway with flanged ends.
   3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
   4. Trim: Bronze.
   5. Disc Holder: Bronze.
   6. Gasket: Asbestos free.

2.09 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP:
   1. 2 NPS to 8 NPS.
   2. CWP Rating: 300 psig.
   3. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
   4. Seal: EPDM or Nitrile.
   5. Disc: Ductile iron.
   6. Coating: Black, non-lead paint.

2.10 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to ball, butterfly, and plug valve stems.
   3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
   4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.

D. Provide chainwheels on operators for valves 4 NPS and larger where located 96-inches or more above finished floor.

END OF SECTION 230523

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

I. MFMA-4 - Metal Framing Standards Publication; 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with MSS SP-58.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 4.0. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Ferguson Enterprises Inc: www.fnw.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   3. Comply with MFMA-4.
   4. Channel Material:

a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D. Thermal Insulated Pipe Supports:
1. Manufacturers:
a. Buckaroos, Inc: www.buckaroos.com/#sle.
b. KB Enterprises: www.snappitz.com/#sle.
2. General Construction and Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. PVC Jacket:
a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
b. Minimum Service Temperature: Minus 40 degrees F.
c. Maximum Service Temperature: 180 degrees F.
d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
e. Thickness: 60 mil.
f. Connections: Brush on welding adhesive.
4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
5. Products:
a. Buckaroos, Inc; CoolDry: www.buckaroos.com/#sle.

E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F:
a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
b. Support From Below: MSS SP-58 Types 35 through 38.
2. Operating Temperatures from 122 to 446 degrees F:
a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
c. Sliding Support: MSS SP-58 Types 35 through 38.

F. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
1. Manufacturers:
a. Anvil International; H-Block: www.anvilintl.com/#sle.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.

3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
   1. Manufacturers:
      a. Ferguson Enterprises Inc: www.fnw.com/#sle.
   2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
   3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:
   1. Manufacturers:
      a. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
   2. Provide copper plated clamps for copper tubing support.
   3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

I. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

J. Strut Clamps: Two-piece pipe clamp.

K. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

L. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

M. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
   1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
   2. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.
   3. Pipe Diameter 8 inches: 0.625 inch U-bolt.
   4. Pipe Diameter 10 inches: 0.75 inch U-bolt.
   5. Pipe Diameter 12 to 16 inches: 0.875 inch U-bolt.
   6. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.

N. Pipe Alignment Guides: Galvanized steel.
   1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.
   2. Pipe Diameter 10 inches and Larger: Roller type.

O. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

P. Pipe Shields for Insulated Piping:
   1. Manufacturers:
      a. Anvil International: www.anvilintl.com/#sle.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Minimum Service Temperature: Minus 40 degrees F.
      e. Maximum Service Temperature: 178 degrees F.
      f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

Q. Anchors and Fasteners:
   1. Manufacturers - Mechanical Anchors:

a. Hilti, Inc: www.us.hilti.com/#sle.
b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
c. Powers Fasteners, Inc: www.powers.com/#sle.
d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc: www.us.hilti.com/#sle.
   b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
   c. Powers Fasteners, Inc: www.powers.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

R. Pipe Installation Accessories:
1. Copper Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
2. Thermal Insulated Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
3. Overhead Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
4. Plenum Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
5. Telescoping Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
6. Inserts and Clamps:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

2.02 RETROFIT PIPING COVER SYSTEM

A. Manufacturers:
1. DecoShield Systems, Inc: www.decoshield.com/#sle.

B. General Requirements:
   1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.

C. Materials:
   1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.
   2. Cover Units: L-shaped and U-shaped cross-section units of flame retardant resin material, paintable finish.
   3. Unit Length: 7.5 feet.
   4. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
   5. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 230529

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SECTION 230548
VIBRATION CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration isolators.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate size, shape, reinforcement, and attachment of housekeeping pads supporting vibration isolated/restrained equipment.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Kinetic Noise Control, Inc; www.kineticsnoise.com/#sle.

B. Mason Industries; www.mason-ind.com/#sle.

C. Vibration Eliminator Company, Inc; www.veco-nyc.com/#sle.

D. Source Limitations: Furnish vibration isolation/seismic control products by single manufacturer.

2.02 VIBRATION ISOLATION REQUIREMENTS

A. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Spring Elements for Spring Isolators:
   1. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8, unless otherwise indicated; provide up to 50 percent overload capacity.
   2. Select springs to provide operating static deflections as required.
   3. Designed to provide additional travel to solid of not less than 50 percent of rated deflection.
   4. Outside Diameter: Minimum of 0.8 times compressed height of spring, unless internally nested.
   5. Spring Ends: Square and ground for stability.
   6. Support springs with neoprene cup or metal base plate with ribbed neoprene pad, minimum 0.25 inch thick, bonded to base plate.
   7. Color code or otherwise identify springs to indicate load capacity; color striping not adequate.
   8. Provide capability to replace springs with load capacaties of up to 5,000 lbs.

C. Corrosion Protection:
   1. Springs: Powder-coated enamel.
   2. Housings: Galvanized, powder-coated enamel, or painted with rust-resistant paint; provide hot-dipped galvanized housing as indicated on drawings.

2.03 VIBRATION ISOLATORS

A. Vibration Isolators for Nonseismic Applications:
   1. Freestanding Spring Floor Mounted Isolators, Nonseismic Only; KINETICS Model FDS.
      a. Description: Free standing, unhoused, laterally stable springs wound from high strength spring steel.
      b. Assemble springs between top and bottom steel load plate; provide upper load plate with steel leveling bolt lock nut and washer for attachment to supported equipment; provide lower load plate with nonskid noise isolation pad bonded to bottom and provisions for bolting isolator to supporting structure.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify manufacturer's representative prior to installing vibration isolation/restraint devices for guidance with installation procedures.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions; deviation from instructions to be reviewed and approved by manufacturer.

B. Vibration Isolation:
   1. Adjust mountings to level equipment.
   2. On completion of installation of isolation materials and before startup of isolated equipment, clear debris from areas surrounding and beneath isolated equipment, leaving equipment free to move on isolation supports.
   3. Make no rigid connections between equipment and building structure that degrades noise and vibration isolation system. Loop electrical conduit connections to isolated equipment for free motion of isolated equipment.
   4. Make pipe, duct, and electrical connections to isolated equipment without reducing system flexibility; if passing through walls and floors, prevent transmition of vibrations.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Vibration Isolation:
   1. Provide services of manufacturer's representative to inspect completed system and report in writing installation errors, improperly selected isolation devices, and faults capable of affecting performance of system.

END OF SECTION 230548

SECTION 230550
WIND RESTRAINT FOR HVAC SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.03 APPLICABLE CODES AND STANDARDS

A. Provide work in compliance with the following codes and standards:

B. 2018 International Building Code (Section 1609).

C. 2018 International Mechanical Code (Section 301, Item 301.15).

D. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI 7-10.

1.04 QUALITY ASSURANCE

A. General:
   1. The contractor shall provide professional engineer stamped and signed calculations, and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical and electrical systems.
   2. Systems requiring wind restraint including, but not limited to:
      a. Exhaust fans.
      b. Hooded intake or relief ventilators.
      c. Ductwork.
      d. Rooftop air handling equipment.
      e. Condensing units.
      f. Miscellaneous HVAC equipment.
      g. Roof curbs and pipe/duct/equipment supports associated with any of the equipment listed above.

1.05 SUBMITTALS

A. Submit wind force level (Fp) calculations from applicable building code. Submit pre- approved restraint selections, installation details, and plans indicating locations of restraints.

B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.

C. Submit manufacturer's product data.

D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:
   1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.
   2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.

PART 1 PRODUCTS

2.01 CODE INFORMATION

A. This project is subject to the wind bracing requirements of the 2015 International Building Code (Section 1609) and American Society of Civil Engineers ASCE/SEI 7-10. The following criteria are applicable to this project:
   1. Nominal Design Wind Speed (V) (Per ASCE 7-10): 120 mph.
   2. Risk Category (Per ASCE 7-10): III
   3. Exposure Category (Per ASCE 7-10): C
   4. Height and Exposure Adjustment Coefficient (Per ASCE 7-10): 1.21

B. Engineer stamping wind restraint drawings shall verify the design criteria based on project location and details.

2.02 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:
   1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
   2. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
   3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.

B. Friction from gravity loads shall not be considered resistance to wind forces.

PART 1 EXECUTION

3.01 INSTALLATION

A. Wind Restraint of Ductwork and Equipment:
   1. All restraint systems shall be installed in strict accordance with the manufacturer's restraint guidelines and all certified submittal data.
   2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.
   3. Friction clips shall not be used for anchorage attachments.
   4. Expansion anchors shall not be used for non-vibration isolated equipment rated over 10 HP.
   5. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction and vertical restraints shall be provided to resist overturning.
   6. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stresses or misalignment.
   7. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.
   8. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
   9. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.
   10. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
   11. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult Structural Engineer of record.
   12. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The Contractor shall submit loads to the Structural Engineer of record for approval in this event.
   13. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
   14. Provide reinforced clevis bolts where required.

15. Do not brace a system to two independent structures such as a roof and wall.

END OF SECTION 230550

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SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Adhesive-backed duct markers.
D. Pipe markers.
E. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Air Terminal Units: Tags.
C. Automatic Controls: Tags. Key to control schematic.
D. Control Panels: Nameplates.
E. Dampers: Ceiling tacks, where located above lay-in ceiling.
F. Ductwork: Adhesive-backed markers.
G. Instrumentation: Tags.
H. Major Control Components: Nameplates.
I. Piping: Pipe markers.
J. Pumps: Nameplates.
K. Small-sized Equipment: Tags.
L. Tanks: Nameplates.
M. Thermostats: Nameplates.
N. Valves: Tags and ceiling tacks where located above lay-in ceiling.
O. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
3. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Green/White Green/White.

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Color code as follows:
1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
2. Chilled Water: Blue with white letters.
3. Heating Hot Water: Yellow with black letters
4. Abandoned Pipe: White with red letters.

2.06 CEILING TACKS

A. Manufacturers:
   1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.
   3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Install ductwork with adhesive-backed duct markers. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 230553

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SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024.

C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.03 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in I-P (inch-pound) units only.
   6. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Engineer.
      g. Project Contractor.

h. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Fire and volume dampers are in place and open.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Hydronic systems are flushed, filled, and vented.
   12. Pumps are rotating correctly.
   13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations.

B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

A. Test, adjust, and balance the following:
1. HVAC Pumps.
2. Boilers.
3. Air Cooled Water Chillers.
4. Air Cooled Refrigerant Condensers.
5. Air Coils.
6. Air Handling Units and Fan Coils
7. Fans.
8. Air Terminal Units.
9. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives (if applicable):
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Gas meter timing dial size.
   6. Gas meter time per revolution.
   7. Gas flow rate.
   8. Heat input.
   9. Flue gas temperature at outlet.

E. Air Cooled Condensers:
   1. Manufacturer.
   2. Model number.
   3. Serial number.
   4. Entering DB air temperature, design and actual.
   5. Leaving DB air temperature, design and actual.
   6. Number of compressors.

F. Chillers:
   1. Identification/number.
   2. Manufacturer.
   3. Capacity.
   4. Model number.
   5. Serial number.

G. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.
   9. Leaving air WB temperature, design and actual.
   10. Water flow, design and actual.
   11. Water pressure drop, design and actual.
   12. Entering water temperature, design and actual.
   13. Leaving water temperature, design and actual.
   14. Air pressure drop, design and actual.

H. Heating Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Water flow, design and actual.
   7. Water pressure drop, design and actual.
   8. Entering water temperature, design and actual.
   9. Leaving water temperature, design and actual.
   10. Entering air temperature, design and actual.
   11. Leaving air temperature, design and actual.

12. Air pressure drop, design and actual.

I. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Arrangement/Class/Discharge.
   6. Air flow, specified and actual.
   7. Return air flow, specified and actual.
   8. Outside air flow, specified and actual.
   9. Total static pressure (total external), specified and actual.
   10. Inlet pressure.
   11. Discharge pressure.
   12. Fan RPM.

J. Return Air/Outside Air:
   1. Identification/location.
   2. Design air flow.
   3. Actual air flow.
   4. Design return air flow.
   5. Actual return air flow.
   6. Design outside air flow.
   7. Actual outside air flow.
   8. Return air temperature.
   9. Outside air temperature.
   10. Required mixed air temperature.
   11. Actual mixed air temperature.
   12. Design outside/return air ratio.
   13. Actual outside/return air ratio.

K. Exhaust Fans:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Air flow, specified and actual.
   6. Total static pressure (total external), specified and actual.
   7. Inlet pressure.
   8. Discharge pressure.
   9. Sheave Make/Size/Bore. (If applicable).
   10. Number of Belts/Make/Size. (If applicable).
   11. Fan RPM.

L. Duct Traverses:
   1. System zone/branch.
   2. Duct size.
   3. Area.
   4. Design velocity.
   5. Design air flow.
   6. Test velocity.
   7. Test air flow.
   8. Duct static pressure.

M. Flow Measuring Stations:

1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Design Flow rate.
8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

N. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

O. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION 230593

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SECTION 230713
DUCT INSULATION-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

H. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 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.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
   4. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
   5. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1200 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

G. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
1. Provide with standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

F. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.

B. Outside Air Intake Ducts:
1. Insulation:
a. Flexible Glass Fiber Duct Insulation:
1) Thickness required to provide an R value not less than R-12.
b. Rigid Glass Fiber Duct Insulation:
1) Thickness required to provide an R value not less than R-12.

C. Supply Ducts:
1. Flexible Glass Fiber Duct Insulation:

a. Thickness required to provide an R value not less than R-6.

2. Rigid Glass Fiber Duct Insulation:
   a. Thickness required to provide an R value not less than R-6.
3. In Mechanical Rooms:
   a. Rigid Glass Fiber Duct Insulation:
      1) Thickness required to provide an R value not less than R-6.

D. Return and Relief Ducts in Mechanical Rooms:
   1. Rigid Glass Fiber Duct Insulation:
      a. Thickness required to provide an R value not less than R-6.

END OF SECTION 230713

SECTION 230716
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

I. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

J. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

K. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2022.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; Aerocel AC Sheet and Roll: www.aeroflexusa.com/#sle.
   2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

H. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

I. Inserts and Shields:
   1. Application: Equipment 1-1/2 inches diameter or larger.

2. Shields: Galvanized steel between hangers and inserts.
3. Insert Location: Between support shield and equipment and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Finish insulation at supports, protrusions, and interruptions.

K. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

A. Cooling Systems:
1. Air Separators. 1-1/2-inch thick flexible elastomeric.
2. Expansion Tanks. 1-1/2-inch thick flexible elastomeric.

END OF SECTION 230716

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SECTION 230719
HVAC PIPING INSULATION-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

K. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2022.

L. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.

M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.

N. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

O. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

P. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).

Q. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

S. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville Corporation; _____: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.

2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5 by 5.

I. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

J. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

A. PVC Plastic.
1. Manufacturers:
a. Johns Manville Corporation; _____: www.jm.com/#sle.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 15 mil.
e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.

B. Vapor Barrier Membranes: ASTM C1136, Type IX.
1. Multilayer Laminate Vapor Barrier:
a. Thickness: 2.4 mil.
b. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
c. Manufacturers:
1) Polyguard Products; ZERO-PERM: www.polyguardproducts.com/#sle.
2) Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. General Requirements:
1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.

4. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
   1. Corrosion Control Gel:
      a. Manufacturers:
         1) Polyguard Products; RG2400LT: www.polyguardproducts.com/#sle.
         2) Substitutions: See Section 016000 - Product Requirements.
      b. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

L. Concealed Piping: Finish with fitting covers on flanges, fittings, valves, and specialties.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. NPS 1-1/4 and Smaller: 1-1/2 inch thick Rigid Glass Fiber.
      b. NPS 1-1/2 and Larger: 2 inch thick Rigid Glass Fiber.
   2. Boiler Feed Water:
      a. NPS 1-1/4 and Smaller: 1 inch thick Rigid Glass Fiber.
      b. NPS 1-1/2 and Larger: 1-1/2 inch thick Rigid Glass Fiber.

B. Cooling Systems:
   1. Chilled Water:
      a. NPS 3 and Smaller: 1-1/2 inch thick Rigid Glass Fiber with Vapor Barrier.
      b. NPS 4 to NPS 12: 2 inch thick Rigid Glass Fiber with Vapor Barrier.
   2. Cold Condensate Drains:
      a. All Sizes: 1/2 inch thick Rigid Glass Fiber with Vapor Barrier.
      b. All Sizes: 3/4 inch thick Flexible Elastomeric Cellular with Vapor Barrier.

END OF SECTION 230719

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SECTION 230800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Ductwork and accessories.
   4. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.03 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.
      g. Heating and/or cooling valve tag ID.
      h. Minimum air flow rate.

i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

D. Project Record Documents: In addition to requirements specified elsewhere, include.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified elswhere, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

F. Training Manuals: In addition to requirements specified elsewhere.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals. Provide digital copy as well.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
   1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Global commands features.
   8. Security and access codes.
   9. Occupant over-rides (manual, telephone, key, keypad, etc.).
   10. O&M schedules and alarms.
   11. Occupancy sensors and controls.
   12. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to

Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.

D. TAB Review: Instruct Owner's personnel for minimum 4 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

E. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 16 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 16 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically

and printing trends; provide practice in setting up trend logging and monitoring during training session.

d. Every display screen, allowing time for questions.

e. Point database entry and modifications.

3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

F. Provide the services of manufacturer representatives to assist instructors where necessary.

G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 230800

SECTION 230901
BUILDING AUTOMATION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings are directly applicable to this Section, and this Section is directly applicable to them.

B. The general provisions of the Contract, including General and Supplementary Conditions and/or Division 01 Specification Sections, are directly applicable to this Section, and this Section is directly applicable to them.

C. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

D. Collectively, these items will be referred to as the Contract Documents.

1.02 DEFINITIONS AND ABBREVIATIONS

A. Where definitions in Division 01 conflict with the definitions herein, Contractor will comply with the most stringent requirement.

B. BAS Component: a generic reference to any hardware component which is provided by Contractor, including but not limited to controllers, power supplies, transformers, relays, actuators, sensors, or other devices.

C. Building Automation System (BAS): Also referred to as Building Management System (BMS), Direct Digital Control (DDC).

D. Building Controller: Controller, which is at, and controlling at, the building-level. Could also be a large portion of a building, such as a wing, depending on hardware capability. Generally, are the middle tier of the overall BAS network, and report up to a Building or Enterprise Supervisor. Also, generally what Device Controllers would be integrated with. See Section 2.5 System Architecture for full definition and specification.

E. Building-Level Network (BLN): An ethernet, fiber, and/or wireless network dedicated to the BAS, which connects Building Controllers and Building Supervisors. The BLN may be a separate network from Owner's LAN, or as part of the LAN, which has been segmented to be used exclusively by the BAS. See Section 2.5 System Architecture for full definition and specification.

F. Building Supervisor: Server, which is at, and controlling at, the building-level. Generally used when Building Controllers do not have sufficient hardware capability to support an entire building. Generally, are the middle tier of the overall BAS network, and installed on a Server in lieu of being a stand-alone piece of hardware. Also, generally what Building Controllers would be integrated with. Building Supervisors may be further integrated to an Enterprise Supervisor. See Section 2.5 System Architecture for full definition and specification.

G. Controller: A generic reference to a BAS Controller, including but not limited to Device Controllers and Building Controllers.

H. Contract Documents: All documents which compose the project, including but not limited to drawings, specifications, RFPs, scope of work, general conditions, and supplemental conditions.

I. Control Panels: an assembly composed of an enclosure and one or more BAS Component(s).

J. Critical: A special area or zone which receives specialized BAS Components.

K. Device Controller: Also referred to as Field-Level Controller. Controller, which is at, and controlling at, at the device-level. Device in this instance is understood to reference MEP Equipment. Generally, are the lowest tier of the overall BAS network, and report up to a Building Controller. See Section 2.5 System Architecture for full definition and specification.

L. Device-Level Network (DLN): A copper, ethernet, fiber, and/or wireless network dedicated to the BAS, which connects Device Controllers and Building Controllers. See Section 2.5 System Architecture for full definition and specification.

M. Enterprise Supervisor: Server, which is at, and controlling at, the enterprise-level. Generally, are the highest tier of the overall BAS network, and installed on a server in lieu of being a stand-alone piece of hardware. Also, generally what Building Controllers and/or Supervisors would be integrated with. See Section 2.5 System Architecture for full definition and specification.

N. Field-Level: See Device Controllers and Device-Level Network.

O. Furnish: To supply and deliver to project site, ready for installation.

P. Install: To place in position for service or use.

Q. Local Area Network (LAN): Ethernet, fiber, and/or wireless network which connects computers and other networkable devices (printers, etc.), and has a connection to the WAN. See Section 2.5 System Architecture for full definition and specification.

R. Manufacturer: The brand of the BAS being provided (ex: Distech, Honeywell, etc).

S. MEP: Mechanical, electrical, and plumbing.

T. MEP Equipment: Where MEP Equipment is used, it is understood to mean any piece of MEP Equipment which the BAS will in some way, shape, or form, interface with, via hardwired connection or integration. MEP Equipment includes, but is not limited to VAV, AHU, RTU, split systems, hot water heaters, heat exchangers, boilers, chillers, and pumps.

U. MSI: Master Systems Integrator: see MSI section for full definition and specification.

V. Owner: The financial provider and user of the BAS, as well as Owner Representatives.

W. Owner Representatives: Representatives for the Owner which are on staff, contracted, or hired to protect the interests of the Owner, such as Engineers, Architects, Commissioning Agents, and other parties.

X. Project: The facility/building as defined in the Contract Documents.

Y. Server: A computer in which BAS software is installed on.

Z. Sequence of Operation: The steps that MEP Equipment takes to achieve the desired operation to provide optimal comfort and/or ventilation for the Project.

AA. Substantial Completion: Written authorization by the Owner that the project has reached a point of completion that it can be utilized.

BB. Supervisor: A generic reference to a BAS Supervisor, including but not limited to Building Supervisors and Enterprise Supervisors.

CC. Provide: To furnish and install, complete and ready for intended use.

DD. Vendor: The installer, integrator, and/or contractor for the BAS being provided.

EE. Wide Area Network (WAN): Ethernet and/or fiber-based network which connects multiple facilities via the internet. See Section 2.5 System Architecture for full definition and specification.

FF. Warranty Period: The time between Substantial Completion and the duration of Warranty, as specified.

1.03 GENERAL SPECIFICATIONS

A. Contractor shall provide all hardware, software, configuration, programming, graphics (GUI), checkout, alarms, trending, functional testing, and commissioning necessary to provide a complete and fully functioning BAS. Contractor shall include all hardware, control wiring, wiring accessories, wiring connections, software, and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system,

now and in the future.

1. Provide all necessary BAS Components on each piece of MEP Equipment to:
    a. Perform the specified Sequence of Operation and meet the design/performance intent of the MEP Equipment.
    b. Comply with BAS Components as shown on the control diagrams.
    c. Comply with the point lists.
    d. Comply with the Specifications herein.
    e. Comply with the design intent of the BAS.
2. Where the Sequence of Operation, control diagrams, points list, or specifications conflict with each other, Contractor will comply with the most stringent requirement.

B. It is Contractor's responsibility to review all the Contract Documents and report any discrepancies to Owner.

C. Substitutions
    1. Wherever the words "approved equal," "for review," or "for acceptance" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of BAS Component for that specified, submit all information pertinent to the adequacy and adaptability of the proposed BAS Component to Owner and secure their approval before the BAS Component is ordered.

1.04 TRAINING

A. Provide four hours of training for Owner personnel, and/or maintenance contractor, on the operation and maintenance of the BAS.

B. Provide four hours of training for Owner personnel, and/or maintenance contractor, on the operation and maintenance of the BAS, 90 to 180 days after Substantial Completion.

1.05 CODES AND REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2022).

B. CTA-709.1 - Control Network Protocol Specification 2019.

C. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications 2020, with Amendment (2021).

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

E. UL (DIR) - Online Certifications Directory Current Edition.

F. Comply with all current federal, state, and local codes, requirements, ordinances, and regulations, in accordance with the authory(ies) having jurisdiction (AHJ).

G. Comply with the National Electric Code (NEC).

H. Comply with all manufacturer guidelines and requirements.

I. Comply with all Owner rules, guidelines, procedures and requirements, including Owner IT.

J. The latest published edition of a reference shall be applicable to the Project unless identified by a specific edition date.

K. All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:
    1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
    2. American National Standards Institute (ANSI)
    3. UL 916: Energy Management Systems
    4. LonMark International

5. BACnet Testing Lab

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

1.07 COORDINATION OF WORK AND INTEGRATION

A. Certain LonMark, BACnet, Modbus, and other products, systems, and interface devices, may be provided by other trades via MEP Equipment. Examine the Contract Documents to ascertain the requirements to install, wire, program, commission, and/or interface to these systems. Particular attention must be paid towards the interface boards submitted by the various MEP Equipment providers. It is Contractor's responsibility to verify the submitted interfaces will integrate properly into the BAS. Report any discrepancies to Owner. Discrepancies brought to Owner's attention after the procurement of that piece of MEP Equipment will be integrated at no additional cost to Owner. Contractor will provide additional interface(s) needed to integrate piece of MEP Equipment.

B. Contractor shall review MEP Equipment for compliance with control diagrams, Sequence of Operation, and points lists. Report any discrepancies to Owner.

C. Wherever work interconnects with work of other trades, coordinate with other trades and with Owner to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.

D. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Verify all locations with Owner and/or General Contractor prior to installation.

E. Coordinate sources of 120V power with the Electrical Contractor and Owner. Extend power from source(s) as needed.

F. Coordinate location of data ports/drops to the LAN/WAN with the Electrical Contractor and Owner.

G. Coordinate shipping of BAS Components to another Contractor or manufacturer for factory-installation.

1.08 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Provide one replacement for each unique actuator, Controller, thermostat, wall module, or any other BAS Component provided.

1.09 QUALITY ASSURANCE

A. The BAS and BAS Components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

B. Control Panels, both new and modified, shall comply with UL 508A.

C. Electrical Components, Devices, and Accessories: UL listed and labeled as defined in NFPA 70.

1.10 CONTRACTOR QUALIFICATIONS

A. Qualifications may be requested from Contractor prior to the bidding process. Owner reserves the right to not allow Contractors to bid if they do not meet the qualifications or provide them in a timely manner. Qualifications will be provided for all items below in an orderly format for review by Owner.

B. Contractor shall have a successful history in the design and installation of the BAS being provided that consists of web-browser monitoring and control of LonWorks, BACnet, and/or Modbus Device Controllers. These projects must be on-line and functional such that Owner can

observe the BAS in full operation. Include proper references, contact names, emails, and phone numbers of these reference projects, with a minimum of five projects similar to this Project.

C. Contractor shall demonstrate experience in BAS installations for not less than five years, in BAS installation projects with point counts equal to this Project, and systems of the same character as this Project.

D. Contractor shall have specialized in and be experienced with the installation of the proposed product line for not less than five years, on at least ten projects of similar size and complexity.

E. Contractor shall be factory authorized by manufacturer of product line and be in good standing with the manufacturer.

F. Contractor shall be located within 50 miles of Project.

G. Contractor shall be a Certified Tridium Systems Integrator.

H. Contractor shall have a minimum of three, Niagara Technical Certification Program (TCP) certified personnel.

I. Contractor shall have a minimum of three personnel who are certified in LonWorks, BACnet, and/or Modbus line(s) of controls to be installed as part of this project.

J. Be of sufficient size to provide service, including both routine maintenance and emergency support within 24 hours upon receipt of request.

1.11 ACTION SUBMITTALS

A. Product Data Submittal
   1. Submit manufacturer's technical product data for each BAS Component, including but not limited to Controller, sensor, actuator, relay and panel, indicating dimensions, capacities, performance, electrical characteristics, and material finishes. Also include installation and start-up instructions.
      a. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate, mark-through, and highlight only applicable information.
      b. Generic submittals will be automatically rejected.
   2. Submit documentation indicating LonMark, NICs, and/or BTL compliance and include Protocol Implementation Conformance (PIC) Statements.

B. Shop Drawings Submittal
   1. Submit shop drawings. Shop drawings will include:
   2. Bill of Materials (BOM): indicating equipment served, quantity, manufacturer, point range (i.e. 0-10 in. w.c.), sensor range (i.e. 0-10V), and model number for all BAS Components being provided.
      a. Disconnect Schedule: additionally, indicating MCA, MOP, voltage, # of phases, size, NEMA rating, # of poles, and neutral (Y/N).
      b. Starter Schedule: additionally, indicating horsepower, voltage, # of phases, size, NEMA rating, and bypass.
      c. VFD Schedule: additionally, indicating horsepower, voltage, # of phases, size and NEMA rating, bypass (Y/N), number of contactors (if bypass), disconnect (Y/N), and disconnect type (fused/non-fused).
      d. Hydronic Valves (Pressure-Dependent): additionally, indicating gpm, line size, calculated Cv and design pressure drop, actual Cv and actual pressure drop, close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing/diverting (if 3 way), service (2-position/modulating), and fail position.
         1) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer’s data.
         2) Actuator will be scheduled with the valve per the standard BOM.

e. Hydronic Valves (Pressure-Independent): additionally, indicating gpm, line size, selected valve gpm, maximum valve gpm, min/max pressure drops, close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing/diverting (if 3 way), service (2-position/modulating), and fail position.
   1) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer's data.
   2) Actuator will be scheduled with the valve per the standard BOM.

f. Steam Valves: additionally, indicating lb/hr, inlet pressure, outlet pressure, line size, calculated Cv and design pressure drop, actual Cv and actual pressure drop, close-off pressure, type (ball/globe/butterfly), connection, valve size, 2/3-way, mixing or diverting (if 3 way), service (2-position/modulating), and fail position.
   1) Actual pressure drop will correct for any line-size to valve-size restrictions per the manufacturer's data.
   2) Provide sizing methodology/calculations for manufacturer selected.
   3) Actuator will be scheduled with the valve per the standard BOM.

g. Air Flow Metering Stations (AMFS): additionally, indicating duct size, output, network capable (LonWorks/BACnet), and number of probes/sensors.

h. Water/Steam Flow Meters: additionally, indicating line size, output, network capable (LonWorks/BACnet), and flow meter style/type.

i. Damper Schedule: additionally indicating, duct size, blade type, leakage, and construction.

j. VAV schedule: indicating VAV type, K factor, and max/min/reheat flows.

3. Schematic Flow Diagram: schematic representation of MEP Equipment. Diagram will show all BAS Components on schematic, point name, and point number (i.e. UI-1). Where MEP Equipment varies slightly, schematic will be clearly diagramed to indicate any differences between each piece of MEP Equipment. Stating the schematic as "typical" is not acceptable.
4. Wiring Diagram: indicating power, signal, and control wiring. Where terminal blocks are provided, provide indication where wiring terminates to terminal block.
5. Sequence of Operation: Any modifications proposed to the Sequence of Operation will be clearly marked up as part of the shop drawings or submitted as an annotated Microsoft Word document in addition to the shop drawings. A default Contractor Sequence of Operation, included without regard to the Contract Document's Sequence of Operation, will result in a rejected submittal.
6. Control Panel Diagrams: indicating panel faces, with layouts of any BAS Components to be installed in the panel face, BAS Component locations inside panel, and labeling of BAS Components.
7. One-line diagram for all controllers showing the network layout. Where Project is to connect with an existing BAS, indicate how the new network will integrate with the new and/or existing BAS Components.
8. Indicate anticipated device ID, Network number, MAC Addressing, and Max Masters for all BACnet devices. Provide logical schema for BACnet addressing.
9. Individual floor plans with device (controllers, routers, sensors, etc.) locations with all interconnecting wiring routing including space sensors, Device and Building-Level Network wiring, power wiring, and low voltage power wiring.
10. Additional Requirements:
    a. Point names will be consistent between the schematics and wiring diagrams.
    b. Misc. Points List: where controllers being provided for other purposes are also used to control a miscellaneous point, such as an exhaust fan or lighting contactor, provide a list of those miscellaneous points in a concise format for quick identification of their location and associated Controller.
    c. Provide a complete list of any deviations of submitted products to the specification in this document.

d. Where existing BAS Components are being reused, such as controllers or sensors, clearly indicate (via coloring, line type, etc) the BAS Components being reused as “existing” and new components as “new.”

C. Graphics Submittal
1. Provide screen captures of graphical user interfaces developed by Contractor on previous projects. These screen shots shall represent actual work performed by Contractor and not generic work from the line of controls which Contractor represents. Screenshots will be applicable to the MEP systems as part of this project. “Generic” screenshots of MEP systems will not be accepted. Provide client contact information for Owner to validate. Any comments from the submittal process will be incorporated into the actual graphics for the project.
2. Follow Owner’s graphics standards.
3. Zoning Map
a. Provide submittal of graphic floorplans for markup by Owner to identify required zoning to use for scheduling. Floorplan markup will be used by Contractor to segment equipment that satisfies the identified zones.

D. Point-Naming Submittal
1. Points shall be named consistently. Provide list of point names and point conventions.
2. Point naming shall be consistent with an existing standard, such as Project Haystack.

E. IP Drop Request Submittal
1. Provide list of BAS Component(s) which need an IP drop to the LAN/WAN.
2. Provide location, quantity (if multiple per Control Panel/location), and IP address requirements (DHCP, fixed, etc), and total number of IP address reservations, including room for future growth.
3. Provide list to a minimum of ten business days’ notice prior to needing the drop.

F. Schedule/Sequence of Construction Submittal
1. Provide schedule and sequence of construction, as it pertains to the installation of the BAS, for review.

G. Functional Performance Testing (FPT) Submittal
1. Provide FPT agendas and testing procedures for review.
2. FPT should include at a minimum Sequence of Operation, point-to-point verification to graphical interface, historical data logging, and alarms testing procedures.

1.12 START-UP AND ASSOCIATED TESTING SUBMITTALS

A. Point-to-Point Testing/Checkout Sheets Submittal
1. Prior to startup of MEP Equipment, Contractor will provide checkout sheets for each piece of MEP Equipment.
2. Checkout sheets will contain at a minimum:
a. Equipment name and location.
b. Associated Controller address (MAC or Node ID), name, type, and instance number.
c. Point name, type (resistance, amperage, voltage, etc), and range (i.e., -5 to +5 in w.g.).

B. Start-Up Testing Submittal
1. As part of the startup of MEP Equipment, Contractor will provide start-up testing sheets for each piece of MEP Equipment.
2. Start-up testing sheets will contain at a minimum:
a. Equipment name and location.
b. Sequence of Operation and step-by-step procedure used to check programming and configuration.
c. Any modifications required to Sequence of Operation for MEP Equipment performance.

d. Final graphical screens.
e. PID tuning parameters for each loop.

C. Adjusting and Calibration Submittal
1. As part of the startup of MEP Equipment, Contractor will provide a calibration submittal for each piece of MEP Equipment.
2. Calibration submittal will contain at a minimum:
a. Equipment name and location.
b. Point name, type, and range.
c. Sensor type and manufacturer's stated accuracy.
d. Calibration type (single point, two point, etc).
e. Checking, adjusting, and calibration data.
f. Sensor installed accuracy.
g. Sensor pass, fail, replaced, etc.
h. Calibration equipment used and associated certificates of calibration, including expiration dates.

1.13 CLOSE-OUT SUBMITTALS

A. Operating and Maintenance Manuals
1. Provide all documentation as required in the submittal processes to-date, updated to as-built conditions.
2. In addition, provide the following:
a. Include control response, settings, set points, throttling ranges, gains, reset schedules, adjustable parameters, and limits.
b. A table (or similar) of all Testing, Adjusting and Balancing (TAB) values for each piece of MEP Equipment and BAS-calibrated equipment, such as airflow metering stations (AFMS).
c. Any O&Ms for equipment not originally included in the submittal, in addition to product data.
d. Accurately record actual set points, calibrations/offsets, and settings of controls, final Sequence of Operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.
e. Database of all point names.

B. As-Built Shop Drawings
1. Provide PDF of shop drawings which have been corrected to reflect the as-built state.
a. Incorporate any redlines made in field during installation.
b. Update Sequence of Operation to reflect MEP Equipment operation as changed during installation, commissioning, and/or functional performance testing.
c. Provide reference to being "as-built" version on each sheet of the shop drawings.
2. Provide hard copy of appropriate shop drawing page(s) inside each Control Panel.

C. Software Closeout
1. Provide all usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to Owner.
2. Provide software backup of entire BAS and associated components on digital media for Owner record. Coordinate file location of automatic backup of software with Owner.

D. Reference 3.11 Closeout for additional requirements.

1.14 MATERIALS AND EQUIPMENT

A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, referenced standards, and conform to codes and ordinances of the AHJ.

B. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Contract Documents specifically allow existing materials to remain in place.

C. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

1.15 COLORS AND LABELING

A. Where requirements elsewhere in the documents conflict with the requirements below, Contractor will comply with the most stringent requirement.

B. Provide BAS Components consistent with the following color requirements.

1	Control Panels	Blue
2	Conduit	Blue
3	Input/Output Wiring	Yellow
4	BACnet Copper Wiring	Orange
5	LonWorks Copper Wiring	Purple
6	Modbus Copper Wiring	Blue
7	Ethernet/Fiber Cable	Consistent with color of primary communications protocol.
8	Tubing	Black with White Stripe

C. Provided BAS Components with the following labeling requirements.
   1. Controllers
      a. Vinyl or nylon label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with MEP Equipment served by Controller, permanently mounted.
   2. Control Panels
      a. Two-layer engraved phenolic or engraver's plastic tag, 1 inch or greater in height, adhesive backed, engraved with MEP Equipment served by panel, permanently mounted.
   3. Input/Output Wiring
      a. Nylon or self-laminated wire-wrap label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with BAS Component connected to cable and cable number, permanently mounted at termination to terminal block in Control Panel on cable jacket.
      b. Premade labels or wire marker tape is not allowed.
   4. BAS Component
      a. Vinyl or nylon label, 1/2 inch or greater in height, black text on white background, adhesive backed, printed with MEP Equipment served and BAS Component purpose (ex. AHU-1 SF Start/Stop), permanently mounted.

1.16 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. The entire BAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within twenty-four months from the date of Substantial Completion the installed equipment is found to be defective in operation, workmanship or materials, Contractor shall replace, repair, or adjust the defect at no cost to Owner.

C. Corrective software and/or hardware modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.
   1. Modifications made which are corrective to one piece of MEP Equipment will be replicated to all MEP Equipment for consistency in programming.

2. User documentation will be updated in all locations, including but not limited to hard copies, Control Panel hard copies, O&Ms, and PDF copies accessible via download inside the BAS system.
3. Maintain revision control (i.e., v1_05) to indicate which is the latest version of all documentation, software, and programming.

D. Owner reserves the right to make changes to the BAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any changes made by Owner unless Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

E. At no cost to Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware, and hardware. Prior to the closeout of the warranty period, Contractor shall meet with Owner to address any questions or concerns and offer ongoing services to Owner.

F. Electronic Actuators: Parts and labor for 5 years from the date of substantial completion.

G. Air and Water Flow Meters: Parts and labor for 3 years from the date of substantial completion.

1.17 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND VENDORS

A. Subject to the Specifications and requirements herein, the BAS will be provided by (listed in alphabetical order):
1. Distech by CMS Controls
2. Distech by Engineered Control Solutions (ECS)
3. Distech by Hoffman Building Technologies (HBT)
4. Honeywell by Engineered Control Solutions (ECS)
   a. Independently Licensed Controllers (ILC) models required.
5. Johnson Controls Facitlity Explorer by CCAC.
6. Lynxspring by Brady Trane
7. Schneider Electric TAC I/A Series by Schneider Electric

B. Products by the manufacturer listed shall be used for Device and Building Controllers. Sensors, actuators, valves, dampers, and other BAS Components may be manufactured by others as indicated.

2.02 GENERAL

A. Owner shall receive ownership of all job-specific configuration documentation, data files, software and/or code developed for the Project. This shall include all custom, job-specific software code, databases, and documentation for all configuration and programming that is generated for the Project and/or configured for use with the Device and Building Controllers or Building and Enterprise Supervisors, and any related LAN, WAN, Intranet, and Internet connected routers and devices.

B. Any and all required IDs and passwords for admin and programming-level access to any BAS Component or software program shall be provided to Owner.

C. It is Owner’s intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification to work on Niagara

Framework systems. The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: accept.station.in="*" accept.station.out="*" accept.wb.out="*" accept.wb.in="*". In any case, Owner shall maintain the right to direct Contractor to modify any software license, regardless of supplier, as desired by Owner.

D. Contractor shall not install any “brand-specific” software, proprietary JAR files, applications, or utilities on Niagara Framework based devices, unless otherwise permitted. Provide exceptions to Owner for review.

E. Many programming tools are specific to the brand, gives an out for those situations, or can use to reject brands not in conformance.

F. All Device and Building Controllers installed for the project shall not be limited in their ability to communicate with a specific brand/Manufacturer or Vendor of the BAS. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replacement of, or in parallel with, existing components.

G. Device and Building Controllers shall have the ability to perform energy management routines via preprogrammed function blocks or template programs.

H. Browser-based access: A remote/local user using a standard browser will be able access all BAS facilities and graphics via the LAN or direct connection, with proper username and password. Only HTML5 browser-based graphical user interfaces (GUI) is acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer, Edge, Firefox, or Chrome.
   1. Graphics shall be Niagara “virtuals” which allow graphics to be present on both the JACE and Supervisor, allowing for an update in one location to be automatically applied to the other.

I. Remote data access: The system shall support browser-based remote access over the Internet to the building data.
   1. The Contractor shall coordinate with Owner IT to ensure all remote browser access is protected with the latest BAS software updates.
   2. The Contractor shall coordinate with Owner IT to ensure a VPN (Virtual Private Network) is installed to protect Owner from cyber-attacks.

J. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a Supervisor server on the LAN. User tools for BLN and/or DLN management shall be provided and licensed to Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.

K. Database Schema shall be published and provided to Owner to facilitate easy access to BLN and DLN data.

L. Owner shall be the named license holder of all software associated with any and all incremental work on the project. Contractor will coordinate with Owner IT for any requirements regarding software/hardware licensing.

M. Where multiple pieces of Niagara equipment exist, use single-JACE sign-on. Coordinate with Owner on requirements.

2.03 DEVICE COUNT AND SOFTWARE MAINTENANCE AGREEMENTS

A. All Device Controllers, Building Controllers, and Supervisors which have a license structure to where only a certain quantity of BAS Components or devices can connect to it shall be selected such that there is a minimum 25% capacity for future BAS Component or device connections. (i.e. if there are 80 connected devices, the license shall allow for 80*1.25=100 potential device connections (20 extra device connections possible).

B. All Building Controllers and Supervisors which have a license structure requiring a Software Maintenance Agreement (SMA) shall be for a period of five years.

2.04 SYSTEM PERFORMANCE

A. Description: The BAS shall comply with the following minimum performance requirements. Performance requirements are based on a fully functioning BAS with all trends and alarms enabled:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than 2 seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 6 seconds.
   5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

2.05 SYSTEM ARCHITECTURE

A. The system architecture provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Building and Device-Level Network shall be based on industry standard open platforms as specified herein, and utilize commonly available operation, management, and application software. All software packages and databases shall be licensed to Owner to allow unrestricted maintenance and operation of the BAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.

B. Reference 4.1 Network Diagram for diagram of System Architecture layout.

C. The system architecture shall consist of a Wide Area Network (WAN), a Local Area Network (LAN), a Building-Level Network (BLN), and one or more Device-Level Network(s) (DLN), as well as an Enterprise Supervisor, a Building Supervisor, Building Controller(s), and Device Controller(s), as applicable.
   1. Wide Area Network (WAN): WAN infrastructure provided by Owner. Contractor will coordinate with Owner IT for configuration (ports, firewall, etc) for a successful BAS installation.
      a. The WAN infrastructure shall be used to connect the Enterprise Supervisor to the Building Supervisor and/or Building Controller(s).
   2. Local Area Network (LAN): LAN infrastructure provided by Owner. Contractor will coordinate with Owner IT for configuration (ports, firewall, etc) for a successful BAS installation.
      a. The LAN infrastructure shall be the connection point to the WAN for the BAS, and also serve as the BLN.
   3. Building-Level Network (BLN): BLN shall be a segmented network on the Owner’s LAN.
      a. The BLN shall be used for connection of Building Controller(s) and/or Building Supervisor only. No Device Controller(s) shall be connected to the BLN.
   4. Device Level Network (DLN): DLN infrastructure provided by Contractor.
      a. DLN will be BACnet TCP/IP (Ethernet).
      b. Contractor will provide one or more DLNs to maintain network speeds as specified herein.
      c. Additional DLNs of a different protocol than listed may be added to integrate unique pieces of equipment not provided by Contractor, however all Contractor-provided equipment shall be consistent with the DLN above.
   5. The LAN will be under construction and not necessarily complete prior to work commencing. As such, a temporary BLN will be provided by Contractor for functionality of the BAS. This may include wireless access points, switches, or other temporary hardware

for full functionality. Upon completion of the LAN, which will also serve as the BLN, Contractor shall remove the temporary equipment and provide final installation of devices to the permanent BLN. Testing of the system will be provided to ensure functionality is the same as on the temporary system.

6. The LAN is existing and segmented for the BLN.

2.06 SYSTEM ARCHITECTURE, ADDITIONAL REQUIREMENTS

A. Niagara Framework will be Niagara 4 (N4), with the latest stable released installed (as identified by Contractor) and will be compatible with any existing Niagara systems. Where the incorrect software version is installed, it shall be corrected at no additional cost to Owner.

B. Prior to bid, where a modification to the System Architecture is desired, Contractor will obtain permission for the proposed System Architecture. Contractor will provide documentation with proposed modifications and how they will improve the System Architecture as specified. If not approved, Contractor will provide the System Architecture as specified.

C. Prior to the bid, Contractor may request for additional connections to the WAN/LAN beyond the ones specified herein. Should those connections be disallowed, Contractor shall provide additional BLN(s) or DLN(s) at no additional cost to Owner.

D. Capacity of any BLN or DLN shall be limited to 70% of the allowable device count to allow for future minor modifications or expansions to the network. Provide calculations on request.

E. Device Controllers shall communicate on a hardwired network.

F. Twisted-Pair Based Device Level and/or Building Level Networks (DLN/BLN):
   1. BACnet MS/TP networks where the baud rate for equipment is “fixed” and cannot be changed shall be segmented from the main DLN(s). The main DLN(s) will not be slowed to accept Device Controllers with slower baud rates than the majority of the Device Controllers can achieve.
   2. ARCnet and/or Token-Ring based DLNs shall not be acceptable.
   3. The communication speed between Device Controllers shall be sufficient to ensure fast system response time under any loading condition. At a minimum, network speed shall be minimally 78K bits per second (LonWorks FTT-10A), 19.2K bits per second (Modbus RTU), 76,800 baud (BACnet MS/TP).
      a. Where speeds must be reduced, provide justification to Owner for approval.
   4. Provide a maximum of 40 LonWorks FTT-10A controllers per segment. Provide a maximum of 25 BACnet MS/TP controllers per segment. Provide a maximum of 25 Modbus RTU controllers per segment.
      a. Controller counts may be increased where specifically recommended/approved by the Manufacturer and system performance will be achieved as specified. If network performance suffers due to excessive controllers, Contractor shall provide additional BLN(s) or DLN(s) at no additional cost to Owner.

G. Ethernet Based Device Level and/or Building Level Networks (DLN/BLN):
   1. Where DLN is an ethernet-based network (vs traditional copper twisted-pair network), the requirements of the BLN shall also apply to the DLN.
   2. Ethernet-based BLN or DLN shall be consistent with Owner IT standards and requirements, and at a minimum IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput. Provide all routers, switches, and other hardware for functionality.

2.07 DEVICE CONTROLLERS

A. Provide a Device Controller for each piece of MEP Equipment, or as specifically identified.

B. General
   1. Device Controllers shall fundamentally communicate with the protocol as specified in the System Architecture for the DLN. Device Controllers which communicate over a different protocol and then convert to the specified protocol via a protocol converter, router, or

gateway are not acceptable.

2. All Device Controllers shall be able to communicate peer-to-peer without the need for a Building Controller and shall be capable of assuming all responsibilities typically assumed by a Building Controller.
3. Any Device Controller shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other Controller connected on the same communication cabling. So called “Slave Controllers” are not acceptable.
4. A dedicated Device Controller will be provided for each piece of MEP Equipment. Controller “sharing,” where one Controller does one or more pieces of MEP Equipment, is not allowed, unless specifically approved by Owner.
5. Each Device Controller shall have a minimum of 10% spare capacity for each point type for future point connection, rounded up to the nearest whole number.
6. Performance
    a. Each Device Controller shall have a minimum of 64KB of RAM and 384KB of non-volatile flash memory.
    b. Each Device Controller shall have a 32-bit microprocessor operating at a minimum of 68 MHz.
    c. Real time clock with rechargeable battery and 20 days power backup.
7. The control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. The control program shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
8. Provide single Device Controllers with the physical and software resource count for standalone operation of each piece of MEP Equipment. The Sequence of Operation and required points for control shall reside on a single Device Controller.
    a. Remote I/O modules (via a field-wired communications bus designed for remote I/O purposes) are acceptable for points required to achieve the Sequence of Operation.
        1) BACnet, LonWorks, Modbus, and any other communication protocol designed for Device Controller to Building Controller communication is not acceptable for remote I/O communication.
        2) Expansion I/O modules plugged directly into the Controller are acceptable for points required to achieve the Sequence of Operation.
        3) Additional Device Controllers connected via the DLN are not acceptable for points required to achieve the Sequence of Operation.
9. Device Controllers with integral sensors or devices (i.e., a VAV terminal unit controller with integral damper actuator and pressure sensor), shall comply with the specification requirements for those sensors if they were submitted separately. If the Controller’s sensors or devices do not comply, the sensors or devices will be provided separately.
10. BACnet Device Controller Specific Requirements:
    a. Each BACnet Controller on the BACnet MS/TP communications trunk shall provide a loading characteristic of 1/8th load.
    b. Provide BACnet Controllers that are BACnet Testing Laboratory (BTL) listed (v14 or later). Controllers will be marked with the BTL certified logos. Controllers must be within the following categories:
        1) BACnet Building Controller (B-BC)
        2) BACnet Advanced Application Controller (B-AAC)
        3) BACnet Application Specific Controller (B-ASC)
11. LonWorks Device Controller Specific Requirements:
    a. Provide LonWorks Device Controllers that conform to LonMark Certified Interoperability Standards. Components will be marked with the LonMark certified logos.
12. Modbus Device Controller Specific Requirements:
    a. Provide Modbus Device Controllers that conform to the Modbus Conformance Testing Program and be independently verified by an approved third-party for

conformance.

C. Configurable Device Controllers
   1. Shall contain an application-specific control program which can be configured to meet the Sequence of Operation.
   2. Where a configurable Controller cannot be configured to meet the Sequence of Operation, a Programable Controller will be used. Alternatively, Contractor may submit a request to modify the Sequence of Operation so that a Configurable Controller may be used in lieu of a Programmable Controller.

D. Programable Device Controllers
   1. Shall be fully programmable and the programming software shall have a library of pre-built, tested, and user re-definable control sequences for a wide range of typical HVAC applications.

E. Ethernet Device Controllers
   1. Provide with a 2-port or greater managed or unmanaged integrated switch.
   2. Controllers should be able to be “daisy chained” to eliminate multiple dedicated ethernet drops for each Controller.

2.08 BUILDING CONTROLLERS

A. Provide Building Controller(s) with sufficient expansions to integrate DLNs while maintaining network speed, point count requirements, spare capacity, and other requirements as specified.

B. Building Controller(s) shall be JACE 8000 series.
   1. Provide with embedded workbench.
   2. Provide with all required expansions for LonWorks FTT-10A, RS485, etc. to achieve the necessary quantity of DLN(s).

C. Provide sufficient quantity of Building Controllers to maintain average processing power at 70% or less. Where Building Controllers are running above 70% consistently, additional Building Controllers will be provided and DLNs rewired at no cost to the Owner.

2.09 BUILDING SUPERVISORS

A. Where there is a single Building Controller, no Building Supervisor is required.

B. In lieu of a Building Supervisor, use Enterprise Supervisor.
   1. No computer will be installed onsite as part of the Project.
   2. For graphics that spread over multiple Building Controllers, build inside Enterprise Supervisor and link to corresponding Building Controller(s) (ex., master floorplan graphic inside Enterprise Supervisor, with hyperlinks to IPs for Building Controllers in each wing).

2.10 ENTERPRISE SUPERVISORS

A. Integrate Building Supervisor and/or Building Controller(s) to the existing Enterprise Supervisor. Coordinate integration with assistance from the Master Systems Integrator.

2.11 CONTROL PANELS AND ENCLOSURES

A. Control Panels are an assembly composed of an enclosure and one or more BAS Component(s). Control Panels will be provided for:
   1. All MEP Equipment which requires a Device Controller(s) and does not have an Enclosure for a Device Controller(s) included as part of the MEP Equipment.
   2. All Building Controller(s).

B. Reference 1.9 Quality Assurance for Control Panel rating requirements.
   1. All Control Panels provided for MEP Equipment shall be assembled and installed in accordance with UL508A. Field wiring to the Control Panel shall be terminated to a field wiring terminal as indicated on the required drawings provided with the Control Panel. Control Panels which are modified after UL508A listing by adding BAS Component(s) not shown on the UL508A panel drawings are 1) not allowed, or 2) require UL508A

recertification from an authorized UL508A inspector. In short, 'generic' UL508A Control Panels which have power prewired but contain no BAS Component(s) as listed are not allowed.

C. Controller(s) installed inside of MEP Equipment shall only be done so in spaces/enclosures designed for a Controller to be installed (i.e. a VAV controls enclosure). The fact a Controller fits inside the space does not constitute being designed for a Controller to be installed. Controller shall not be installed on the outside of any MEP Equipment or in a plenum, even if Controller is plenum rated.

D. Enclosures shall have continuously welded and ground smooth seams, have doors that open 180 degrees, concealed and continuous hinge, and ground studs on door and body.

E. Indoor/inside enclosures shall be NEMA/UL Listed Type 1. Enclosure shall be powder-coated steel, consistent with color chart herein. Outdoor/outside Enclosures shall be NEMA/UL Listed 3R or 4X. Enclosure shall be power-coated steel consistent with color chart herein or stainless steel.

F. All enclosures will be provided with a removable backplate to which BAS Components will be fastened. No BAS Components will be fastened to the enclosure body. BAS Components, such as pilot lights and switches, displays, and operator interfaces may be mounted to the enclosure door, so long as they are designed to do so. No component will sacrifice or downgrade the NEMA rating of the enclosure.

G. Control Panels will be sized (width, height, and depth) so that all BAS Components, including but not limited to Controllers, relays, power supplies and transformers, fit inside neatly and in an organized fashion. Provide cable tray for all wire to rest in and fasten to backplate. Cable tray shall be sufficiently sized for future expansion and/or service loop for field-wiring.

H. Control Panels which have more than one BAS Component are required to be provided prewired to numbered terminal blocks. All BAS Components and terminal blocks will be fastened to the removable backplate and wired between the BAS Components and terminal block at Contractor's panel shop. The terminal block will serve as the demarcation point between factory/shop wiring and field wiring. At no point shall field wiring cross the terminal block and be wired directly to a factory/shop-installed BAS Component. Any BAS Component that was intended to be in the field, such as a relay, will not be installed inside the Enclosure in the field.

1. Exception: Enclosures which house only one BAS Component, such as a Controller, are not required to have numbered terminal blocks, and may have field wiring terminated directly to the BAS Component.

I. Maintain separation between Class 2 wiring and other wiring, such as power, for both field and factory connections.

J. The design intent of the Control Panels is to have the ability to, in the future, disconnect all field wiring from the terminal blocks, remove the backplate with old control components, install new backplate with new control components and reconnect wire to the terminal blocks. Contractor will maintain design intent with their panel design and installation.

K. Where the Specification conflicts with Control Panel requirements in Division 26, Contractor will comply with the most stringent requirement.

2.12 CABLE, WIRING, TUBING, AND ACCESSORIES

A. Comply with Division 26.

B. BAS cable for input and outputs shall comply to the color chart herein and have "BAS CABLE" (or equivalent) physically written on the cable from the cable manufacturer at regular intervals.

C. BAS cable for LonWorks shall comply to the color chart herein and have "LONMARK" physically written on the cable from the cable manufacturer at regular intervals. BAS cable for BACnet shall comply with the color chart herein and have "BACNET" physically written on the cable from the cable manufacturer at regular intervals. BAS cable for other protocols will have

the appropriate protocol written on the cable.

D. All control wiring and tubing shall be plenum rated, no riser cable or tubing is allowed. Conform with NFPA 262 Flame Test for approved plenum use without conduit.

E. Provide with integral ripcord.

F. Treat cable with a lubricant to increase cable pulling productivity and efficiency and to decrease the risk of cable damage due to excessive pulling strengths. A non-staining lubricant shall be applied to coat the full length of the cable during the manufacturing process. The lubricant shall produce a low coefficient of friction on the cable jacket material that reduces pulling friction by up to 70%. The lubricant shall continue to reduce friction after it has dried; remaining as a slippery film that retains lubricity for months after use. The cable lubricant shall comply with the physical and performance requirements of Telcordia Standard, TR-NWT-002811, and Generic Requirements for Cable Placing Lubricants. The lubricant shall not contain solvents nor have a flash point.

G. BACnet and Modbus cable will be continuously shielded. LonWorks cable must be shielded into and out of VFDs, or any other noise-generating piece of equipment. Input/output (I/O) cable need not be shielded.

H. Ethernet cable shall comply with the color chart herein and be consistent with Owner IT standards and requirements, and at a minimum IEEE 802.3 Category 6 cable.

I. Tubing for air pressure sensors shall be polyethylene, approved for plenum installations, have high stress-crack resistance and be resistant to ultraviolet light.

2.13 TRANSFORMERS AND DC POWER SUPPLIES

A. Control Transformers
   1. Class 2, sized and rated for application. Circuit breaker overcurrent protection; fused or internal overcurrent protection is not allowed. Transformers shall be sized so that connected load does not exceed 75 percent of rating. Functional Devices TR series or approved equal.

B. DC Power Supplies
   1. Class 2, sized and rated for application. Overcurrent protection with auto-reset; fused or internal overcurrent protection is not allowed. Transformers shall be sized so that connected load does not exceed 75 percent of rating. IDEC PS5R-V Series or approved equal.

2.14 SURGE PROTECTION

A. Provide any power supply surge protection, filters, etc. as necessary for proper operation and protection of all BAS Components.

B. All BAS Components shall be capable of handling voltage variations 10% above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

C. Provide Control Panel surge protection for:
   1. Building Controllers and/or their associated Control Panels
   2. Control Panels with 11 or more hardwired input/output points entering/exiting the panel.
   3. Control Panels with network routers, switches, and/or other network/interface devices.
   4. Location(s) required by Owner based on submitted controls architecture.
   5. Manufactured by Ditech DTK-120HW or approved equal.

D. Provide surge protection for DLN and/or BLN at every point network enters or leaves the building enclosure.
   1. Manufactured by Ditech DTK-2MHLP series or approved equal for copper twisted-pair networks.
   2. Manufactured by Ditech DTK-110C6A series or approved equal for ethernet networks.

2.15 SWITCHES

A. Provide network switches inside Control Panels as required for BLN and/or DLN communications.

B. Manufactured by Contemporary Controls Skorpion Switch Series or approved equal.

2.16 SOFTWARE

A. Provide one copy of ALL programming tools for all Device Controllers. Provide multiple versions of Software as required. Software will be fully licensed and not a “partial” or “light/lite” software version. Any functionality the Manufacturer and/or Vendor has available to them will also be provided to the Owner.

B. Install software on Owner-chosen computer. Coordinate with Owner on processing, memory, operating system, and other computer requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine areas and conditions under which BAS is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner and Contractor. Report any issues to Owner and/or General Contractor.

B. These Specifications call out certain duties of Contractor and any subcontractor(s). They are not intended as a material list of all items required by the Project.

3.02 INSTALLATION

A. Provide related items and work indicated in the Contract Documents, as specified or not specified, necessary to provide a complete and fully functioning BAS, including but not limited to:
   1. All incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc.
   2. All BAS Components, devices, power supplies, transformers, fittings, sensors, controllers, wiring, accessories, etc.
   3. All wiring, including communication network, analog points, digital points, low voltage power, line voltage power, emergency power, etc.
   4. All associated power and low voltage connections.
   5. All conduit, junction boxes, fittings, panels, enclosures, hardware, etc.

B. Utilize licensed electricians for all electrical distribution systems.

C. The Contract Documents show the general arrangement of the respective systems. Follow as closely as actual building construction and the work of other trades will permit.

D. Maintain redlines of shop drawings throughout installation process. Redlines will be used to generate O&Ms, and any other closeout documentation as specified herein. Shop drawings for O&Ms which are submitted unchanged from the Action Submittal phase will be required to be as-built to actual constructed conditions at no cost to Owner.

3.03 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION, AND CLEANING

A. All products and materials shall be new, clean, and free of defects, damage, and corrosion.

B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.

C. Where BAS Components are required to be factory-mounted on MEP Equipment by others, arrange for shipping of BAS Components to MEP Equipment manufacturer.

3.04 SITE CLEAN-UP

A. At conclusion of each day’s work, and at the request of Owner, clean up and remove from the site all rubbish, debris, and trash accumulated during the day as a result of work of Contractor.

B. Marks on walls and/or ceiling tiles caused by Contractor shall be cleaned by Contractor.

C. Ceiling tiles, drywall, carpet, paint, and all architectural finishes damaged by Contractor shall be replaced by Contractor.

3.05 POWER WIRING, CONTROL WIRING, AND CONTROL TUBING

A. Comply with Division 26.

B. Extend 120V power circuits from points provided to control voltage transformers. Where dedicated junction boxes have been provided, coordinate the exact locations with the Electrical Contractor. Where they have not, coordinate the spare circuit breakers to be used with the Electrical Contractor and/or Owner.

C. Install all wiring and tubing in conduit.
   1. Exception: Class 2 wiring and tubing may be installed exposed in rated plenum spaces where exposed plenum cable and tubing is appropriate. Install all BAS wiring and tubing in dedicated BAS J-hooks; no wiring or tubing will be run with other low-voltage cables (such as Owner IT cable tray). Tie cables and tubing together and to J-hook (if open style, not required if has built-in fastener).

D. Install wire, cable, and accessories with sufficient slack and flexible connections to allow for vibration of piping and equipment.

E. Wire safeties and limit controls to prevent operation of MEP Equipment in any selector position (off-hand-auto).

F. Provide sleeves and conduit for passage of wiring through structural masonry, concrete walls and floors, and elsewhere for the proper protection of the BAS. Seal as required.

G. Splices are not permitted within the BLN or DLN communication cables. Only continuous network topologies or continuous homeruns are allowed for these networks. Splices identified, including damage to cable, will result in cable being re-pulled at no additional cost to Owner.

H. Limit DLN and BLN cable lengths to no longer than 70% of the longest dimension published by the manufacturer of the cable or Controller, between the most remote network nodes/Controllers.

I. Shielded wiring will have shields twisted together and taped against jacket of cable. No exposed shields will be allowed. Ground shield at one end of cable.

J. LonWorks communication network shall transition from unshielded to shielded at device prior to VFD(s), be shielded into and out of the VFD(s), and transition back to unshielded at device after VFD(s).

K. Power wiring, control wiring, and wiring accessories (i.e. conduit) shall be consistent with color chart herein.

L. Power wiring, control wiring, and wiring accessories shall comply with Division 26. Where the Specification conflicts with Division 26, Contractor will comply with the most stringent requirement.

M. Install control transformers and DC power supplies inside Control Panels. Transformers randomly installed in plenum, or connected to junction box via nipple mount, is not allowed.

N. Install surge protection for wiring as required. Surge protection for 120V shall be installed exterior to Control Panel. Surge protection for communication network will be installed in close proximity to grounding locations and bars. Route communication network such that surge protection can be installed in accordance with manufacturer's instructions. Excessive grounding wiring runs and/or grounding to structural steel for surge protection is not permitted.

O. Maintain all bend radius requirements with control tubing. Do not kink tubing. Do not use tees, elbows, or other fittings in tubing.

P. I/O wiring shall be labeled in accordance with 1.15 Colors and Labeling. Wire number shall correspond to wire number shown on Closeout Documentation.

Q. I/O cabling will be sized in accordance with the load and distance traveled. Input wiring will be minimally 22AWG. Output wiring will be minimally 18AWG.

3.06 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

A. Contractor shall thoroughly and completely program and configure BAS Components, software, supplemental software, application programming, network communications, operator workstations, computers, printer, and network communications to permit the functional requirements of the BAS herein specified. The setup shall include as a minimum the following network management procedures:
   1. Automatic backup of the BAS database to appropriate media.
   2. Program, load, and debug all software installations, including integration of third-party applications (i.e., analytics and energy management).
   3. Network user auditing routine.

3.07 POINT-TO-POINT TESTING/CHECKOUT

A. As a part of installation, provide checkout (also called point-to-point testing) of all BAS Components.

B. Prior to start-up of any MEP Equipment, ensure all points have been properly set up, including but not limited to sensor type and range.

C. Ensure BAS Component is accessible for maintenance.

D. Ensure sensors and devices have been installed in the correct location in accordance with actual field conditions and modifications made to the flow diagram in the Contract Documents. Ensure sensors and devices have the proper flow direction, orientation, insertion depth, and any other applicable requirements.

E. Provide means to increase or decrease sensed value and ensure the BAS responds accordingly.

F. Checkout will be performed via Owner's final graphic screens. If checkout is performed within the programming function of the BAS, it shall be repeated when the final graphic screens are complete and available for use.

G. Check operation of valve/damper-actuator combination to confirm that actuator modulates valve/damper smoothly throughout stroke to both open and closed positions. Check valve for proper close off.

H. Provide documentation of the checkout process for each piece of MEP Equipment.

3.08 START-UP TESTING

A. At the conclusion of point-to-point testing/checkout, provide start-up testing of all BAS Components.

B. Provide start-up of all MEP Equipment. Perform start-up in conjunction with any applicable trades.

C. Provide start-up testing to ensure all configuration and programming conforms with Sequence of Operation.

D. Start-up testing will be performed via Owner's final graphic screens. If start-up testing is performed within the programming function of the BAS, it shall be repeated when the final graphic screens are complete and available for use.

E. Tune PIDs to provide reasonable speed response to change in variables while having stable operation.

F. Provide documentation of the start-up testing process, including any modifications made to the Sequence of Operation, for each piece of MEP Equipment.

3.09 ADJUSTING AND CALIBRATION

A. Adjust and calibrate all points on the BAS as follows.

B. Prior to calibration, complete all point-to-point testing/checkout and start-up testing to ensure the BAS is fully functioning.

C. Calibrations shall be made inside the Niagara wire sheet. Do not calibrate sensors inside the device controller.

D. Calibrated instrument shall be minimally twice as accurate as the sensor's installed accuracy.

E. Using calibrated instruments, document actual value (per calibrated instrument) and indicated sensor reading (per the BAS). Adjust using a single point offset or a double-point calibration. Document calibration value(s).

F. If sensor reading is within the manufacturer's stated accuracy, do not calibrate the sensor. Document actual value and sensor reading.

G. If sensor is greater than manufacturer's stated accuracy, investigate installation of sensor (i.e., 5-10 pipe/duct diameters downstream, etc), programming of sensor (i.e., SVNTs, range, voltage instead of mA and resistance causing high voltage drop, etc.), transient issues (i.e., turbulence, diffuser blowing on sensor). If investigation uncovers potential source of error, correct sensor installation.

H. If no errors are found and sensor's accuracy is between 100 and 200% of manufacturer's stated accuracy, provide:
   1. Single-point offset for sensors whose readings will vary less than 20% (ex., room temperature).
   2. Two-point calibration for sensors whose readings will vary greater than 20%.
   3. Document actual value, sensor reading, and offset/calibration values.

I. If no errors are found and sensor's accuracy is greater than 200% of manufacturer's stated accuracy, replace sensor. Alternatively, provide documentation for approval as to why sensor's error is more than 200% of manufacturer's stated accuracy.

J. Work with Testing and Balance (TAB) Contractor to input calibrations performed within TAB Contractor's scope of work. Provide dedicated personnel to assist TAB Contractor during their work, provide a fully functioning TAB graphical screen on the BAS for TAB Contractor use, or provide means to adjust TAB via wall module. Assist TAB Contractor with questions regarding TAB graphical screen.

K. Do not calibrate any sensor which has a guaranteed installed accuracy, such as airflow monitoring stations (AFMS) or water flow sensors.

3.10 FUNCTIONAL PERFORMANCE TESTING (FPT) PROCEDURE

A. Perform point-to-point testing/checkout, start-up testing, adjusting/calibration testing, configuration, and programming on all MEP Equipment and the BAS as a whole to provide a complete and fully functioning BAS.

B. BAS shall be complete and fully functioning prior to any Functional Performance Testing (FPT). Assist Owner and/or Owner Representatives, which may include but is not limited to the Engineer, Architect, Commissioning Agent (CxA), and/or Testing and Balance (TAB) Firm, with FPT, which may include but is not limited to verification, commissioning, and/or Graphical User Interface (GUI) acceptance testing. Provide dedicated personnel to those activities as specified herein or as requested by Owner.

C. Provide documentation as specified to prove the BAS is complete and fully functional prior to FPT activities.

D. At a minimum, perform the following FPT procedures. The following may be achieved within a Commissioning Plan or another FPT as required within the Contract Documents.

1. Provide Owner an agenda and schedule of FPT activities for approval and coordination as part of Action Submittals.
2. Complete all necessary installation to have a complete and fully functional BAS. Provide written notice that BAS is ready for FPT.
3. Demonstrate BAS systems to Owner. Perform FPT including but not limited to Sequence of Operation, point-to-point verification to graphical interface, historical data logging, and alarms.
4. Owner to provide detailed punch list to Contractor.
5. Contractor to repair issues on Owner punch list within five business days.

3.11 CLOSEOUT

A. Upon completion of Functional Performance Testing (FPT), Contractor provides all requirements as specified in 1.13 Close-Out Submittals to Owner.

B. Contractor trains Owner on all aspects of the BAS including architecture, devices, software, and final Sequences of Operation.

C. Owner issues letter to Contractor declaring that system is Substantially Complete. Date of this letter starts the Warranty Period.

D. Final Acceptance. Owner issues letter to Contractor accepting system. Final pay app can be issued for release of any remaining contingency funds.

3.12 CONTROL PANELS

A. Install Control Panels at locations in accordance with the Contract Documents and/or Owner. Ensure proper service clearances will be achieved at the end of construction. Control Panels without proper service clearances will be relocated at no cost to Owner.

B. For any Control Panel that exceeds 16 inches in any dimension, provide a trough above/below Control Panel. Trough shall be separated into high and low voltage. Provide a high and low voltage conduit or nipple between trough and Control Panel, sized appropriately for the high and low voltage wiring. All other conduit that serves the Control Panel shall enter/exit the trough. Do not terminate any other conduit(s) to the Control Panel outside of two conduits/nipples identified.

C. Provide a service loop for all controls wiring. Service loop will be installed in trough (where provided) or inside Control Panel cable tray (where allowed).

D. Contractor shall extend power to the Control Panel from a junction box or an acceptable location (coordinate with Owner and/or Division 26).

3.13 GRAPHICS/OPERATOR INTERFACE

A. The graphics shall comply with the Owner’s requirements and BAS Master Plan.

3.14 RETROFIT WORK, ADDITIONAL REQUIREMENTS

A. Control Panels
   1. Where existing control panels are to be reused, provide control panel design which facilitates the reuse of wiring without needed to be extended (ex: install terminal blocks across top of control panel backplate to allow for minimal need for extending wiring).
   2. Where wiring must be extended to reach, wiring will be spliced in a permanent fashion (i.e., solder and heat shrink). Wire nuts in the control panel are not allowed.
   3. Where the existing control panel does not facilitate an installation that otherwise would require excessive extending of wire, the existing panel can be used as a “patch panel” via terminal blocks.
   4. Where there is no existing trough or control panel, comply with specifications and install a new control panel and/or trough.

B. General

1. Damaged wire, splices from previous work, or any other rework required will be performed as part of the base bid.

END OF SECTION 230901

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SECTION 230910
BAS SENSORS AND DEVICES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

B. ANSI/FCI 70-2 - Control Valve Seat Leakage 2021.

C. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.

1.02 SUBMITTALS

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

C. Manufacturer's Instructions: Provide for all manufactured components.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience approved by manufacturer.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide BAS Components as indicated in the Contract Documents, Sequence of Operation, control diagrams, points lists, Specifications, or as needed to perform the intended operations consistent with the design intent of the BAS and design/performance intent of the MEP Equipment.

B. Provide with metal enclosure for all plenum applications. Any sensor mounted in plenum that has a plastic enclosure will be rated for plenum installation or installed in a plenum-rated enclosure.

C. All sensors shall be vibration and corrosion resistant.

D. Accuracy statements are written for the specific sensor. Installation shall not degrade accuracy more than double what accuracy statement for sensor requires.

E. Enclosures:
   1. Provide suitable enclosure for BAS Component for ambient conditions encountered by application.
   2. NEMA Type 1 or 2 for indoor and protected applications.
   3. NEMA Type 3R, 4 or 4X for outdoor and unprotected applications.

2.02 TEMPERATURE SENSORS, STANDARD ACCURACY

A. Manufacturers:
   1. ACI
   2. BAPI
   3. Distech
   4. Honeywell
   5. JCI

B. General Requirements:
   1. Sensor shall be thermistor or RTD inherently compatible with BMS.
   2. Accuracy: ±0.5 deg F over 32 to 158 deg F range.
   3. Operating Temperature Range: -40 to 300 deg F.

C. Outside Air Temperature (OAT) Sensor: Sensor installed in wall-mounted weatherproof enclosure with conduit entrance, with PVC sun and windscreen as required.

D. Duct-Mounted Single-Point Temperature Sensor: Rigid sensor sealed in 0.25-inch stainless steel probe of length between one-third and two-thirds of the duct width in duct-mounted metal housing with conduit entrance.

E. Duct-Mounted Averaging Element Temperature Sensor: Multi-point sensor, contained in a flexible copper or woven continuous metallic sheath, with length sized for duct.
   1. Provide a minimum of 1 foot of sensing element for every three square feet of duct/coil area. Multiple averaging elements may be required.
   2. Averaging elements shall be used where ducts are prone to stratification, and downstream of heating/cooling coils.
   3. Where multiple sensors are provided, sensors may be wired in a series-series, parallel-parallel pattern (requires four or nine sensors) in lieu of multiple inputs.
   4. Plenum rated sheaths are not acceptable.

F. Wall-Mounted Flat-Plate Temperature Sensor: Stainless steel, flat plate sensor that fits in a standard 2-inch by 4-inch junction box with tamperproof screws. Provide with insulated back.

G. Thermowell-Mounted Immersion Temperature Sensor: Rigid sensor sealed in 0.25-inch stainless steel probe, with three-part moisture protection system, that has minimum length of 20% of the pipe width. Provide machined, single-piece brass or stainless steel thermowell compatible with sensor housing.

H. Strap-On Piping Temperature Sensor: Sensor with metal clamps to fasten to piping. Strap-on sensors are only acceptable where specifically called for in Contract Documents. Thermowell and insertion sensor shall be installed where strap-on temperature sensor not specifically called for.

2.03 TEMPERATURE SENSORS, MATCHED PAIR

A. Where two temperature sensors will be used together to calculate a BTU measurement, provide a matched pair.

B. General Requirements
   1. All requirements for Standard Accuracy Temperature Sensors are applicable, except where more stringent below.
   2. Sensor shall be thermistor or RTD with matched transmitter, bath calibrated, 4-20mA output proportional to temperature range and compatible with BAS and 24 Vac/dc power supply.

3. Measurement Range: 32 to 200 deg F.
4. Range of sensor output shall be appropriate for the application the sensor is installed in. Range of the output shall be set at the factory and shown on the provided documentation.

2.04 HUMIDITY SENSORS, STANDARD ACCURACY

A. Manufacturers
1. ACI
2. BAPI
3. Distech
4. Honeywell
5. JCI

B. General Requirements:
1. Laser-trimmed thermoset polymer-based capacitive-type sensor, 4-20mA or 0-10Vdc output proportional to relative humidity range of 0% to 100% and 24 Vac/dc power supply.
2. Accuracy: ±2 percent over 10 to 90 percent range.
3. Measurement Range: 0-100%.
4. Operating Temperature Range: -40 to 140 deg F.

C. Outside Air Relative Humidity (OAH) Sensor: Sensor installed in wall-mounted weatherproof enclosure with conduit entrance, with PVC sun and windscreen as required.

D. Duct-Mounted Relative Humidity Sensor: Sensor in duct-mounted plenum-rated housing with conduit entrance.

E. Wall-Mounted Relative Humidity Sensor: Sensor in white plastic enclosure with insulated back.

2.05 COMBINATION RELATIVE HUMIDITY AND TEMPERATURE SENSORS

A. Where there is a requirement for the monitoring of both relative humidity and temperature at the same location, provide combination relative humidity and temperature sensors. The individual sensors must each meet the specifications details herein.

B. Where required in the drawings, combination relative and humidity sensors shall have the ability to output additional parameters, including dew point, enthalpy, and wet bulb temperature.

2.06 WALL MODULES AND ROOM SENSORS, STANDARD ACCURACY

A. General
1. Wall modules and room sensors cover devices which mount on a wall and provide an interface between the MEP Equipment and the occupant.

B. Manufacturers: Provide a wall module consistent with the manufacturer providing the overall controls.

C. General Requirements:
1. Wall modules which measure including but not limited to temperature, relative humidity, and/or carbon dioxide must each meet the specifications details herein.
2. Provide with plastic enclosure with display, override switch, override indicator, and setpoint adjustment.

2.07 DRY (AIR) PRESSURE SWITCH

A. Manufacturers
1. Dwyer
2. Cleveland Controls

B. General Requirements
1. Diaphragm pressure switch with SPDT contacts.
2. Sensor shall be uni-directional.
3. Manual or automatic reset, in accordance with Contract Documents.
4. Setpoint adjustment knob.

5. Accuracy: ±2 percent of full scale output.
6. Measurement Range: 0 to 12 in wg.
7. Operating Temperature Range: -4 to 185 deg F.

C. "Paddle-style" air flow switches are not allowed. Use dry pressure switch in lieu of paddle.

2.08 DRY (AIR) PRESSURE SENSOR, STANDARD ACCURACY

A. Manufacturers
1. ACI
2. Honeywell
3. Setra
4. Veris

B. General Requirements
1. Diaphragm pressure transducer and amplifier type sensor, 4-20mA or 0-10Vdc output proportional to pressure range and compatible with BMS system and 24 Vac/dc power supply.
2. Sensor shall be uni- or bi-directional for application as stated below.
3. Sensor shall have local display.
4. Accuracy: ±1 percent of full-scale output/selected range.
5. Measurement Range: See applications below.
6. Operating Temperature Range: -4 to 140 deg F.
7. Burst pressure: 5 psid.

2.09 DUCT-MOUNTED STATIC PRESSURE SENSORS:

A. Uni-directional.

B. Measurement Range: 0 to 5 in wg. for low and medium pressure applications and higher as required for high pressure applications.

2.10 ROOM PRESSURE SENSORS:

A. Bi-directional.

B. Measurement Range: -0.2 to 0.2 in wg.

C. Provide with surge damper (Amphenol SD-01 or equivalent) and room static pressure pickup with fine stainless steel mesh filter.

2.11 BUILDING PRESSURE SENSORS:

A. Bi-directional.

B. Measurement Range: -0.2 to 0.2 in wg.

C. Provide outside air reference kit, (Dwyer A-306 or equivalent), with tubing, mounting bracket and required hardware.

D. Provide with surge damper (Amphenol SD-01 or equivalent) and room static pressure pickup with fine stainless steel mesh filter.

2.12 AIR FILTER/COIL DIFFERENTIAL PRESSURE SENSORS:

A. Uni-directional.

B. Measurement Range: 0 to 2 in wg and higher as required.

C. Provide with static pressure probe(s).

2.13 WET (WATER) PRESSURE SWITCH

A. Manufacturers
1. Ashcroft

B. General Requirements
1. Diaphragm pressure switch with SPDT contacts.

2. Sensor shall have stainless steel wetted components in a weatherproof wiring housing.
3. Sensor shall be uni-directional.
4. Manual or automatic reset, in accordance with drawings.
5. Setpoint adjustment knob.
6. Accuracy: ±2 percent of full scale output.
7. Measurement Range: 0 to two times the setpoint or anticipated pressure.
8. Operating Temperature Range: -20 to 150 deg F.

C. “Paddle-style” water flow switches are not allowed. Use wet pressure switch in lieu of paddle.

2.14 WET (WATER) PRESSURE SENSOR

A. Manufacturers
1. Senva
2. Setra
3. Veris

B. General Requirements
1. Diaphragm pressure transducer and amplifier type sensor, 4-20mA or 0-10Vdc output proportional to pressure range and 24 Vac/dc power supply.
2. Sensor shall have stainless steel wetted components in a weatherproof wiring housing.
3. Sensor shall be uni-directional, unless bi-directional required for reversing flow.
4. Sensor shall have local display.
5. Accuracy: ±0.25 percent of full-scale output/selected range.
6. Measurement Range: See applications below.
7. Operating Temperature Range: See applications below.
8. Proof Pressure: two times rated input pressure, or greater.
9. Burst Pressure: five times rated input pressure, or greater.

C. Water “Gauge” Pressure Sensors:
1. Measurement Range: 0 to two times the setpoint or anticipated pressure.
2. Operating Temperature Range: 0 to 175 deg F.

D. Water Differential Pressure Sensors:
1. Measurement Range: 0 to two times the setpoint or anticipated pressure.
2. Operating Temperature Range: 0 to 175 deg F.

E. Provide with four or five valve manifold. Sensor to be connected to manifold at factory.

2.15 CURRENT SWITCHES/TRANSDUCERS

A. Manufacturers
1. ACI
2. Setra
3. Veris

B. General Requirements
1. Sensor shall be rated for their associated motor load and voltage, have input and output isolation, and have LED indication of status.
2. Sensor shall be selected based on application, including but not limited to standard 60 hertz motors, variable speed drive, or ECM.
3. Accuracy: ±2 percent of full-scale output.
4. Measurement Range: 0 to two times the anticipated current.
5. Operating Temperature Range: 5 to 140 deg F.

C. Current Switch (CS):
1. Self-powered current switch with N.O. contacts.
2. Provide with adjustable trip point where indicated in Contract Documents, or as required for proper operation for application.

D. Current Transducer (CT):
   1. Sensor with 4-20mA or 0-10Vdc output proportional to current draw and 24Vac/dc power supply.

2.16 CARBON DIOXIDE SENSORS

A. Manufacturers
   1. Honeywell
   2. Vaisala
   3. Veris

B. General Requirements
   1. Non-dispersion infrared (NDIR) type sensor, 4-20mA or 0-10Vdc output proportional to carbon dioxide (CO2) range and 24 Vac/dc power supply.
   2. Sensor shall have local display.
   3. Accuracy: ±2 percent of reading, or 30 ppm, whichever higher.
   4. Measurement Range: 0 to 2000 ppm.
   5. Operating Temperature Range: 32 to 122 deg F.
   6. Standard Calibration: No maintenance or periodic sensor replacement needed. The sensor shall have a 5-year calibration interval, utilizing an automatic unoccupied period calibration.

C. Wall-Mount Carbon Dioxide Sensors: Sensor with plastic enclosure that fits on a standard 2-inch by 4-inch junction box.

D. Duct-Mount Carbon Dioxide Sensors: Sensor with sampling tube, duct-mounted metal housing with conduit entrance.

E. Where CO2 is provided beside temperature and/or humidity sensors, it shall be provided separately and not combined into a single sensor.

2.17 AIRFLOW MEASUREMENT STATION (AFMS)

A. Manufacturers
   1. Ebtron

B. General Requirements
   1. Thermal dispersion type flow sensor, composed of one or more sensor probes (multiple sensors per probe) and transmitter, 4-20mA or 0-10Vdc output proportional to flow range and 24 Vac/dc power supply.
   2. Measurement will be made using the principle of thermal dispersion. Provide one self-heated bead-in-glass thermistor and one zero power bead-in-glass thermistor at each sensing node. Thermal dispersion devices that indirectly heat a thermistor are not acceptable. Other measurement technologies are not acceptable.
   3. Sensor probe tubes and mounting brackets shall be constructed of gold anodized, 6063 aluminum alloy, 304 stainless steel, or 316 stainless steel.
   4. Internal wiring in probes shall be resilient to exposure of moisture and not effect sensor operation.
   5. Sensor probe shall be comprised of multiple sensors, with calibration data stored in the cable connecting plug, such that switching transmitters will automatically read corresponding calibration and sensor data. Quantity of sensors per probe and quantity of probes shall vary based on duct/fan configuration to provide the required accuracy.
   6. Accuracy: ±3 percent of reading over full scale, when installed in accordance with manufacturer guidelines. ±5 percent of reading over full scale for outdoor air intakes, when installed in accordance with manufacturer guidelines. Accuracy is for installed air flow monitoring sensor, not for individual sensors in each probe.
   7. Measurement Range: 0 to 5,000 feet per minute (fpm).
   8. Operating Temperature Range: Probes: -20 to 160 deg F. Transmitter: -20 to 120 deg F.

9. Sensing elements will be NIST traceable.
10. Transmitter:
    1) Heavy-duty construction with LED display with 4-20mA air flow and temperature output signals. Outputs may be field configured for additional signals.
    2) Capable of communicating with BAS on communication protocol as specified in 230901.
    3) Transmitter shall generate alarms for individual sensor errors and transmit over the BMS network.
    4) Transmitter will be provided with Bluetooth low-energy interface card, capable of transmitting information to Android or iOS devices.
11. Duct Air Flow Measuring Stations: Probes will be ordered specific to duct as installed in field.
12. Fan Inlet Air Flow Measuring Stations: The sensing element shall be specifically designed to measure air flow of a centrifugal fan at the inlet cone. Coordinate mounting style with fan selection and manufacturer recommendations. For double-inlet fans, provide one set of elements for each inlet.

2.18 INSERTION TURBINE WATER FLOW METERS

A. Manufacturers
   1. Onicon F-1000 series

B. General
   1. Provide with NIST traceable, wet calibrated flow-measuring element, integral transmitter (4-20mA or 0-10Vdc output proportional to flow range), installation valves, depth gage, calibration certificate, and attached tag indicating calibration information.
   2. Flow meter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.
   3. Provide power from 24 Vac/dc power supply.
   4. Contractor shall be responsible for selecting flow meter options submitted based on application. Flow meter shall be constructed, calibrated, and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected flow rate, ambient conditions, and fluid characteristics which include but are not limited to pressure, temperature, conductivity, and viscosity.
   5. Single or dual axial insertion turbine design with electronic impedance-based sensing circuit. Dual insertion turbine shall incorporate two contra rotating turbines and an averaging circuit to reduce measurement errors due to flow distortions, such as swirl, when installed in piping configurations with reduced straight run.
      a. Coordinate single or dual turbine requirements with as-built conditions to ensure accuracy is achieved as specified.
   6. 316L stainless steel construction.
   7. Maximum pressure rating: 400 psig or greater.
   8. Maximum temperature rating: 280°F or greater.
   9. Accuracy: ±2 percent of reading from 0.4 to 20 fps, when installed in accordance with manufacturer guidelines.
   10. Flow range: 0 to 20 fps
   11. Provide with installation kit appropriate for application.
   12. Application
      a. Chilled water, chilled glycol, hot water, or any other media which contains minimal particulate.

2.19 INSERTION ELECTROMAGNETIC WATER FLOW METERS

A. Manufacturers
   1. Onicon F-3500 Series

B. General

1. Provide with NIST traceable, wet calibrated flow-measuring element, integral transmitter (4-20mA or 0-10Vdc output proportional to flow range), installation valves, depth gage, calibration certificate, and attached tag indicating calibration information.
2. Flow meter shall be wet tappable, allowing insertion and removal from the flow stream without system shutdown.
3. Provide power from 24 Vac/dc power supply.
4. Contractor shall be responsible for selecting flow meter options submitted based on application. Flow meter shall be constructed, calibrated, and scaled for the intended application in terms of pipe size, pipe material, installation requirements, expected flow rate, ambient conditions, and fluid characteristics which include but are not limited to pressure, temperature, conductivity, and viscosity.
5. Electromagnetic sensing element shall utilize two sets of diametrically opposed electrodes to measure the average flow rate velocity.
6. 316L stainless steel construction.
7. Maximum pressure rating: 400 psig or greater.
8. Maximum temperature rating: 200°F or greater.
9. Accuracy: ±1 percent of reading from 2 to 20 fps, when installed in accordance with manufacturer guidelines.
10. Flow range: 0 to 20 fps
11. Provide with installation kit appropriate for application.

C. Application
1. Condenser water or any other media which contains particulate.

2.20 BTU (ENERGY) METERS

A. Manufacturers
1. Onicon System 10

B. General
1. Water flow meter, dual temperature sensors, and transmitter, 4-20mA or 0-10Vdc output proportional to flow range and each temperature (3 analog outputs total), and 24 Vac/dc power supply.
2. Provide water flow meter in accordance with the specification herein.
3. Provide matched temperature sensors in accordance with the specification herein.
4. Transmitter
   a. Provide with local display and operator interface. Display shall visually indicate instantaneous flow rate, supply temperature, return temperature, thermal energy flow rate (MBH).
   b. Capable of communicating with BAS on communication protocol as specified in 230901.

2.21 THERMOSTATS

A. Manufacturers
1. ACI
2. Honeywell
3. JCI
4. Schneider Electric

B. General
1. Label switches "FAN ON-OFF", "FAN HIGH-LOW-OFF", "FAN HIGH-MED-LOW-OFF", or as applicable.
2. Mount on standard junction box.
3. Thermostat portion must meet the specifications details herein as required for application.

C. Digital Stand-Alone Thermostat
1. Electronic, solid-state, microcomputer-based room thermostat.

2. Automatic switching from heating to cooling.
3. PID control to minimize overshoot and deviation from setpoint.
4. Set up for four separate temperatures/periods per day, with individual programming for each day of the week (4 programs per day, 7 days per week, 28 potential programs).
5. Instant override of setpoint for continuous or timed period from 1 hour to 31 days.
6. Short-cycle protection.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keypad disable, and fan on-auto-circulate.
8. Powered off unit 24Vac transformer, with solid-state memory in which programming is retained on power failure. Battery acceptable only for time and date upkeep during power failure.
9. Thermostat display features include the following: time of day, actual room temperature, programmed temperature, programmed time, duration of timed override, day of week, and system mode indications include "heating," “cooling,” "off," "fan auto," “fan circulate,” and "fan on."
10. Combination Thermostat, Humidistat, Carbon Dioxide, and/or Occupancy Sensor: Where there is a requirement for a thermostat with humidistat, carbon dioxide, and/or occupancy sensing functions at the same location, provide combination unit. The individual sensors must each meet the specifications details herein.
11. Provide remote sensing element (electronic sensor) as required for application.

D. Low-Voltage, On-Off Thermostats
1. 24Vac, bimetal-operated, mercury-free, heat anticipator, concealed set-point adjustment, space temperature indicator, 55 to 85 deg F setpoint range, and 2 deg F maximum differential.
2. Selector Switch: Integral, manual on-off-auto.

E. Line-Voltage, On-Off Thermostats
1. Line voltage listed for electrical rating, bimetal-operated, mercury-free, open contact or bellows-actuated, snap-switch or equivalent solid-state type, heat anticipator, concealed set-point adjustment, space temperature indicator, 55 to 85 deg F setpoint range, and 2 deg F maximum differential.
2. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
3. Selector Switch: Integral, manual on-off-auto.
4. Combination Thermostat and Fan Switches: Push-button or lever-operated fan switch.

F. Freezestat/Low-Limit Duct Thermostat (LTD)
1. Manual reset switch.
2. Snap-acting SPDT with gas/refrigerant filled copper capillary that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint. Sensing range 15 to 55 deg F.
3. Bulb Length: Sized for duct/coil with minimum 5 feet.
4. Quantity: Provide a minimum of 1 foot of sensing element for each square foot of duct/coil area. Multiple Low-Limit Thermostats may be required.

G. High-Limit Humidistat
1. Snap acting SPDT, duct or room mount, automatic reset switch that trips if humidity sensed is equal to or above setpoint. Sensing range 15 to 95% relative humidity.
2. Strap-On Piping Aquastat Temperature Sensor
3. Snap acting SPDT, pipe mount, automatic or manual reset switch (as indicated in Contract Documents) that trips if temperature sensed is equal to or above setpoint. Sensing range appropriate for application.

2.22 RELAYS

A. Manufacturers

1. IDEC
2. Functional Devices
3. Veris

B. General Requirements
1. Electrically rated for application, minimally SPDT with 10A (resistive) contacts.
2. Provide with LED indicator light.
3. Provide with hand-off-auto (HOA) unless otherwise specified. HOA not required if controller has internal HOA or output being controlled has HOA (i.e. VFD).
4. Plenum rated where required.

C. BAS Panel-Mounted Relays: “ice-cube” / socket style with mounting base and replaceable relay. Relays in panel will be screw terminal terminations; relays with wiring whip from factory are not allowed for panel mounting.

D. Nipple-Mounted Relays: enclosed relay compatible with conduit knockout. Acceptable for field use. With or without factory-provided wiring whip.

E. Track-Mounted Relays: acceptable for use in terminal unit control panels. Screw terminal terminations. Track-mounted relays are not to be installed in field unless inside an equipment control panel (i.e., no track-mounted relays in electrical boxes).

F. Combination Motor Starter / Current Switch Relays: allowed only for single-phase equipment and must be mounted such that pilot light is exposed (i.e., combination motor starter / current switch relays which install inside of motor starter/VFDs are not allowed). The individual sensors must each meet the specifications details herein.

2.23 ADDITIONAL SENSORS AND DEVICES

A. Shaft-Mounted Limit Switches: SPDT/DPDT mercury-free, gravity-actuated mechanical switch with adjustable shaft connection.

B. Whisker Limit Switches: SPDT/DPDT mechanical whisker switch with adjustable trim arm.

C. Condensate Drain Pan Overflow Safety Switch: Low-voltage, float-type safety switch designed for condensate drain pan high-level alarm for unit shutdown and alarming. Little Giant Pump/Franklin Electric (ACS series) or equal. Whisker switch with foam float is not acceptable.

D. Water Leak Detection Alarm: Adjustable-height multi-point water detection sensor constructed to be corrosion and abrasion resistant and configured for normally open or normally closed as required by the application with 24Vac/dc power supply. Provide remote-mounted sensing probe and cable as needed for each application. Operating Temperature Range: -40 to +185 deg F.

E. Emergency Stop Buttons: ADA-compliant, red emergency pushbutton in yellow polycarbonate plastic enclosure with clear flip-up cover and stainless steel backplate. Button shall be reset by twisting or pulling out the button; a procedure that requires disassembly or a key is not acceptable. 120V or 24 V as needed. Provide label with indication of operation (ex. “Boiler E-Stop”). Safety Technology International (STI) Stopper Station series or equal.

2.24 ELECTRONIC ACTUATORS

A. Manufacturers: All valve actuators shall be supplied from a single manufacturer. All damper actuators shall be supplied from a single manufacturer. Provide actuators manufactured by one of the following:
1. Belimo
2. Honeywell
3. Johnson Controls
4. Schneider Electric (TAC Dura-Drive)

B. General
1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

2. Actuators shall operate related valve(s)/damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the valve/damper is subjected.
3. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the designed pump/fan shutoff pressure as a minimum requirement.
4. Select actuators to fail in desired position in the event of a power failure. See Contract Documents for power failure modes.
5. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.
6. Type: Motor operated, with gears, electric and electronic.
7. Voltage: 24Vac unless otherwise specified. 120V actuators may be allowed if coordinated by BAS Contractor with Electrical Contractor to provide local disconnect and power. Circuit must be fed from the same power panel as the MEP Equipment or Control Panel and a spare circuit must be available.
8. Power: Contractor is responsible for sizing control transformers based on the VA of the actuator(s) selected.
9. Provide electronic overload protection throughout the entire operating range in both directions.
10. Coupling: V-bolt and V-shaped, toothed cradle. Bolt and set screw method of attachment is unacceptable.
11. Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
12. Two-Position Actuators: Single direction, spring return or non-spring return type.
13. Modulating Actuators:
    a. Capable of stopping at all points across full range and starting in either direction from any point in range.
    b. Control Input Signal:
        1) Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position, and other input drives actuator to close position. No signal of either input, the actuator remains in the last position.
        2) Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for 0-5Vdc, 0-10Vdc, 1-5Vdc, 2-10Vdc, and 4-20mA signals.
    c. Floating control actuators shall be allowed only for damper and valve control for room terminal units where there is not a room pressurization requirement. See General Requirements for definition of those spaces. Use of floating controls must be specifically requested by Contractor for specific spaces and reviewed by Owner. Submission of floating control actuators without specific comment by Contractor for spaces and the resulting review by Owner does not constitute approval for use.
    d. Pulse width modulation (PWM), or any other analog signal that is not specified above is not allowed.
14. Position Feedback: Where indicated, equip two-position actuators with auxiliary switches (SPDT) for remote monitoring of open and/or closed position. Point of open and/or closed position can be adjusted over the actuators range of operation (0-100%). Where indicated, equip modulating actuators with a position feedback through current and/or voltage signal for remote monitoring.
15. Fail-Safe: Where indicated, provide actuator to fail via a mechanical spring return mechanism, to drive controlled device to an end position (open or close) on loss of power. Electronic fail-safe is not allowed, unless specifically reviewed and accepted by Owner. Provide external, manual gear release on non-spring return actuators.
16. Temperature Rating:
    a. Standard Dampers and Valves: -22 to +122 deg F.

b. Smoke Dampers: -22 to +250 deg F.
17. Provide actuator enclosure with a heater and thermostat where required by application.
18. Stroke Time:
    a. Normal: 120 seconds or less from fully closed to fully open, or fully open to fully closed.
    b. Fast-Acting: 12 seconds open, 5 seconds closed unless otherwise noted.

C. Damper Actuators

D. The total damper area operated by an actuator shall not exceed 80 percent of damper manufacturer's maximum area rating.

E. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison off a single control signal.

F. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

G. Use shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

H. Actuator will mount directly to damper with coupler as described above. No foot mount kits, jackshafts, or linkages shall be used.
1. Sizing: Size for running torque calculated as follows:
    a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sqft. of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sqft. of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sqft. of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sqft. of damper.
    e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1,000 to 2,500 fpm: Increase running torque by 1.5.
    f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2,500 to 3,000 fpm: Increase running torque by 2.0.

I. Smoke and Combination Fire/Smoke Damper Actuators

J. Actuator shall come connected to damper as a rated assembly, sized per the damper manufacturer’s requirements, and meet the specifications herein.
1. Actuators operating in smoke control systems shall comply with governing code and NFPA requirements.

K. Valve Actuators
1. Valve actuators will be direct coupled “rotary-style” unless otherwise specified. Where required, direct coupled “linear-style” actuators may be used.
2. Sizing
    a. Hydronic: Size for torque required to achieve valve close off at 150% of maximum pump differential pressure.

2.25 CONTROL VALVES

A. General
1. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
2. Control valves assemblies shall be provided and delivered from a single manufacturer as a complete assembly, with the actuator installed at the factory.
3. Control valves shall be two- or three-way as specified in Contract Documents.
4. Provide with extended neck as required to accommodate insulation thicknesses.
5. Refer to Division 23 for general information about valve construction and installation.

B. Hydronic Ball-Style Control Valves
1. Manufacturers
    a. Belimo (CCV Series)

b. Honeywell (VB Series)

2. Construction
   a. 2-Inch NPS and Smaller: 350 psi at 250 deg F brass/bronze body, stainless steel ball with matching blow-out proof stem, full port with stainless steel or composite characterizing insert, Teflon seats, dual EPDM O-ring seals, solder or threaded ends.
   b. 2 1/2-Inch NPS and Larger: 175 psi at 250 deg F iron body, stainless steel ball and matching blow-out proof stem, full port with stainless steel or composite characterizing insert, Teflon seats, dual EPDM O-ring seals, ANSI Class 125/150 flanged ends.
   c. ANSI class IV seat leakage for two-way, ANSI class IV seal leakage for three-way A-Port and class III for B-Port.
3. Flow Characteristics
   a. Two-way two-position valves shall be full port.
   b. Two-way modulating valves shall have equal percentage characteristics.
   c. Three-way valves shall have equal percentage characteristics on A-Port and linear characteristics for B-Port. Bypass applications shall have linear percentage characteristics.
4. Sizing
   a. Two Position: Line size or size using a 1 psig pressure differential.
   b. Two-Way Modulating: Size using 4 psig or equal to the load pressure drop, whichever is greater.
   c. Three-Way Modulating: Size using 4 psig or equal to the load pressure drop, whichever is smaller.
   d. Effective Cv: for any valve smaller than line size, the pressure drop due to the reduction in pipe size shall be taken into effect. Provide effective Cv on submittal.

C. Hydronic Butterfly-Style Control Valves
1. Manufacturers
   a. Belimo (HD Series)
   b. Honeywell (VFF Series)
2. Construction
   a. 2 to 12-Inch NPS: Class 125/150 cast-iron full-lugged body, stainless steel disc, EPDM seat and extended neck. Disc-to-stem connection shall utilize an internal spline.
   b. 14-Inch NPS and Larger: Class 125/150 cast-iron full-lugged body, stainless steel disc, EPDM seat and extended neck. Disc-to-stem connection shall utilize a dual-pin method.
   c. Leakage: 200 psid zero leakage for 2 to 12-inch NPS and 150 psid zero leakage for 14-inch NPS and larger.
3. Sizing
   a. Two Position: Line size or size using a 1 psig pressure differential.
   b. Two-Way Modulating: Size using 3 psig or equal to the load pressure drop, whichever is greater. Size for the design flow with the disc at 60-degree open position and the design velocity less than 12 FPS.
   c. Effective Cv: for any valve smaller than line size, the pressure drop due to the reduction in pipe size shall be taken into effect.

D. Pressure-Independent Hydronic Ball-Style Control Valves
1. Manufacturers
   a. Belimo (PIQCV up to 3/4”; ePIV for 1” and up)
   b. Johnson Controls (PI-1000 series)
   c. Danfoss (AB-QM Series)
   d. Bell & Gossett Ultra Setter
   e. Flow Control Industries, Inc. (Delta P Series)

f. Griswold (MVP Series)

2. General
   a. Valve shall meet all the requirements set forth in the Hydronic Ball-Style Control Valve section, in addition to the requirements below.
   b. Operating Differential Pressure Range: 5 to 50 psid or better.
   c. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. The control valves shall accurately control the flow from 0 to 100% full rated flow.
3. Construction
   a. Mechanical pressure regulation style PIC valves shall have factory installed pressure/temperature test ports (Pete's Plugs) across the pressure regulator at the factory.
   b. Pressure independent control valves 1" NPT or larger may use ultrasonic flow measurement. The ultrasonic flow meter will meet the specifications herein.
4. Flow Characteristics: see Hydronic Ball-Style Control Valves.
5. Sizing
   a. Valve shall be sized at line size for the GPM specified of MEP Equipment.
   b. Provide minimum and maximum full-open pressure drop of valves.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 GENERAL INSTALLATION

A. Install aspirating guards on wall-mounted devices in the following locations:
   1. Building entrances.
   2. Public areas.
   3. Where indicated on construction documents.

B. Exposed wire nuts, including in plenum, will not be acceptable. All connections will be made inside a rated enclosure.

C. Install labels and nameplates to identify control components according 230901.

D. Install hydronic instrument wells, valves, and other accessories according to Division 23.

E. Install refrigerant instrument wells, valves, and other accessories according to Division 23.

F. Smoke detectors, high and low limit thermostats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

G. Coordinate fire alarm relay connections to the fire alarm system with the fire alarm installer.

H. Where sensors have a display, mount such that display can be read from ground.

I. Install sensors in visible and accessible areas. Do not hide sensors on top of ductwork or insulate over sensors.

J. For sensors on rigid insulation for duct or piping, install sensor prior to insulation. Sensors installed after insulation will be required to cut and seal insulation around sensor.

K. Sensors requiring an external power source shall use DC power from switching DC power supply. Do not use alternating current for sensors unless specifically required by the manufacturer. Do not use on-board DC power for sensors unless specifically required by the manufacturer.

3.03 TEMPERATURE/HUMIDITY/WALL MODULE AND ROOM SENSORS INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Contract Documents and room details before installation. Install devices 48 inches above the floor per ADA requirements. The location(s) to be selected by Owner. No sensor shall be mounted until the Owner and/or Owner Representatives give specific location instructions. Do not install sensor(s) on the inside of exterior building walls (including column fur outs) unless explicitly approved by Owner.

B. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

C. Install outdoor air temperature and humidity sensors on north-facing wall at designated location. If sensor cannot be placed on north wall, submit RFI for approved location and provide with PVC sun shield and windscreen.

D. Single-point temperature sensors may be used in ducts where there is no air stratification possibilities. Sensor shall be mounted sufficiently downstream to allow for sufficient mixing, five to ten duct diameters at a minimum.

E. Install mixing plenum sensors in a serpentine manner horizontally (not vertically) across duct. Support each bend with a capillary clip.

F. Thermowells to be installed in piping. Contractor to “stub-up” any thermowell which is too long to install directly into piping. Install heat-conducting fluid in thermowell prior to installing sensor.

G. Install heat-conducting fluid where strap-on temperature sensors contact piping. Sand and clean piping prior to installation. Insulate around sensor.

H. Install cooler/freezer sensors in rubber clamp to isolate sensor from surrounding metal. Run conduit inside cooler/freezer for sensor away from door and storage racks. After sensor has been checked out, seal all penetrations with low expansion insulating foam. Coordinate installation with cooler/freezer vendor.

I. Install humidity sensor in areas where relatively humidity will not rise above 90% RH. If area will have high humidity consistently, relocate to different area and use dewpoint/ psychrometric calculations to calculate relatively humidity of the area required.

J. Wall Modules
   1. Limit setpoint adjustment to ±3 deg F unless otherwise specified on the Drawings.

K. Pressure Sensor Installation

L. Supply (Positive) Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube/probe. Make pressure tap connections according to manufacturer's recommendations.

M. Return (Negative) Duct Static Pressure. Pipe low-pressure tap to duct using a pitot tube/probe. Make pressure tap connections according to manufacturer's recommendations.

N. Room Pressure: Pipe appropriate pressure sensor port (positive space: high pressure, negative space: low pressure) to room. Pipe opposite pressure point to reference outside of room. Connect to stainless steel mesh snubber mounted to white 2 in by 4 in plate at locations on drawings.

O. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through outside air reference kit. Mount kit per manufacturer's instructions. Pipe high-pressure port to stainless steel mesh snubber mounted to white 2 in by 4 in plate at locations on drawings.

P. Pressure transducers, except those controlling VAV boxes, shall be located in Control Panels, not on MEP Equipment or on ducts. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.

Q. Do not install tees for TAB purposes in air pressure tubing. Remove tees where found.

R. Install differential pressure sensor valve manifold at eye level. Provide hard copper tubing from water mains to valve manifold; soft copper not allowed. Provide isolation valves in tubing prior to valve manifold.

3.04 CURRENT SWITCHES/TRANSDUCER INSTALLATION

A. Wire may be "wrapped" around CS/CT to obtain better status indication.

B. CS/CTs requiring commissioning/startup will be done per manufacturer installation instructions.

3.05 AIR FLOW MEASUREMENT STATIONS (AFMS) INSTALLATION

A. Install AFMS in locations indicated and required to perform the Sequences of Operation. Install AFMS in accordance with the manufacturer's recommendations.

B. Do not install AFMS sensors and probes until all sanding and grinding activities are complete to protect them from accumulating dust and debris.

C. Prior to ordering, measure actual duct size as installed in field and provide to vendor.

D. Mount transmitter at eye level. Measure distance from probe to transmitter and order wire whip of sufficient length to reach. Install probe wire whip in conduit of sufficient size for connector to pass through.

3.06 THERMOSTATS

A. Install Freezestat/Low-Limit Duct Thermostat (LTD) in ducts and plenums in a serpentine manner horizontally (not vertically) across duct. Support each bend with a capillary clip. Provide rows at 12 inch spacing; the element covers a maximum of 6 inches above and below sensing element. At the bottom of the duct or plenum, the row with the tail end of the sensing element shall be a maximum of 6 inches from the bottom.

3.07 WATER FLOW AND BTU METER INSTALLATION

A. Install water flow meters in locations indicated to perform the Sequences of Operation. Install water flow meter in accordance with the manufacturer's recommendations.

B. Do not install AFMS sensors and probes until all sanding and grinding activities are complete to protect them from accumulating dust and debris.

C. Prior to ordering, measure actual pipe size and verify furnished material as installed in field and provide to vendor.

D. Mount transmitter at eye level. Measure distance from probe to transmitter and order wire whip of sufficient length to reach. Install probe wire whip in conduit of sufficient size for connector to pass through.

E. Provide installation kit (i.e., threadolet, nipple/standoff, pipe tee, isolation valve, etc) to Mechanical Contractor for installation. Kit will be specific to the application. Installation accessories which are not provided by the vendor will not be acceptable.

3.08 RELAYS

A. Nipple-mount relays will be mounted at a location where pilot light is visible from floor.

3.09 VALVES, DAMPERS, AND ELECTRONIC ACTUATORS INSTALLATION

A. Wire parallel actuators according to manufacturer's recommendations.

B. Dampers and Damper Actuators
   1. Install automatic dampers according to Division 23.
   2. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation.
   3. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately the 5° open position, manually close the damper, and then tighten linkage.
   4. Provide necessary mounting hardware and linkages for actuator installation.
   5. Install damper motors on outside of duct in climate controlled areas, including mechanical rooms. Provide sufficient standoff/offset of damper actuator from ductwork to allow for insulation behind actuator.
   6. Where clearance cannot be maintained, locations exposed to outdoor temperatures, or actuator is inside ductwork, provide 12 inch by 12 inch access door per specifications for any actuator inside of ductwork.

C. Control Valves and Valve Actuators
   1. Provide sufficient standoff/offset of valve actuator from piping to allow for insulation of valve.
   2. PIC Valves
      a. Where not provided from the factory, install pressure/temperature test ports (Pete’s Plugs) for testing of pressure differential across the PIC valve.
      b. For PIC valves with electronic flow metering, coordinate with mechanical contractor to ensure 5 pipe diameters of straight pipe entering valve.

3.10 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of control system for one year from Date of Substantial Completion.

C. Provide complete service of controls systems, including call backs, and submit written report of each service call.

D. In addition to normal service calls, make minimum of 4 complete normal inspections of approximately 4 hours duration to inspect, calibrate, and adjust controls.

END OF SECTION 230910

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SECTION 230934
VARIABLE TORQUE AC DRIVE CONTROLLERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. IEC 61800-3 - Adjustable Speed Electrical Power Drive Systems - Part3: EMC Requirements and Specific Test Methods for PDS and Machine Tools; 2022.

B. IEEE 519 - IEEE Standard for Harmonic Control in Electric Power Systems; 2022.

1.02 WORK INCLUDED

A. Variable Frequency Drives (VFD).

B. Furnish all labor, materials, equipment and service to perform all operations required for the complete installation and related work as required in all contract documents.

1.03 SUBMITTALS

A. Submit manufacturer's product data, shop drawings, and installation instructions in accordance with the general conditions.

B. Contract Closeout Reports.

C. Operation and Maintenance Data.

D. Contract Closeout Reports.

1.04 QUALITY ASSURANCE

A. The VFD manufacturer shall furnish a Variable Frequency drive that is compatible with motor meeting NEMA MG1 part 31.

B. The manufacturer of the VFD described in this specification shall have a minimum of twenty (20) years experience in the design, construction and application of adjustable frequency drives.

C. The VFD manufacturer shall perform, but not be limited to, the following quality assurance controls, procedures and tests to insure VFD performance of ALL manufactured VFD controllers:
   1. Circuit Testing:
      a. All circuits are pre-burned tested for in-circuit component parameters and functional performance.
      b. All burned-in circuits are tested for functional performance post-burn.
   2. Hipot Testing:
      a. Post-assembly, all drives are subjected to high potential testing at 2,500 VAC, for 1 second.
   3. Drive Setup and Functional Tests:
      a. SET-UP: the following VFD variables are factory set prior to shipping:
         1) Acceleration ramp
         2) Deceleration ramp
         3) MIN and MAX Speed
         4) Current limit
      b. FINAL TEST: the following VFD functional checks are made and verified prior to shipping:
         1) Fault and Function-loss circuit operation
         2) Auto-reset function
         3) Load test using an actual motor at full speed
         4) Hand/off/auto operation

1.05 CODES AND STANDARDS

A. Referenced Standards and Guidelines:
   1. Institute of Electrical and Electronic Engineers (IEEE)
      a. IEEE 519-2014, Guide for Harmonic Content and Control.
   2. Underwriters Laboratories (as appropriate)
      a. UL508
      b. UL508A
      c. UL508C
   3. National Electrical Manufacturer's Association (NEMA)
      a. ICS 7.0, AC Adjustable Speed Drives
   4. International Electrotechnical Commission (IEC)
      a. EN/IEC 61800-3
   5. National Electric Code (NEC)
      a. NEC 430.120, Adjustable-Speed Drive Systems
   6. International Building Code (IBC)
      a. IBC 2012 Seismic – referencing ASC 7-05 and ICC AC-156

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Alternate manufacturer's requests must be submitted in writing to the Engineer for approval at least 20 working days prior to bid. Approval does not relieve the supplier of specification requirements.
   1. ABB (ACH Series) (Basis of Design)
   2. Yaskawa (Z1000 Series)
   3. Square-D (E-Flex Series)

2.02 GENERAL

A. The VFD shall provide full rated output from a line of ±10% of nominal voltage. The VFD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage.
   1. VFDs shall be capable of continuous full load operation under the following environmental operating conditions:
      a. -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VFD full load current.
      b. Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VFD full load current.
      c. Humidity less than 95%, non-condensing.
   2. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
   3. VFD's shall consist of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design induction motor.
   4. Motors mounted more than 100 feet from the motor require output filtering. Both Drive and Motor shall comply with NEMA MG1 section 30.40.4.2 which specifies the limits of peak maximum voltage.

2.03 DRIVE FUNCTION

A. All VFDs shall have the following standard features:
   1. All circuit boards shall be coated to protect against corrosion.
   2. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand"

and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.

4. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VFD protection shall be based on thermal sensing and not cooling fan operation.
5. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
6. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

B. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). Keypad shall digitally indicate:
   1. Frequency output
   2. Voltage output
   3. Current output
   4. Motor RPM
   5. Input kW
   6. Elapsed Time
   7. Time Stamped Fault Indication
   8. DC Bus Voltage

C. Serial Communications:
   1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, and BACnet.

2.04 PROTECTIVE FEATURES:

A. VFDs shall have 5% impedance from dual (positive and negative) DC bus chokes, or 5% AC line reactors. VFD’s with only one DC choke are not acceptable.

B. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV’s shall have a minimum 125 joule rating per phase across the diode bridge. VFDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).

C. EMI / RFI filters. All VFD’s shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2) with up to 100 feet of motor cable.

D. The VFD shall include the following protective circuits and features:
   1. Motor current exceeds 200% of drive continuous current rating.
   2. Output phase-to-phase short circuit condition.
   3. Total ground fault under any operating condition.
   4. High input line voltage.
   5. Low input line voltage.
   6. Loss of input or output phase.
   7. External fault. (This protective circuit shall permit wiring of remote N.C. safety contact to shut down the drive). User supplied end switches, thermal switches, fire-stats, freeze-stats inputs will be connected to this VFD supplied circuit.

2.05 GENERAL OPTIONS AND MODIFICATIONS

A. The following options shall be included as specified:

1. VFDs and options shall be UL508 listed as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR without the need for external input fuses.
2. A main input disconnect shall mount within the standard UL Type 1 enclosure for positive power disconnect of the VFD. It shall have the capability for door padlocking.
3. At minimum VFDs shall have 5% impedance from dual (positive and negative) DC bus chokes, or 5% AC line reactors. Add additional filtering as required to meet IEEE519-2014. A computer aided analysis should be performed by the contractor prior to submissions to show compliance with IEEE519-2014.

PART 2 EXECUTION

3.01 INSTALLATION

A. VFD’s shall be furnished and programmed by the MC.

B. Provide inspection by manufacturer's athorized representative.

C. The VFD manufacturer shall maintain and staff local service engineers and must maintain a reasonable supply of spare parts for the VFD's to meet ordinary repair requirements within 100 miles of the installation site. Warehousing of spare parts shall be open to the Engineer for observation.

D. The manufacturer of the equipment provided shall warrant his equipment against defects in workmanship and parts failure for 30-months from date of start-up. This warranty shall cover all parts, labor and travel related expenses.

E. The contractor shall utilize the field bus for serial communication between the Variable Frequency Drive (VFD) and the Building Management System (BMS).

END OF SECTION 230934

SECTION 231126
FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for propane gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 312316 - Excavation.

B. Section 312316.13 - Trenching.

C. Section 312323 - Fill.

1.03 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2011 (Addendum A, 2012).

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B31.1 - Power Piping; 2024.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

G. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

H. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

J. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

K. NFPA 58 - Liquefied Petroleum Gas Code; 2020, with Amendment.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.01 PROPANE GAS PIPING, BURIED

A. Polyethylene Pipe: ASTM D2513, SDR 11.
   1. Fittings: ASTM D2683 or ASTM D2513 socket type.
   2. Joints: Fusion welded.

2.02 PROPANE GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 58, threaded or welded to ASME B31.1.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

2.05 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, ductile iron, or brass body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, grooved, or Threaded ends with union.

2.06 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:
   1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
   2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

B. Materials in Contact With Gas:
   1. Housing: Aluminum, steel (free of non-ferrous metals).
   2. Seals and Diaphragms: NBR-based rubber.

C. Maximum Inlet Operating Pressure: 10 psi.
   1. Appliance Regulator: 10 psi.
   2. Line Pressure Regulator: 10 psi.

D. Maximum Body Pressure: 10 psi.

E. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 231126

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.
B. Heating water piping, above grade.
C. Chilled water piping, buried.
D. Chilled water piping, above grade.
E. Equipment condensatedrains and overflows.
F. Pipe hangers and supports.
G. Unions, flanges, mechanical couplings, and dielectric connections.

1.02 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
D. ASME B31.9 - Building Services Piping; 2020.
E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.
G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).
I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
K. ASTM B32 - Standard Specification for Solder Metal; 2020.
L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
N. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018.
O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
P. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
Q. AWWA C606 - Grooved and Shouldered Joints; 2022.
R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.03 SUBMITTALS

A. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.

2. Provide manufacturers catalog information.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
         1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
         2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
      c. Use rigid joints unless otherwise indicated.
      d. Use gaskets of molded synthetic rubber with central cavity, pressure-responsive configuration, and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
      e. Provide steel coupling nuts and bolts complying with ASTM A183.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
   1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
   2. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
   3. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER[<>] PIPING, ABOVE GRADE

A. Steel Pipe: NPS 2-1/2" and Greater, ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.Threaded Joints: ASME B16.3, malleable iron fittings.Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.Steel Pipe Sizes 12 Inches and Greater: ASTM A53/A53M, 3/8 inch wall, black, using one of the following joint types:
2. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
3. Threaded Joints: ASTM A536 ductile iron fittings.
4. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: NPS 2" and Smaller, ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: NPS 2-1/2" and Greater, ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: NPS 2" and Smaller, ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

2.04 CHILLED WATER PIPING, BURIED

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
1. Fittings: ASTM A234/A234M, wrought steel welding type with double layer, half-lapped polyethylene tape.
2. Joints: Welded in accordance with AWS D1.1/D1.1M.
3. Casing: Closed glass cell insulation.

2.05 EQUIPMENT CONDENSATE DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
12. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
13. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

C. Rooftop Supports for Low-Slope Roofs and Attic Roof: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
1. Bases: High-density polypropylene.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
5. Height: Provide minimum clearance of 12 inches under pipe to top of roofing.

2.07 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
1. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Gaskets: 1/16 inch thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Housing Material: Ductile iron, galvanized complying with ASTM A536.
2. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
3. Manufacturers:
a. Apollo Valves; _____: www.apollovalves.com/#sle.
b. Grinnell Products; _____: www.grinnell.com/#sle.
c. Victaulic Company; _____: www.victaulic.com/#sle.

D. Dielectric Connections:
1. Waterways:
2. Flanges:
3. Unions:

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified _____.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.

I. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

M. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.
   1. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   2. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   3. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
   4. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

5. 8 Inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

3.04 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
   4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
   5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
   1. Procedures in subparagraphs below are paraphrased from ASME B31.9.
   2. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
   3. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
   4. Isolate expansion tanks and determine that hydronic system is full of water.
   5. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure (minimum 100psi, duration 15min). Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
   6. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
   7. Prepare written report of testing.

C. Perform the following before operating the system:
   1. Open manual valves fully.
   2. Inspect pumps for proper rotation.
   3. Set makeup pressure-reducing valves for required system pressure.
   4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
   5. Set temperature controls so all coils are calling for full flow.
   6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
   7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air and dirt separators.

D. Strainers.

E. Suction diffusers.

F. Pump connectors.

G. Pressure-temperature test plugs.

H. Relief valves.

I. Automatic Flow Limiting Valves

1.02 REFERENCE STANDARDS

A. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.03 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 EXPANSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   3. Taco, Inc: www.taco-hvac.com/#sle.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible

EPDM bladder sealed into tank, and steel support stand.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.02 AIR VENTS

A. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

2.03 AIR AND DIRT SEPARATORS

A. Manufacturers:
1. Taco, Inc; 4900 (size and capacity as called for on plans)
2. Bell and Gossett
3. Armstrong

B. Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F. Manufacturer shall be holder of ASME U stamp. Manufacturer to have optional 250 psi and 150 psi ASME units available.

C. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units four 4-inch and larger shall be provided with flanged system connections as standard. Inlet and outlet connections to be inline with piping system. Both inlet and outlet to be in the same horizontal and vertical planes.

D. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.

E. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.

F. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½” and smaller the valve and all of its fittings shall be 1”. On units three 3” and larger the valve and all openings shall be 2”.

G. The air and dirt removal device shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less.

H. The unit manufacturer shall provide the owner and design engineer third party independent test data certifying that their unit performs to the above standards. Suppliers not providing these independent performance test results will not be acceptable.

I. The air and dirt separator shall employ the use of high surface area pall rings to achieve optimal separation of air and dirt with minimal pressure drop. The pall rings shall be made of stainless steel. Stainless steel will be the only acceptable material used for suppressing turbulence and increasing surface area for high efficiency air and dirt removal. Inferior materials of construction such as copper for the straining medium will not be acceptable.

J. J. Manufacturer must have at least 15 years of experience with microbubble coalescing and dirt

1. removal technology.

2.04 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Grinnell Products: www.grinnell.com/#sle.

B. Size 2 inch and Under:
   1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
   1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch or 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
   1. Provide flanged or grooved iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.05 SUCTION DIFFUSERS

A. Manufacturers:
   1. Grinnell Products: www.grinnell.com/#sle.
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   3. Victaulic Company of America: www.victaulic.com/#sle.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh startup screen, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.06 PUMP CONNECTORS

A. Manufacturers:
   1. Anvil International; AnviFlex: www.anvilintl.com/#sle.
   2. Ferguson Enterprises Inc: www.fnw.com/#sle.
   3. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
   2. Accommodate the Following:
      a. Axial Deflection in Compression and Expansion: _____ inch.
      b. Lateral Movement: _____ inch.
      c. Angular Rotation: 15 degrees.
      d. Force developed by 1.5 times specified maximum allowable operating pressure.
   3. End Connections: Same as specified for pipe jointing.
   4. Provide necessary accessories including, but not limited to, swivel joints.

2.07 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. Ferguson Enterprises Inc: www.fnw.com/#sle.
   2. Peterson Equipment Company Inc: www.petesplug.com/#sle.
   3. Sisco Manufacturing Company Inc: www.siscomfg.com/#sle.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.08 RELIEF VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Armstrong International, Inc: www.armstronginternational.com/#sle.
   3. ITT Bell & Gossett: www.bellgossett.com/#sle.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.09 AUTOMATIC FLOW LIMITING VALVES

A. Manufacturers:
   1. Griswold Controls LLC; Isolator R Valve: www.griswoldcontrols.com/#sle.
   2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.

B. Size 0.50 inch to 14 inch:
   1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
   2. Metal construction materials consist of bronze or brass.
   3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch to 24 inch:
   1. Comply with ASME B16.5.
   2. Class: 150.
   3. Provide ball, globe, butterfly, or wafer style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
   4. Valve body construction materials consist of cast iron, carbon steel, ductile iron, or gray iron.
   5. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. Provide manual air vents in ceiling spaces and other concealed location

D. Provide automatic air vents in exposed locations and in mechanical rooms.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blowdown connection.

G. Provide pump suction fitting on suction side of base-mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H. Support pump fittings with floor-mounted pipe and flange supports.

I. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Pipe relief valve outlet to nearest floor drain.

END OF SECTION 232114

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SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Separately coupled, vertically mounted, in-line centrifugal pumps.

1.02 RELATED REQUIREMENTS

A. Section 230513 - Common Motor Requirements for HVAC Equipment-CPL.

B. Section 230716 - HVAC Equipment Insulation.

C. Section 230923 - Direct-Digital Control System for HVAC.

D. Section 230934 - Variable-Frequency Motor Controllers.

E. Section 232113 - Hydronic Piping.

F. Section 232114 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Seal Kit: one mechanical seal kit for each pump.
   3. Bearings.
   4. Gaskets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Taco Comfort Solutions; KS Series: www.tacocomfort.com

B. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.

C. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.

2.02 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Source Limitations: Obtain pumps from single source from single manufacturer.Base Mounted Pumps: Aligned by qualified millwright.

C. Electrical Requirements:
   1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.
   2. Variable Frequency Drives (VFDs): Provide in accordance with Section 230934, except for integral-VFDs.

2.03 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, API 610-OH4-type, overhung-impeller, separately coupled, in-line pump as defined in HI 14.1, HI 14.2 and HI 14.3; designed for installation with pump and motor shafts mounted vertically.

B. Pump Construction:
   1. Casing: Radially split, ASTM A48/A48M, cast iron, with replaceable bronze wear rings, drain plug at bottom, threaded gauge tappings at inlet and outlet, and flanged connections.
   2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps that are not variable-frequency-drive controlled, trim impeller to match specified performance.
   3. Pump Shaft: Type 416 stainless steel.
   4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and NBR bellows and gasket.

C. Shaft Coupling: Rigid, aluminum alloy 6061-T6, capable of absorbing vibration.

D. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Enclosure: Open, drip proof.
   2. NEMA Premium Efficient motors as defined in NEMA MG 1.
   3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
   5. Variable-frequency motor.
   6. Provide integral pump motor variable- frequency controller.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

D. Provide air cock and drain connection on horizontal pump casings.

E. Lubricate pumps before start-up.

F. Controls: Interface each pump starter or VFD with HVAC controller; see Section 230923.

END OF SECTION 232123

SECTION 232123
SELF-SENSING HYDRONIC PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Variable Speed Pump Package
   1. Vertical Inline Pump
   2. Variable Frequency Drives
   3. TEFC motor
   4. Integral Controls Platform

1.02 REFERENCE STANDARDS

A. ANSI - American National Standards Institute; 2020.

B. ASTM - Ameican Society for Testing and Materials; Current.

C. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.

1.03 REFERENCES

A. HI – The Hydraulic Institute ANSI – American National Standards Institute

B. NEMA – National Electrical Manufacturers Association

C. Underwriters Laboratories, Inc.

D. ETL – Electrical Testing Laboratories

E. CSA – Canadian Standards Association

F. NEC – National Electrical Code

G. ISO – International Standards Organization

H. IEC – International Electrochemical Commission

I. IEEE – Institute of Electrical and Electronic Engineers

1.04 SUBMITTALS

A. Submittals shall include the following:
   1. System summary sheet
   2. Sequence of operation
   3. Shop drawing indicating dimensions, required clearances and location and size of each field connection.
   4. Power and control wiring diagrams
   5. System profile analysis including variable speed pump curves and system curve. The analysis shall also include job specific load profile and staging points.
      a. Submittals must be specific to this project. Generic submittals will not be accepted.

1.05 QUALITY ASSURANCE

A. The pump control package shall be fully assembled by the manufacturer. The manufacturer shall be responsible for the complete pump control package, including system interface with pumps and VFDs, as well as the successful operation of all components supplied by the pump control system manufacturer.

B. All functions of the variable speed pump control system shall be thoroughly field tested prior to actual start-up. This test shall be conducted with motors connected to AFD output and it shall test all inputs, outputs and program execution specific to this application.

C. Pump control package shall be listed by Underwriter’s Laboratories and bear the UL label.

1.06 DELIVERY STORAGE AND HANDLING

A. Delivery and Requirements:
   1. Deliver material in accordance with Section 01 61 00 Common Product Requirements.
   2. Deliver materials and components in manufacturer's original packaging with identification labels intact and in sizes to suit project.
   3. Include manufacturer's name, job number, pump location, and pump model and series numbers on identification labels.

B. Storage and Handling Requirements:
   1. Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer. Storage must be weather tight, rain proof, and dust proof.
   2. Exercise care to avoid damage during unloading and storing.
   3. Leave pump port protection plates in place until pumps are ready to connect to piping.
   4. Do not place cable slings around pump shaft or integrated control enclosure.
   5. Once installed the contractor must keep a dust proof cover over the drive, motor, and integral controller.

1.07 MAINTENANCE MATERIALS

A. Furnish spare parts that match products installed and that are packaged with protective covering for storage and identified withlabels describing contents.
   1. Seal kit: One mechanical seal kit for each pump.
   2. Bearings
   3. Gaskets

1.08 WARRANTY

A. Manufacturer's warranty: The entire package shall carry an 18-month parts warranty. The drive will carry a parts and labor warranty. The motor will carry a 12-month parts and labor warranty but must be delivered to a local authorized motor warranty shop by the installing contractor. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:
   1. Taco, Inc. – SKV/SKS Self-Sensing Series with ProBalance.
   2. Bell and Gossett
   3. Armstrong

2.02 MANUFACTURED UNITS

A. The self-sensing product shall consist of a factory prepackaged and preprogrammed pump, drive, motor, and integral controls package.

B. The drive shall be mounted and integral to the motor. It shall be mounted with rubber vibration mounts. The mounting and packing of the drive shall be done in a manner that transmitted acceleration levels will be three times below the allowable limits published by the drive manufacturer. These limits will apply to a frequency range of 0-10,000 HZ.

C. The performance speed of this package shall 1750 RPM nominal as standard. Exceptions for 3600 RPM will be noted in the schedules. 3600 RPM shall NOT be an allowable substitution for a specified 1750 PRM package. 3600 RPM products might be considered as a substitution for 1750 RPM only if that manufacturer provides a spare motor, drive, and seal for each pumping unit.

D. Pump logic controller, variable frequency drives, sensor/transmitters and related equipment shall be installed by the mechanical contractor as shown on the plans.

2.03 COMPONENTS

A. Pump Logic Controller.
   1. The controller operation shall operate the system using a tested and proven program that safeguards against undesirable or damaging conditions including:
      a. Motor overload
      b. Pump flow surges
      c. Hydraulic cycling (hunting).
      d. End of curve unstable operation: The pump logic controller, through a factory pre-programmed algorithm, shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires a flow meter for activation. The operator interface shall include an owner adjustable flow setpoint to set the parameters for this routine.
   2. The pump logic controller shall be capable of starting, unloading, and stopping pumps based on a system performance program that will minimize energy consumption, provide reliable performance and bumpless transitions.
   3. The integrated logic controller shall be capable of running four different hydronic optimization sub-routines:
      a. Setup one: This subroutine shall allow the pump package to track a quadratic system curve and will optimize a secondary distribution loop. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
      b. Setup two: This subroutine shall allow two pumps to run as backup for each other and shall alternate the pumps based on a real time clock.
      c. Setup three: This subroutine shall allow the package to run in a customer defined flow rate. The package will always seek to run at the user defined flow even with fouling causing system changes. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
      d. Setup four: This subroutine shall incorporate a traditional external sensing and control platform. It shall allow the option of controlling the pumps with three zones of differential pressure or central plant differential temperature. This optional setup shall allow the owner the option of external sensing without adding an external controller. This feature shall be equal to Taco System Logic (TSL) or equal.
   4. The control platform shall include a subroutine equal to the Taco Self-Sensing Series with ProBalance™. This subroutine shall allow for the automatic balancing of secondary system distribution pumps. The package shall automatically run system distribution pumps to a user defined duty point and will recognize that duty point and hold the pumps at a speed that matches the actual installed system quadratic system curve. The package will then use this data to set up a new duty point as the max point for the quadratic control curve. Use of external balancing devices or contractors will not be needed.
   5. The package shall serve as a flow metering device and will display pump flow at the user interface.
   6. Shall have optional ProView controller that automates pump balancing.

B. PUMPS (See pump schedule on plans for exact model, type, and duty points.)
   1. Vertical Split Coupled Pumps. above 10 HP to a max of 700 HP shall be split coupled.
      a. Pumps shall be Taco Model SKS or approved equal. The pumps shall be single stage vertical inline design. The seal shall be serviceable without disturbing the piping connections. The capacities and characteristics shall be as called for in the plans/schedules.

b. Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.
c. All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided to allow servicing.
d. The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
e. The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.
f. The pump shall be manufactured with AISI 416 Stainless Steel shaft.
g. The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250ºF. The mechanical seal shall be an inside type seal yet engineered and applied in a manner that is as or more accessible than a specialty outside seal. This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. The entire pump line shall use no more than three different sizes of seals. Outside mechanical seals are NOT acceptable.
h. The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without removal of the motor. The motor mount must be designed to accept several different motor frame standards; CZ and HP. The motor shall be a TEFC, inverter rated motor with class F insulation and shaft grounding ring.
i. In order to both simplify and reduce the total cost of ownership; the manufacturer shall standardize on no more than three sizes of mechanical seals throughout the entire range of the family of pumps. The manufacturer shall not use multiple part numbers for the same part.

C. VARIABLE FREQUENCY DRIVES
1. The VFD shall convert incoming fixed frequency three-phase ac power into an adjustable frequency and voltage for controlling the speed of three-phase ac motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
2. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
3. The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the dc bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with

saturating (non-linear) dc link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

4. The VFD's full load output current rating shall meet or exceed NEC table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
5. The VFD shall provide full motor torque at any selected frequency from 20 hz to base speed while providing a variable torque v/hz output at reduced speed. This is to allow driving direct drive fans without high-speed derating or low speed excessive magnetization, as would occur if a constant torque v/hz curve was used at reduced speeds. Breakaway current of 160% shall be available.
6. A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.
7. VFD must be able to produce full torque at low speed to operate direct drive fans.
8. Output power circuit switching shall be accomplished without interlocks or damage to the VFD.
9. An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.
10. Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog i/o and discrete digital i/o shall include additional isolation modules.
11. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
12. All VFDs shall contain integral EMI filters to attenuate radio frequency interference conducted to the ac power line.
13. The drive enclosure shall be standard as NEMA 12 (IP 55) and optional shall be NEMA 4X (IP 66). See schedules for project requirements.
14. Protective features:
    a. A minimum of class 20 i2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
    b. Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
    c. Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
    d. Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
    e. Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

f. The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.
g. VFD shall include a “signal loss detection” algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.
h. VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.
i. VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.
j. Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.
k. VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
l. If the temperature of the VFD’s heat sink rises to 80°c, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD’s temperature becomes too high.
m. In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output
n. current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
o. The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
p. The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
q. When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

15. Internal Control Algorithm
    a. This is a standard HVAC drive that has been upgraded and modified by pump experts for Hydronic applications. It is set up with a closed loop internal control sequence that will optimize life cycle, system comfort, and minimize energy consumption.
16. Interface Features
    a. Hand, off and auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
    b. There shall be an “info” key on the keypad. The info key shall include “on-line” context sensitive assistance for programming and troubleshooting.
    c. The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in hand or auto mode. This is to alert the building automation system whether the VFD is being controlled locally or by the building automation system.
    d. Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.
    e. All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.

f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.
g. Display shall be programmable to communicate in multiple languages including English, Spanish and French.
h. A red fault light, a yellow warning light and a green power-on light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
i. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual fan, pump, and compressor menus specifically designed to facilitate start-up of these applications.
j. A four-feedback PID controller to control the speed of the VFD shall be standard. This controller shall accept up to four feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.
k. The VFD shall be able to apply individual scaling to each feedback signal.
l. For fan flow tracking applications, the VFD shall be able to calculate the square root of any or all individual feedback signals so that a pressure sensor can be used to measure air flow.
m. The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.
n. The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.
o. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
p. Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.
q. Programmable sleep mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into sleep mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.
r. A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.
s. VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°f).
t. VFD shall be programmable to sense the loss of load and signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

17. Standard Control and Monitoring Inputs and Outputs
    a. Six dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
    b. Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.
    c. Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.
    d. Each relay shall have an adjustable on delay / off delay time.
    e. Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.
    f. Each shall be independently selectable to be used with either an analog voltage or current signal.
    g. The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
    h. A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
    i. The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,
    j. One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
    k. It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
    l. It shall be possible to command all digital and analog output through the serial communication bus.
18. Optional Control and Monitoring Inputs and Outputs
    a. It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.
    b. These modules shall use rigid connectors to plug into the VFD’s control card.
    c. The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the
    d. module.
    e. Modules may include such items as:
    f. Additional digital outputs, including relay outputs
    g. Additional digital inputs
    h. Additional analog outputs
    i. Additional analog inputs, including Ni or Pt temperature sensor inputs
    j. It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.
19. Standard programmable firefighter’s override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display firemode whenever in firefighter’s override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.
20. A real-time clock shall be an integral part of the VFD.
21. It shall be possible to use this to display the current date and time on the VFD’s display.
22. Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. Is shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall

provide free PC- based software to set up the calendar for this schedule.

23. All VFD faults shall be time stamped to aid troubleshooting.
24. It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.
25. The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.
26. The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.
27. The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:
    a. Comparators for comparing VFD analog values to programmed trigger values
    b. Logic operators to combine up to three logic expressions using Boolean algebra
    c. Delay timers
    d. A 20-step programmable structure
28. The VFD shall include a cascade controller which allows the VFD to operate in closed loop setpoint (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.
29. Serial communications
    a. The VFD shall include a standard eia-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:
        1) Johnson Controls Metasys N2
            (a) Modbus RTU
            (b) Siemens FLN
            (c) BACnet MS/TP
        2) Optional communication shall include:
            (a) LonWorks Free Topology (FTP)
    b. VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge pc software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system. The VFD shall have provisions for an optional 24 v DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.
30. Adjustments
    a. The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 khz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.
    b. Four independent setups shall be provided.
    c. Four preset speeds per setup shall be provided for a total of 16.
    d. Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.
    e. Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.
    f. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.

g. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
h. An automatic “start delay” may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.
i. Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

31. Optional features
    a. All optional features shall be built and mounted by VFD manufacturer. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.
    b. All panels shall be marked for their short circuit current rating in compliance with UL.
32. Service conditions
    a. Ambient temperature, continuous, full speed, full load operation:
    b. -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
    c. -10 to 40°C (14 to 104°F) 150 HP and larger
    d. 0 to 95% relative humidity, non-condensing.
    e. Elevation to 3,300 feet without derating.
    f. AC line voltage variation, -10 to +10% of nominal with full output. No side clearance shall be required for cooling.
    g. All power and control wiring shall be done from the bottom.
    h. All VFDs shall be plenum rated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer’s instructions and all applicable codes.

B. Ensure that pump is pipe-mounted and free to float with any movement, expansion and contraction of piping system.

C. Support pump using floor mounted saddle as required.

D. For vertical in-line pumps supported from structure, ensure no pipe strain is imposed on pump flanges.

E. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer’s instructions and all applicable codes.

F. Control wiring for remote mounted switches and sensor/transmitters shall be the responsibility of the controls contractor. All wiring shall be performed per manufacturer’s instructions and all applicable codes.

3.02 DEMONSTRATION

A. The control package manufacturer’s factory trained representative shall provide start-up of the packaged pumping system. This start-up shall include verification of proper installation, system initiation, adjustment and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the Owner or Owner’s designated representative. This jobsite visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer’s start-up request form.

B. The pump control package manufacturer’s factory trained representative shall provide on-site training for owner’s personnel. This training shall fully cover maintenance and operation of all system components.

END OF SECTION 232123

SECTION 232513
WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes water treatment for closed-loop hydronic systems.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Pretreatment and chemical-treatment equipment, showing tanks, maintenance space required, and piping connections to hydronic systems.

1.03 INFORMATIONAL SUBMITTALS

A. Water-Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.

B. Field quality-control reports.

C. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.

D. Water Analysis: Illustrate water quality available at Project site.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider, capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

PART 2 PRODUCTS

2.01 HVAC WATER-TREATMENT MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Anderson Chemical Company.
   2. Aqua-Chem, Inc.
   3. Barclay Water Management, Inc.
   4. Boland Trane Services.
   5. Cascade Water Services, Inc.

2.02 PERFORMANCE REQUIREMENTS

A. Provide all hardware, chemicals, and other material necessary to maintain HVAC water quality in all systems, as indicated in this Specification. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

2.03 MANUAL CHEMICAL-FEED EQUIPMENT

A. Description
   1. A full slipstream filtration device that incorporates a shot feeder, magnetic filter and cartridge filter all in one device.

2. The product shall be all stainless-steel construction including all valves and fittings. Maximum working pressure shall be 150psi with flow rates up to 6.3 Gal/min with a temperature range of 32 to 200F. Dosing capacity shall be a minimum of 1.18 Gallons and Cartridge Filtration range to be no less than 100 to 0.5µ. Magnetic filtration shall consist of no less than four (4) rare earth magnets designed for easy removal and cleaning. Unit to include an automatic air vent. The product must be provided with ½" isolation and drain valves and an insulation jacket. The product must be provided with self-supporting wall-mounting brackets.
3. Provide automatic flow control valve set to the manufacturer's recommended flow.
4. Spare Parts
    a. The product shall be furnished with a quantity of one (1), 100µ, start-up filter.

2.04 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer, compatible with piping system components and connected equipment, and able to attain water quality specified in "Performance Requirements" Article.

PART 3 EXECUTION

3.01 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.02 INSTALLATION

A. Install chemical-application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate. Install all chemical application equipment within a spill-containment area without floor drain.

B. Bypass Feeders: Install in closed hydronic systems and equip with the following:
    a. Install bypass feeder in a bypass circuit around circulating pumps unless indicated otherwise on Drawings.
    b. Install a isolation valves on inlet, outlet, and drain below the feeder inlet.
    c. Install a swing check on the inlet after the isolation valve.

3.03 PIPING CONNECTIONS

A. Piping installation requirement are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings.

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:
1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing

chemicals for water-treatment system.

3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials, and retest piping until no leaks exist.

F. Equipment will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis, advising Owner of changes necessary to adhere to "Performance Requirements" Article.

I. Comply with ASTM D3370 and with the following standards:
1. Silica: ASTM D859.
2. Acidity and Alkalinity: ASTM D1067.
3. Iron: ASTM D1068.
4. Water Hardness: ASTM D1126.

3.05 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above, to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:
1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 232513

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SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Ducts for kitchen exhaust applications.

D. Casings and plenums.

E. Duct cleaning.

1.02 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

M. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

O. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

P. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for _____ pressure class and higher systems.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum ___ years of documented experience.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Seal Class: B

B. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

C. Ducts: Galvanized steel, unless otherwise indicated.

D. Low Pressure Supply (Heating Systems): 2 inch wg pressure class, galvanized steel.

E. Low Pressure Supply (System with Cooling Coils): 2 inch wg pressure class, galvanized steel.

F. Return and Relief: 2 inch wg pressure class, galvanized steel.

G. General Exhaust: 1 inch wg pressure class, galvanized steel.

H. Outside Air Intake: 1/2 inch wg pressure class, galvanized steel.

I. Combustion Air: 1/2 inch wg pressure class, galvanized steel.

J. Transfer Air and Sound Boots: 1/2 inch wg pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   4. Manufacturers:
      a. Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.
      b. Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Zero VOC, Premium Quality: www.designpoly.com/#sle.
      c. Ductmate Industries, Inc, a DMI Company; _____: www.ductmate.com/#sle.

C. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

C. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 FLEXIBLE DUCTS

A. Flexible Air Ducts with Rip-Resistant Scrim:
   1. UL 181, Class 1, aluminum laminate and polyester vapor barrier with rip-resistant scrim reinforcement supported by helically wound spring steel wire.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: From 10 in-wc to 0.5 in-wc negative.
   4. Maximum Velocity: 4,000 fpm.
   5. Temperature Range: Minus 20 to 175 degrees F.

2.05 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:
   1. Duct Size: 1/2 in-wc pressure class stainless steel.
   2. Fabricate using single wall, 20-gauge, 0.035-inch Type 304 stainless steel with external welded joints.
   3. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

F. Kitchen Hood and Grease Exhaust Duct:
   1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
   2. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
      a. UL Listed and labeled to UL 1978.
      b. Construct of 18-gauge, 0.050-inch stainless steel using continuous external welded joints in rectangular sections.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with adhesive.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect diffusers to low pressure ducts directly or with 3 feet maximum length of flexible duct held in place with strap or clamp.

K. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 233300, 233600, and 233700.

L. Duct Insulation: Provide duct insulation. See Section 230713.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION 233100

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Combination fire and smoke dampers.
C. Duct access doors.
D. Duct test holes.
E. Fire dampers.
F. Flexible duct connectors.
G. Volume control dampers.

1.02 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
B. NFPA 92 - Standard for Smoke Control Systems; 2021.
C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. Extra Fusible Links: One of each type and size.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
    1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
    2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
    3. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com/#sle.
    4. Ruskin Company: www.ruskin.com/#sle.
    5. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.
    6. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Greenheck
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ductmate Industries, Inc, a DMI Company; _____: www.ductmate.com/#sle.
   2. Elgen Manufacturing Company, Inc; _____: www.elgenmfg.com/#sle.
   3. Nailor Industries, Inc; _____: www.nailor.com/#sle.
   4. Ruskin Company; _____: www.ruskin.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FIRE DAMPERS

A. Manufacturers:
   1. Lloyd Industries, Inc: www.firedamper.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. United Enertech: www.unitedenertech.com/#sle.
   5. Ward Industries, a brand of Hart and Cooley, Inc; _____: www.wardind.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Horizontal Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

D. Maximum Installed Length: 4 inch.

2.07 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. United Enertech: www.unitedenertech.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gauge, 0.0239 inch, minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide fire dampers and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct

connections, corrosion resistant springs, bearings, bushings and hinges.

E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

C. Inline centrifugal fans and blowers.

D. Kitchen hood upblast roof exhausters.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

I. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fan roof curbs and service utilities installation according to fan size.

B. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Manufacturers:
   1. Greenheck Fan Corporation: www.greenheck.com/#sle.
   2. Loren Cook
   3. Approved Equal

B. Static and Dynamically Balanced: Comply with AMCA 204.

C. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

D. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

E. Fabrication: Comply with AMCA 99.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

A. Manufacturers:
   1. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
   2. Greenheck Fan Corporation: www.greenheck.com/#sle.
   3. Twin City Fan & Blower; BCRD: www.tcf.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

D. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

E. Backdraft Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 CEILING EXHAUST FANS

A. Construction: The fan wheel housing and integral outlet duct shall be injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. The outlet duct shall have provision for an aluminum backdraft damper with continuous aluminum hinge rod. The inlet box shall be minimum 22 gauge galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. A field wiring compartment with disconnect receptacle shall be standard. To accommodate different ceiling thickness, an adjustable pre-punched mounting bracket shall be provided. A white, non-yellowing, high impact styrene injection molded designer style grill shall be provided as standard. Unit shall be designed with provision for field conversion from ceiling to in[if !supportFootnotes][1][endif]line. Unit shall be shipped in ISTA Certified Transit Tested Packaging.

B. Wheel: Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.

C. Motor: Motor shall be totally enclosed, not ventilated (TENV) electronically commutated (EC) with permanently lubricated bearings, built-in thermal overload protection and disconnect plug. Motor shall have an adjustable speed range from 500 to 1800 rpm. Motor shall be furnished at the specified voltage.

2.04 INLINE CENTRIFUGAL FANS AND BLOWERS

A. Manufacturers:
   1. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.
   2. Loren Cook Company; _____: www.lorencook.com/#sle.
   3. Approved Equal

B. General: Fan shall be duct mounted, direct driven centrifugal square inline.

C. Certifications: Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

D. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge steel with airflow straightening vanes and integral duct flanges. Hinged access door shall be located in the specified position. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.

E. Coating: All steel fan components shall be LorenizedTM with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

F. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.

G. Motor: Motor shall be an electronically commutated motor rated for continuous duty and furnished either with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.

2.05 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Manufacturers:
   1. Carnes, a division of Carnes Company Inc; VRBK: www.carnes.com/#sle.
   2. Greenheck Fan Corporation: www.greenheck.com/#sle.
   3. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.
   4. Twin City Fan & Blower; BCRUR: www.tcf.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Belt Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced.
   2. Housing:
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

C. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

D. Drive Assembly:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.

2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

E. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Outdoor Locations: Type 3R.
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

F. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

G. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

H. Options/Accessories:
1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.
2. Birdscreen:
a. Provide galvanized steel construction.
3. Drain Connection:
a. Container allows single-point drainage of grease, water, or other residues.
4. Grease Trap:
a. Aluminum.
b. Container system to collect grease residue.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Inline Fans:
1. Install fans with resilient mountings and flexible electrical leads.
2. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans.

END OF SECTION 233423

SECTION 233600
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Variable-volume units.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 233300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

C. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets; 2008, with Addendum (2011).

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013300-Submittal Procedure, for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:
   1. Krueger-HVAC; _____: www.krueger-hvac.com/#sle.
   2. Price Industries; _____: www.priceindustries.com/#sle.
   3. Titus.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Acoustic Performance Requirements:

1. Sound ratings of air distribution assemblies: Not to exceed 30 NC at a 0.75" w.c. static pressure drop across the unit, and the downstream static pressure of 0.25" w.c.
2. Use attenuation values found in appendix E of AHRI 885.

C. General:
1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
   b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

F. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig.
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

G. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

H. Controls:
1. DDC (Direct-Digital Controls):
   a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or CFM set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
   a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

F. Do not support from ductwork.

G. Connect to ductwork in accordance with Section 233100.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
   1. Leak Test:
      a. After installation, fill water coils and test for leaks.
      b. Repair leaks and retest until no leaks exist.
   2. Operational Test:
      a. Test and adjust controls and safeties.
      b. Replace damaged and malfunctioning controls and other equipment.
      c. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 233600

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SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:

B. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, supply register/grilles.
   4. Wall-mounted, supply register/grilles.
   5. Wall-mounted, exhaust and return register/grilles.

C. Duct-mounted supply and return registers/louvers.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Krueger-HVAC: www.krueger-hvac.com/#sle.

C. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.

D. Price Industries: www.price-hvac.com/#sle.

E. Ruskin Company: www.ruskin.com/#sle.

F. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

2.02 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multicore diffuser to discharge air in 360-degree pattern, with sectorizing baffles where indicated. Project diffuser collar not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.

B. Fabrication: Steel with baked enamel finish.

C. Color: As selected by Architect from manufacturer's standard range.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern.

B. Connections: Round.

C. Frame: Provide surface mount and inverted T-bar type based on RDG Schedule.

D. Fabrication: Steel with baked enamel finish unless otherwise noted or scheduled.

E. Color: As selected by Architect from manufacturer's standard range.

2.04 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.

B. Material: 22 gauge, 0.0299 inch.
   1. Provide with rectangular tap fitting.

C. Color: As selected by Architect from manufacturer's custom range.

2.05 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.07 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Frame: Channel lay-in frame for suspended grid ceilings.

2.08 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

2.09 GOOSENECKS

A. Fabricate in accordance with of minimum 18 gauge, 0.0598 inch galvanized steel.

B. Mount on minimum 12 inch high curb base where size exceeds 9 by 9 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide volume dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION 233700

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SECTION 233714
LOUVERS FOR HVAC

PART 1 GENERAL

1.01 WORK INCLUDED, BUT NOT LIMITED TO:

A. Louvers.

1.02 REFERENCE STANDARDS

A. Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

B. Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.03 SUBMITTALS

A. Submit in accordance with Division 1.

B. Submit performance and data.

C. Submit construction data.

D. Submit shop drawings of factory fabricated assemblies.

E. Submit manufacturers' printed installation instructions. All warranties shall be delivered as part of the close-out submission.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with project requirements, provide louvers by one of the following manufacturers.
   1. Ruskin
   2. Greenheck
   3. Approved equal.

2.02 LOUVERS

A. Stationary drainable louver type with drain gutters gutters in each blade and head with downspouts in jambs and mullions with all welded construction. Hidden vertical supports to allow continuous line appearance up to 120 inches. Steeply angled integral sill.

B. Frame, where scheduled, and blades to be 6063-T6 alloy, minimum .081" thick. Heads, sills and jambs to be one piece structural members as detailed and to have integral caulking slot and retaining bead. All fastenings to be stainless steel. Structural support to be designed by the louver manufacturer to carry a wind load of not less than 20 pounds per square foot.

C. Blades: Drainable. 35-degree at four-inch spacing. 0.094-inch thick, 6063-T6 Alloy.

D. Maximum recommended airflow velocity through free area is 1,250cfm

E. All louvers furnished with 3/4" mesh x .051" expanded, flattened aluminum bird screen, secured in removable extruded aluminum frames. Louver color shall be by architect.

F. Finish: Louvers and metal panels to have 2 coat organic fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

G. Color: As selected by Architect from manufacturer’s full range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with manufacturer's printed instructions.

B. Provide insulated double wall sheet metal panel of 2” expanded polystyrene insulation as necessary to fit louvers to existing or new openings. Provide gasketing to avoid contact

between dissimilar metals and caulk perimeter of louver watertight.

END OF SECTION 233714

SECTION 233723
HVAC GRAVITY VENTILATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Roof hoods.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity and wind loads without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
   1. Temperature Change (Range): 120 deg F, material surfaces.

C. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.03 ACTION SUBMITTALS

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

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members to which roof curbs and ventilators will be attached.
   2. Sizes and locations of roof openings.

1.05 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
   1. Use types and sizes to suit unit installation conditions.
   2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.02 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.03 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Loren Cook
   2. Greenheck Fan Corporation.
   3. Approved Equal

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Factory fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

D. The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners.

E. The hood shall be constructed of minimum 18 gauge aluminum, bolted to a minimum 8 gauge aluminum support structure.

F. A radius throat must be provided for optimum performance.

G. Lifting lugs shall be provided to help prevent damage from improper lifting.

H. The base shall have continuously welded curb cap corners for maximum leak protection.

I. Birdscreen constructed of 1/2" galvanized mesh shall be mounted in the hood.

J. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure.

K. Unit shall be shipped in ISTA certified transit tested packaging.

L. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 2-inch thick, rigid fiberglass insulation adhered to inside walls; and 2-inch wood nailer. Size as required to fit roof opening and ventilator base. 18-inch height unless otherwise noted on drawings.
   1. Secure roof vent to curb with cadmium plated hardware.
   2. Secure curb directly to building structure.
   3. Slope compensated where installed on sloped roofs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install gravity ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses.

E. Label gravity ventilators according to requirements specified.

F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.02 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 233723

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SECTION 233813
COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

C. NSF 2 - Food Equipment; 2022.

D. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

E. UL 710 - Standard for Exhaust Hoods for Commercial Cooking Equipment; Current Edition, Including All Revisions.

F. UL 1046 - Standard for Grease Filters for Exhaust Ducts; Current Edition, Including All Revisions.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions, adjusting and balancing methods.

C. Shop Drawings: For each custom fabricated unit, provide drawings showing details of construction, dimensions, and interfaces with adjacent construction.

D. Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 HOOD APPLICATIONS

A. Canopy-Style Cooking Hoods:
   1. Style: Single island canopy.
   2. Type: Grease filter type.
   3. Exhaust Location: Top.
   4. Make-Up Air: Introduced into interior of hood only.

2.02 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA (KVS), and the requirements of the Authorities Having Jurisdiction.

B. Cooking Hoods: Provide Type I hoods, with all external joints and seams continuously welded, liquid-tight, and all internal joints, seams, and attachments sealed liquid-tight and grease-tight.
   1. Provide fire extinguishing system for all cooking hoods.
   2. Provide complete assemblies listed and labeled by UL under UL 710 for its intended use.
   3. Provide hoods and exhaust ducts rated for zero clearance to combustible construction.
   4. Provide complete assemblies certified and labeled by NSF under NSF 2.

C. Construction: Materials, inside and out, are stainless steel complying with ASTM A666, Type 304, stretcher leveled; unless otherwise indicated.
   1. Sheet Thickness: 18 gauge, 0.048 inch, minimum.
   2. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.

3. Finish on Surfaces Exposed to View: No.4 (brushed directional); provide stainless steel faces on all sides exposed to view.
4. Finish on Concealed Surfaces: No.4 or No.2B (dull, matte).
5. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8 inches extension from top or back face of unit, with minimum one inch 90 degree flange, unless otherwise indicated.
6. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit; maximum width of 40 inches.
7. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
   a. Hanger Rods: 3/8 inch diameter, minimum.
   b. Hanger Spacing: 48 inches on center, maximum.
   c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.

2.03 HOOD ACCESSORIES

A. Fire Extinguishing Systems:
   1. Fire extinguishing system to comply with NFPA 96.
   2. Type: Dry-chemical type.
   3. Exposed Piping Under Hood: Stainless steel or chrome plated.
   4. Exposed Piping Outside Hood: Not permitted.
   5. Nozzles: Stainless steel or chrome plated brass.
   6. Electrical Components: Provide all components required for properly operating system, including but not limited to wiring, raceways, contactors, circuit breakers, switches and solenoids.
   7. Fire Alarm System: Provide connection point for building fire alarm system capable of signaling system readiness and to generate signal when system is actuated.
   8. Manual Actuators: Wall-mounted pull stations; provide one near each hood and one near exit door.

B. Controls:
   1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.
   2. Fans: Provide controls for fan operation by time clock, programmable by the week, capable of maintaining time cycle after operation of manual push buttons.
   3. Cooking Equipment: Provide manual shutoff and reset button located where indicated; combine with fire extinguishing actuation.
   4. Fire Extinguishing System: Provide automatic actuation complying with NFPA 96; provide local and remote manual actuating stations clearly labeled "Hood Fire Protection"; upon actuation of fire extinguishing system, automatically:
      a. Shut off fans serving that hood.
      b. Shut off fuel source to equipment under hood; actuate solenoid gas valves provided as part of gas piping work.
      c. Shut off electric power to equipment under hood; actuate contactors or switches provided as part of electrical work.
      d. Signal building fire alarm system; normally-open contacts.

C. Control Panels: Factory assembled and pre-wired, ready for utility connections.
   1. UL listed for use with specific hood.
   2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
   3. Provide a single control panel for each group of hoods served by a single exhaust fan.
   4. Enclosures: Flush-mounted; stainless steel, to match hood.
   5. Provide indicator lights on control panel door showing status of fans and power supply.

D. Lights Inside Hoods: Incandescent in quantity and locations indicated, in UL listed vapor-proof fixtures, pre-wired to junction box on top of hood.

1. Incandescent: Surface mounted, thermal shock proof glass globe with chrome plated steel wire guard; 100 watt bulb.
2. Locate switch for operating lights in locations indicated.

E. Grease Filters: Stainless steel, washable, complying with , UL listed and labeled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and NFPA 96.

B. Install hoods level and plumb, securely fastened, with seismic restraints as specified, and free of vibration during normal operation.

C. Weld hood duct collars to ductwork, liquid-tight.

D. Connect to utilities.

3.02 SYSTEM STARTUP

A. Obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment to supervise the starting and adjusting of equipment.

B. Prepare equipment for startup, start and operate equipment for sufficient period to verify proper operation; correct equipment not operating correctly.

C. Demonstrate operation to Owner's designated personnel.

D. Report deficiencies in writing to Architect.

3.03 CLEANING

A. Clean surfaces of equipment.

3.04 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 233813

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SECTION 235100
BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured breechings.

1.02 REFERENCE STANDARDS

A. NFPA 31 - Standard for the Installation of Oil Burning Equipment; 2018.

B. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2019.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

D. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances; Current Edition, Including All Revisions.

1.03 DEFINITIONS

A. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

B. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory built units are used.

C. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

D. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

E. Designer's qualification statement.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum _____ years documented experience, and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Breechings, Chimneys, and Stacks:
   1. Jeramias
   2. Metal-Fab, Inc: www.mtlfab.com/#sle.

3. Selkirk Corporation; Model PS: www.selkirkcommercial.com/#sle.

2.02 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

A. Regulatory Requirements:
   1. Comply with applicable codes for installation of natural gas burning appliances and equipment.
   2. Comply with NFPA 31 for installation of oil burning appliances and equipment.
   3. Factory-built vents and chimneys used for venting natural draft appliances to comply with NFPA 211 and UL listed and labeled.

2.03 MANUFACTURED BREECHINGS

A. Prefabricated system listed to UL-1738 Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV made with AL29-4C stainless, or equivalent UL-1738 approved stainless, steel inner liner, 1” insulating air space, and 304 stainless steel outer jacket. Vent shall be designed fro maximum 550°F and positive pressure of 6" W.C.

B. Complete with: factory appliance flue connector, boot tees, drain caps or inline drains, stack supports, roof flashings, and termination all made in 100% stainless steel for a maintenance-free system. All items specifically required by Appliance and Gas Vent manufacturers installation instructions.

C. Submit CAD Drawings with Draft Calculations showing that the exhaust vent system is in complete compliance with both the Appliance and Vent manufacturers’ installation instructions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

D. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

END OF SECTION 235100

SECTION 235216
CONDENSING BOILERS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim and accessories for generating hot water.

1.02 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.
   1. Prior to flue vent installation, engineered calculations and drawings must be submitted to Architect/Engineer to thoroughly demonstrate that size and configuration conform to recommended size, length and footprint for each submitted boiler.

B. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 50% and 7% input firing rates at incoming water temperatures ranging from 80°F to 160°F.

C. Pressure Drop Curve. Submit pressure drop curve for the following flow ranges per designated capacities below
   1. 1500 - 2000 MBH: 25 - 350 GPM

D. Shop Drawings: For boilers, boiler trim and accessories include:
   1. Plans, elevations, sections, details and attachments to other work
   2. Wiring Diagrams for power, signal and control wiring

E. Source Quality Control Test Reports: Reports shall be included in submittals.

F. Field Quality Control Test Reports: Reports shall be included in submittals.

G. Operation and Maintenance Data: Data to be included in boiler emergency, operation and maintenance manuals.

H. Warranty: Standard warranty specified in this section
   1. Other Informational Submittals:
      a. ASME Stamp Certification and Report: Submit "H" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer must have been regularly engaged in the manufacture of condensing hydronic boilers for not less than thirty (30) years. The manufacturer must be headquartered in North America and manufacture pressure vessels in an ASME-certified facility wholly owned by the manufacturer. The specifying engineer, contractor and end customer must have the option to visit the factory to witness test fire and other relevant procedures.

B. Electrical Components, Devices and Accessories: Boilers must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. AHRI Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and is capable of achieving the energy efficiency and performance ratings within prescribed tolerances.

D. ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV “Heating Boilers”.

E. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

F. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

G. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

H. NOx Emission Standards: When installed and operated in accordance with manufacturer's instructions, the following condensing boiler models shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rules 1146, 1146.1, or 1146.2; and the Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, and Rule 117.465 or the NOx emissions referenced below:
   1. BMK750-2000, BMK4000-6000: 9 ppm NOx corrected to 3% oxygen at all firing rates when firing on natural gas

1.04 COORDINATION

A. Coordinate size and location of concrete bases. Anchor unit to concrete base.

1.05 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with project requirements, provide boilers by one of the following manufacturers
   1. Aerco
   2. Lochinvar
   3. Approved Equal

2.02 CONSTRUCTION

A. Description: Boiler shall be either natural gas, propane or dual fuel fired (nat. gas/propane) fully condensing fire tube design. It shall be design to operate in variable primary or primary secondary piping configuration. Power burner shall have full modulation, discharge into a positive or negative pressure vent and the minimum firing rate shall not exceed the following per model:
   1. BMK2000: 100,000 BTU/hr input

B. Boilers that have an input greater than what is specified above at minimum fire will not be considered. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boiler shall be factory-fabricated, factory-assembled and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure-tight, built on a steel base, including insulated jacket, flue-gas vent connections, combustion-air intake connections, water supply, dual inlet returns condensate drain connections, and controls.

C. Heat Exchanger: The heat exchanger shall be constructed of 439 stainless steel fire tubes and tubesheets, with a one-pass combustion gas flow design. The fire tubes shall be 1/2" or 5/8" OD, with no less than 0.049" wall thickness. The upper and lower stainless steel tubesheet shall be no less than 0.25" thick. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be ASME stamped for a working pressure not less than 150 psig. Access to the tubesheets and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be no less than 8 inch diameter.

D. Pressure Vessel: The pressure vessel shall have a maximum water volume per each model as listed below:
   1. BMK2000: 40 gallons (151.4 liters)

E. The boiler water pressure drop shall not exceed the following per model size:

F. The boiler water connections shall be flanged 150-pound, ANSI rated.
   1. BMK1500 - 3000: 4 inch flange

G. The pressure vessel shall be constructed of ASME SA53 carbon steel, with a 0.25 inch thick wall and 0.50 inch thick upper head. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases.

H. Dual Returns: The boiler shall include dual return connections for low and high return temperature zones for added flexibility and thermal efficiency optimization. The boiler shall not have a minimum flow rate requirement through either return connection as long as the specified minimum flow of the boiler is met through a combination of the two return connections.

I. Modulating Air/Fuel Valve and Burner: The boiler burner shall be capable of the following firing turndown ratios without loss of combustion efficiency or staging of gas valves. The turndown ratios shall be as follows and are based on BTU size:
   1. BMK1500: 20:1

J. The burner shall not operate above 7.5% oxygen level or 55% excess air. The burner shall produce less than 13 ppm of NOx, under standard calibration, corrected to 3% excess oxygen when firing on natural gas. The burner shall be metal-fiber mesh covering a stainless steel body with spark or proven pilot ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and fuel input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment. A variable speed cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

K. Fuel: The boiler shall use one of the following gas train options:
   1. Natural gas: The unit gas train shall be specifically designed and calibrated for a single predetermined fuel. The gas train shall be a ventless gas train.

L. Minimum boiler efficiencies shall be as follows at a 20ºF delta-T:

EWT	100% FIRE	50% FIRE	7% FIRE
160 °F	**86.5%**	**87%**	**87%**
140 °F	**87%**	**87.5%**	**87.5%**
120 °F	**88.5%**	**89%**	**90%**
100 °F	**93.2%**	**94.5%**	**95.2%**
80 °F	**95.6%**	**96.8%**	**98.2%**

M. Exhaust Manifold: The exhaust manifold shall be of corrosion resistant cast aluminum or 316 stainless steel with the following diameter flue connections:
   1. BMK2000-3000: 8 inch
   2. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

N. Blower: The boiler shall include a variable-speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.
   1. Motors: Blower motors shall comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
      a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require a motor to operate in the service factor range above 1.0.

O. Ignition: Ignition shall be via spark or proven pilot ignition with 100 percent main-valve shutoff and electronic flame supervision.

P. Combustion Air: The boiler shall be designed such that the combustion air is drawn from the inside of the boiler enclosure, decoupling it from the combustion air supply and preheating the air to increase efficiency.

Q. Combustion Air Filter: The boiler shall be equipped with an automotive high flow air filter to ensure efficient combustion and unhindered burner components operation.

R. Enclosure: The plastic and sheet metal enclosure shall be fully removable, allowing for easy access during servicing.

S. O2 sensor located in the Combustion Chamber: The boiler shall be equipped with an Oxygen sensor. The sensor shall be located in the boiler combustion chamber. Boilers without Oxygen sensor or boilers with an Oxygen sensor in the exhaust shall not be acceptable due to measurement estimation and performance accuracy.

2.03 CONTROLS

A. The boiler shall have an integrated boiler control that is capable of operating the boiler and associated accessories including but not limited to: its pumps, valves and dampers.
   1. The control shall have a 5 inch color touch screen display as well as six function buttons that are separate from the display. User shall have the ability to navigate the menus via touchscreen or navigation buttons. Controls not equipped with navigation button options shall not be permitted.
   2. The control shall be equipped with a multi-color linear LED light to indicate the level of firing and/or air/fuel valve position.
   3. The control shall display two temperatures using two dedicated three-digit seven-segment displays.
   4. The control shall offer an Enable/Disable toggle switch as well as two buttons for Testing and Resetting the Low Water Cutoff.

B. The Manager designated boiler control shall be capable of the following functions without the need for additional external controls:
   1. Sequence up to 16 boilers,
   2. Control boiler variable speed or single speed pumps and/or modulating motorized valves,
   3. Operate or modulate a variable or single speed system pump or rotate two system pumps,
   4. Control and communicate with up to 6 SmartPlate domestic water heaters and their domestic hot water pump,
   5. The control shall connect to other plant boiler controls using RS485 and communicate using Modbus protocol.

C. The control system shall be segregated into three components: “Edge [ii]” Control Panel, Power Panel and Input/Output Connection Box. The entire system shall be Underwriters Laboratories recognized.

D. The control panel shall consist of seven individual circuit boards using surface-mount technology in a single enclosure. Each board shall be individually field replaceable. These circuit boards shall include:
   1. A microcontroller board with integrated 5 inch touchscreen color display providing the user interface.
   2. A 7-segment display board. This board includes two 3-digit 7-segment displays. These displays shall be used to view a variety of temperature sensor values and operating and startup function status.
   3. An Interface board connects the microcontroller board to internal components using ribbon cables.
   4. An electric low-water cutoff board connects to the test and manual reset functions on the microcontroller board.
   5. A power supply board is designed to provide the different DC voltages to the rest of the boards. It also acts as voltage regulator and reduce power noise.

6. An ignition and combustion board. This board controls the air/fuel valve and Safety Shutoff Valve, flame status and ignition transformer
7. A connector board used to connect all external electrical connection.

E. Combination plant: The managing boiler control shall be capable of setting and managing a combination plant that consist of up to two groups of boilers, their swing boilers and swing valves. The control shall be capable of performing all the listed features without the need for any additional controls. The use of additional controls to achieve any of these functionalities shall be prohibited to simplify installation and plant management. The combination plant control shall have the following capabilities:
   1. The control shall operate one group of boilers for heating and another group of boilers for domestic hot water using plate heat exchangers or indirect tanks.
   2. The control shall manage and rotate the lead boiler in each of the two groups independent of the other group.
   3. The control shall be capable of managing one or two swing boilers and their motorized swing valves to direct the output of the swing boiler(s) to one of the two groups based on the plant priority settings. The control shall also connect to the header and return sensors for each of the two groups of boilers and use those values to manage the set point for each group.
   4. The control shall offer two independent logics that run simultaneously managing each group of boilers. Each boiler group logic shall have its temperature values, setpoints, PID and feedback parameters that is independent of the other group settings and parameters.

F. System Pump lead/lag rotation: The control shall be capable of operating two system pumps. It shall rotate the lead pump based on user time setting. The use of an external pump lead-lag control shall not be permitted unless function is performed by building management system.

G. Variable Speed Pump: The control shall be capable of modulating a variable speed pump. It shall modulate the pump based on the boiler firing rate, the boiler plant firing rate, or based on the return header temperature differential from supply water temperature on a primary secondary piping application.

H. Minimum number of boiler plant open valves: The control shall manage the minimum number of boiler motorized valves to reduce variable speed pump flow and energy used. The control shall offer a setting to control the number of valves open during low load and standby operation. Manufacturers without this feature shall offer additional pump controller and a smaller single speed pump to run during the low load and standby periods.

I. Control settings transfer using USB: The control shall simplify and significantly lessen startup and boiler setting time by being able to use a USB flash drive to copy settings from one boiler to another boiler. Installers shall use successfully preconfigured boiler settings in their portfolio to newly installed boilers.

J. Combustion calibration: The control shall offer at least 5 calibration points. The use of less than 5 calibration points is not permitted to improve overall system efficiency under all firing rates. Each combustion calibration point shall operate with 5 to 7% O2 levels to improve operating efficiency. Deviating away from these values shall not be acceptable.

K. Assisted Combustion Calibration: The control shall offer an assisted combustion calibration feature to help reduce setup time and improve setup accuracy. The assisted combustion calibration shall adjust the O2 level at each calibration point to help keep O2 level within allowable efficiency. The control shall log, date and time stamp the calibrated point combustion values of O2 and allow the user to log NOx, CO and flame strength. The control shall check these values against manufacturer allowable combustion values and color identify values out of manufacturer acceptable ranges. As an additional capability, the control shall also have the ability to perform manual combustion calibration. Not having Assisted Combustion Calibration function shall be prohibited.

L. Valve Balancing: To help simplify installation and as part of a boiler plant, the control shall be capable of controlling an electronic modulating motorized valve for each of the boilers using the manager boiler control. It shall have a built-in logic to provide a maximum flow using an adjustable valve opening percentage point for each boiler. The control shall be capable of closing any valve that has an off boiler. If all boilers are off, the control shall keep at minimum one valve open to protect pumps.

M. Building Automation: The control shall be able to communicate to Building Management Systems using BACnet and Modbus without the use of external gateways. The control shall be able to communicate over each of the two protocols using IP as well as RS485. The use of external gateways is not acceptable. The control shall be able to communicate to the building management system using:
   1. BACnet MS/TP and BACnet IP/Ethernet. When communicating over BACnet IP, the control shall offer an additional layer of IP security by mapping all control BACnet IP communication to the BACnet server's IP and MAC addresses. Not having this level of security shall deem the IP communication insecure and shall not be acceptable.
   2. Modbus RTU and Modbus IP.

N. Unit and Plant Status: The control shall provide a quick view of the unit status and plant status.
   1. The unit status screen shall provide temperature setpoint, all water inlet and outlet and supply air and exhaust temperature sensors' values. It shall also provide unit current and target firing rates. Additional screens shall display unit run hours, cycle count and average cycles per hour.
   2. The plant status screens shall provide plant temperature setpoint, plant water supply and return temperatures, outdoor temperature and domestic hot water setpoint and current temperatures. Additionally, a status screen shall show the boiler status of each plant unit, plant firing rate.
   3. Unit and Plant event history: The manager control shall display the last 500 historical events per plant or 200 historical events for single unit installations.

O. Software update: The control shall be capable of field software updates without a need for hardware component(s) replacement. This shall be performed either using software on a USB flash drive or via Internet connection. The software update mechanism shall be performed by a trained technician. The software update menus shall be secured using a password level. After the software update, the control shall retain all of its prior field settings.

P. Copy settings from one boiler to the other: To significantly reduce installation time by reducing long repetitive work, the control shall have the capability of saving its settings to a USB flash drive. In addition, the control shall have the ability of copying new settings from a flash drive.

Q. Programmable Inputs and Outputs: The control shall be equipped with multiple relay and analog outputs and dry contact and analog inputs. Each shall be field programmable to meet installation needs. The following I/O options shall be available:
   1. Relay outputs: There shall be two output relays that are programmable. The following relay functions shall be selectable:
   2. Swing Valve 2
   3. System Pump
   4. Summer Pump
   5. Multi-temperature pump
   6. Pump2
   7. Louver
   8. Inputs and interlocks: The following control functions shall be available:
   9. Flow input
   10. Damper end switch input
   11. Louver end switch input

a. Analog output: There shall be three analog outputs that are programmable. The control shall have configurable analog outputs that can be used as one of the following options:

12. Boiler pump
13. Domestic hot water variable speed pump
14. Valve
15. Fire rate
    a. Analog input: There shall be three analog inputs that are programmable. The control shall have configurable analog inputs that can be used as one of the following options:
16. Remote setpoint
17. Smart Plate valve position

R. Backup boiler: The control shall be able to operate a lower efficiency back up boiler during peak periods when main plant boilers are at or close to peak load.

S. The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities.

T. The control panel shall incorporate:
1. Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits firing rate to maintain outlet temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.
2. Setpoint Low Limit: Allow for a selectable minimum operating temperature.
3. Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can to shut off the unit upon loss of external signal, if so desired.

U. The boiler control system shall incorporate the following additional features for enhanced external system interface:
1. System start temperature feature
2. Pump delay timer
3. Auxiliary start delay timer
4. Auxiliary temperature sensor
5. Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate
6. Remote interlock circuit
7. Delayed interlock circuit
8. Easy Setup by providing simplified menu quick settings to expedite plant and boiler setup
9. Delta-T Limiter
10. Freeze protection
11. Fault relay for remote fault alarm
12. Warm-weather shutdown
13. The control shall offer multi-level user security access using different passwords. For additional security, the passwords shall expire if control display was not touched for an extended period 30 minutes.

V. Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME Section IV and CSD-1.

W. O2-Trim or AERtrim: Each boiler shall be equipped with the patented AERtrim system, an advanced O_2-trim system for condensing boiler applications. The system shall utilize a low cost reliable automotive O_2 sensor that measures and monitors the oxygen content of the exhaust

gases. The system shall adjust the blower speed to maintain optimal air-fuel ratios in the event of any site condition changes (air density, gas pressure, BTU content, etc.). The system shall have the following capabilities:

1. Self-Diagnostics
2. System Status and Error Messages
3. When excessive trimming is occurring
4. When O_2 sensor has fallen out of calibration
   a. Adjustable parameter settings
5. O_2 target and range to meet site requirements
6. Schedule daily or weekly self-diagnostics
7. Output of O_2 information shall be displayed on the Edge [ii] control panel.
8. The O_2 sensor shall be installed through the unit's burner plate and measure the oxygen content directly within the unit's combustion chamber.
9. Boilers without an equivalent O_2 trim will be deemed unacceptable. Due to the moisture content of flue gases from condensing boilers, placing the O_2 sensor in the exhaust manifold or stack will be deemed unacceptable.
10. Boilers which require their O2 sensor be changed annually will be deemed unacceptable.

X. Each boiler shall be onAER ready with a standard Ethernet port and include a 5 year onAER subscription at no additional charge. AERCO's onAER service grants the user online access to real time operation and status of their system plant from any computer, tablet or mobile device along with the following capabilities:

1. Efficiency status and trends
2. O2 levels
3. Efficiency and performance optimization tips
4. Preventative Maintenance alerts and scheduling
5. Predictive Maintenance algorithms.
6. Warning and error messages
7. Weekly or monthly performance and status reports
8. Manage multiple boiler plants or buildings
9. Customizable dashboard
10. Add email contacts for alerts and reports, including local AERCO trained technicians
11. Manage and store startup, maintenance and service documentation
12. The boiler manufacturer shall be able to provide a network hub or a network switch to connect up 16 boilers to an online network.

Y. Each boiler shall have integrated Boiler Sequencing Technology (BST), capable of multi-unit sequencing with lead-lag functionality and parallel operation. The system will incorporate the following capabilities:

1. Efficiently sequence 2-to-16 units on the same system to meet load requirement.
2. Integrated control and wiring for seamless installation of optional modulating motorized valve. When valves are utilized, the system shall operate one motorized valve per unit as an element of load sequencing. Valves shall close with decreased load as units turn off, with all valves open under no-load conditions.
3. Automatically rotate lead/lag amongst the units on the chain and monitor run hours per unit and balance load in an effort to equalize run hours among active units.
4. Option to manually designate lead and last boiler
5. Designated manager control, used to display and adjust key system parameters.
6. Automatic bump-less transfer of master function to next unit on the chain in case of designated master unit failure; master/slave status shall be shown on the individual unit displays.

Z. For boiler plants greater than 16 units, the Boiler Manufacturer shall supply as part of the boiler package a completely integrated AERCO Control System (ACS) to control all operation and energy input of the multiple boiler heating plant. The ACS shall be comprised of a microprocessor based control utilizing the MODBUS protocol to communicate with the Boilers via the RS-485 port. One ACS controller shall have the ability to operate up to 32 AERCO boilers.
   1. The controller shall have the ability to vary the firing rate and energy input of each individual boiler throughout its full modulating range to maximize the condensing capability and thermal efficiency output of the entire heating plant. The ACS shall control the boiler outlet header temperature within +2ºF. The controller shall be a PID type controller and uses Ramp Up/Ramp Down control algorithm for accurate temperature control with excellent variable load response. The ACS controller shall provide contact closure for auxiliary equipment such as system pumps and combustion air inlet dampers based upon outdoor air temperature.
   2. The ACS shall have the following anti-cycling features:
      a. Manual designation of lead boiler and last boiler.
      b. Lead boiler rotation at user-specified time interval.
      c. Delay the firing/shutting down of boilers when header temperature within a predefined dead band.
   3. When set on Internal Setpoint Mode, temperature control setpoint on the ACS shall be fully field adjustable from 50ºF to 190ºF in operation. When set on Indoor/Outdoor Reset Mode, the ACS will operate on an adjustable inverse ratio in response to outdoor temperature to control the main header temperature. Reset ratio shall be fully field adjustable from 0.3 to 3.0 in operation. When set on 4ma to 20ma Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint linearly as an externally applied 4-20 ma signal is supplied.
   4. When set on MODBUS Temperature Control Mode, the ACS will operate the plant to vary header temperature setpoint as an external communication utilizing the MODBUS protocol is supplied via the RS-232 port. The ACS controller shall have a vacuum fluorescent display for monitoring of all sensors and interlocks. Non-volatile memory backup of all control parameters shall be internally provided as standard. The controller will automatically balance the sequence of operating time on each boiler by a first-on first-off mode and provide for setback and remote alarm contacts. Connection between central ACS system and individual boilers shall be twisted pair low voltage wiring, with the boilers ‘daisy-chained’ for ease of installation.

2.04 ELECTRICAL POWER

A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified in Division 26 sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.

C. Electrical Characteristics:

Electrical Specifications	Models BMK750-2000
Voltage	120 V
Phase	1
Frequency	60 Hz
Full Load Current	13-16 Amps

2.05 VENTING

A. The exhaust vent must be UL Listed for use with Category II, III and IV appliances and compatible with condensing flue gas service. UL-listed vents of Al 29-4C stainless steel must be used with boilers.
    1) PVC/CPVC is approved for use with BMK750 and 1000 models
B. The minimum exhaust vent duct size for each boiler is six inch (BMK750 - 1500) diameter.
C. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.
D. The minimum ducted combustion air duct size for each boiler is six inch (BMK750 - 1500), diameter.
E. Common vent and common combustion air must be an available option for boiler installation. To improve system efficiency, multi-boiler system shall utilize sequencing logic with common venting as well as individual boiler venting configuration. Manufacturers not allowing parallel modulation for common shall not be acceptable. Consult manufacturer for common vent and combustion air sizing.
F. Follow guidelines specified in manufacturer's venting guide.
G. SOURCE QUALITY CONTROL
    1. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas, and to achieve combustion efficiency. Perform hydrostatic testing.
    2. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
        a. If boilers are not factory assembled and fire-tested, the local vendor is responsible for all field assembly and testing.
    3. Allow Owner access to source quality-control testing of boilers. Notify Architect fourteen days in advance of testing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before boiler installation examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations and piping and electrical connections to verify actual locations, sizes and other conditions affecting boiler performance, maintenance and operations.
    1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
B. Examine mechanical spaces for suitable conditions where boilers will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 BOILER INSTALLATION

A. Install boilers level on concrete bases.
B. Install gas-fired boilers according to NFPA 54.
C. Assemble and install boiler trim.
D. Install electrical devices furnished with boiler but not specified to be factory mounted.
E. Install control wiring to field-mounted electrical devices.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings and specialties.
B. Install piping adjacent to boiler to permit service and maintenance.
C. Install piping from equipment drain connection to nearest floor drain with condensate neutralization kit. Piping shall be at least full size of connection. Provide an isolation valve if

required.

D. Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tapings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting
   1. Kit: Complete system, ASTM A959, Type 29-4C stainless steel pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant. Vent system shall meet category IV venting requirements.
   2. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.
   3. Connect venting full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys and Stacks."

H. Ground equipment.

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Perform hydrostatic test. Repair leaks and retest until no leaks exist.
   3. Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating setpoints and high- and low-limit safety setpoints of fuel supply, water level and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
   5. Remove and replace malfunctioning units and retest as specified above.

C. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

D. Performance Tests:
   1. The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests:
      a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
      b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
      c. Perform field performance tests to determine capacity and efficiency of boilers.
         1) Test for full capacity.

2) Test for boiler efficiency at [low fire, 20, 40, 60, 80, 100, 80, 60, 40 and 20] percent of full capacity. Determine efficiency at each test point.

d. Repeat tests until results comply with requirements indicated.
e. Provide analysis equipment required to determine performance.
f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
g. Notify Architect in advance of test dates.
h. Document test results in a report and submit to Architect.

END OF SECTION 235216

SECTION 236423
OUTDOOR AIR-COOLED LIQUID CHILLER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-cooled scroll water chillers.

1.02 SYSTEM DESCRIPTION

A. Microprocessor controlled, air-cooled liquid chiller for outdoor installation, utilizing scroll compressors and low sound fans.

B. Greenspeed intelligence, all fans are controlled with variable speed fan drive motors. Chiller software shall be specifically developed to coordinate optimal fan speed for application conditions and provide refrigerant circuit optimization, resulting in higher part-load efficiency and reduced acoustic levels.

1.03 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 230513 - Common Motor Requirements for HVAC Equipment-CPL.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

D. Section 230553 - Identification for HVAC Piping and Equipment-CPL.

E. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

F. Section 230800 - Commissioning of HVAC.

G. Section 230923 - Direct-Digital Control System for HVAC.

H. Section 230993 - Sequence of Operations for HVAC Controls.

I. Section 232113 - Hydronic Piping.

J. Section 232114 - Hydronic Specialties.

K. Section 260583 - Wiring Connections.

1.04 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle 2020.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2022, with Errata (2023).

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2022).

E. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate physical size, weight and location of major pieces of equipment to be installed. Notify Architect of any major deviations from the equipment originally specified prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.

E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

F. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories; include trouble-shooting guide.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.

1.07 QUALITY ASSURANCE

A. Unit shall be rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) Standard 550/590, latest edition (U.S.A.) and all units shall be in compliance with ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) 90.1.2007 and ASHRAE 90.1 2010.

B. Unit construction shall comply with ASHRAE 15 Safety Code, UL (Underwriters Laboratories) latest edition, and ASME (American Society of Mechanical Engineers) applicable codes (U.S.A. codes).

C. The management system governing the manufacture of this product is ISO 9001:2015 certified.

D. An operational test, in which the chiller is run under load, is performed at the factory. This test checks for proper operation of fans as well as various controls and safeties, and a Certificate of Unit Testing, indicating successful end-of-line testing, is provided with the unit.

1.08 DELIVERY, STORAGE AND HANDLING

A. Unit controls shall be capable of withstanding 150°F (66°C) storage temperatures in the control compartment.

B. Unit shall be stored and handled per unit manufacturer's recommendations.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty to include coverage for materials and labor for compressor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com/#sle.

B. Trane Technologies, PLC: www.trane.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.
   1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.
   2. When substitution of a different manufacturer or model number is desired, submit sufficient information to demonstrate to Architect that the substitute will have the same or better performance as that specified AND that the related equipment in the system will perform acceptably with the substitute.
   3. If the related equipment must be modified to perform acceptably with the substitute, the entity proposing the substitution is responsible for all additional costs due to re-design and

provision of different related equipment.

2.02 EQUIPMENT

A. General:
   1. Factory-assembled, single-piece air-cooled liquid chiller. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge, and special features required prior to field start-up..

B. Materials of Construction:
   1. The base rail is 11 ga structural quality (Grade 50, Class 2), hot-dipped, zinc-coated, minimized spangle sheet steel (with Magni-coated screws).
   2. Cabinet shall be galvanized steel casing with a baked enamel powder or pre-painted finish.
   3. Painted parts shall withstand 1000 hours in constant neutral salt spray under ASTM B117 conditions with a 1 mm scribe per ASTM D1654. After test, painted parts shall show no signs of wrinkling or cracking, no loss of adhesion, and no evidence of blistering, and the mean creepage shall not exceed 1/4 in. (Rating ³ 4 per ASTM D1654) on either side of the scribe line.

C. Fans:
   1. Condenser fans shall be direct-driven, 9-blade airfoil cross-section, reinforced polymer construction, shrouded-axial type, and shall be statically and dynamically balanced with inherent corrosion resistance.
   2. Air shall be discharged vertically upward.
   3. Fans shall be protected by coated steel wire safety guards.
   4. Fan blades shall have serrated edges to minimize the sound that is produced.

D. Compressor/Compressor Assembly:
   1. Fully hermetic scroll type compressors.
   2. Direct drive, 3500 rpm (60 Hz), protected by motor temperature sensors, suction gas cooled motor.
   3. External vibration isolation rubber-in-shear.
   4. Each compressor shall be equipped with crankcase heaters to minimize oil dilution.

E. Direct Expansion Shell-and-Tube Evaporator:
   1. Shall provide the chiller with a shell-and-tube evaporator.
   2. Shell shall be insulated with 3/4 in. closed-cell, polyvinyl-chloride foam with a maximum K factor of 0.28.
   3. Shall incorporate 2 independent refrigerant circuits.
   4. Unit shall be provided with a factory-installed flow switch.
   5. All connections shall use standard Victaulic®-type fittings.

F. Condenser:
   1. Aluminum fin/copper tube coils: Coil shall be constructed of seamless copper tubes mechanically bonded to aluminum fins. Fins shall have wavy enhancements. These coils are not recommended for corrosive environments.
   2. Tubes shall be cleaned, dehydrated, and sealed.
   3. Assembled condenser coils shall be leak tested and pressure tested at 656 psig
   4. To plan the chiller installation and for ease of maintenance/coil removal, all refrigerant piping entering and leaving the condenser coils shall be located on only one side of the chiller so the coils can be removed (when needed) from the side free of piping. This is important to consider because removing the coils from the header side, although possible, involves extra labor due to extra bending and brazing of the coil headers.

G. Refrigeration Components:
   1. Refrigerant circuit components shall include replaceable core filter drier, moisture-indicating sight glass, electronic expansion device, discharge service valve and liquid line

service valves, and complete operating charge of both refrigerant and compressor oil.

H. Controls, Safeties, and Diagnostics:
   1. Unit controls shall include the following minimum components:
      a. Microprocessor with non-volatile memory. Battery backup system shall not be accepted.
      b. Separate terminal block for power and controls.
      c. Control transformer to serve all controllers, relays, and control components.
      d. ON/OFF control switch.
      e. Replaceable solid-state controllers.
      f. Pressure sensors shall be installed to measure suction and discharge pressure. Thermistors shall be installed to measure cooler entering and leaving fluid temperatures.
   2. Unit controls shall include the following functions:
      a. Automatic circuit lead/lag.
      b. Hermetic scroll compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
      c. Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return-fluid temperature with temperature set point accuracy to 0.1°F.
      d. Limiting the chilled fluid temperature pull-down rate at start-up to an adjustable range of 0.2°F to 2°F per minute to prevent excessive demand spikes at start-up.
      e. Seven-day time schedule.
      f. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
      g. Chilled water pump start/stop control and primary/standby sequencing to ensure equal pump run time.
      h. Dual chiller control for parallel chiller applications without addition of hardware modules and control panels (additional thermistors and wells are required).
      i. Timed maintenance scheduling to signal maintenance activities for pumps, strainer maintenance and user-defined maintenance activities.
      j. Low ambient protection to energize cooler or hydronic system heaters.
      k. Periodic pump start to ensure pump seals are properly maintained during off-season periods.
      l. Single step demand limit control activated by remote contact closure.
      m. Nighttime sound mode to reduce the sound of the machine by a user-defined schedule.
   3. Diagnostics:
      a. The control panel shall include, as standard, a display:
         1) Color touch screen display with stylus.
         2) Display shall allow a user to navigate through menus, select desired options, and modify data.
      b. Features of the display shall include:
         1) Multiple connection ports for USB, Ethernet, or BACnet™[1] IP, Modbus1-RTU (Remote Terminal Unit), LEN (local equipment network), and Carrier Comfort Network® (CCN) connections. NOTE: BACnet IP may require additional programming.
         2) Automatic reporting of alarms over email.
         3) Ability to graphically plot trends of system performance and conditions over time.
         4) Graphical summary display of current chiller operation and water conditions.
         5) Display shall allow access to configuration, maintenance, service, set point, time schedules, alarm history, and status data.
         6) Three levels of password protection against unauthorized access to configuration and maintenance information, and display set up parameters.

7) Full compatibility with the Carrier Comfort Network® (CCN) system to provide email alarm notification and to provide network capability to fully monitor and control chiller.
8) Display shall be capable of displaying the last 50 alarms, with clear full text description and time and date stamp, and will store a snapshot of operating conditions before and after the 10 most recent alarms.
9) Display run hours and number of starts for machine and individual compressors.
10) The control system shall allow software upgrade without the need for new hardware modules.

c. Time of day:
1) Display module, in conjunction with the microprocessor, must also be capable of displaying the output (results) of a service test. Service test shall verify operation of every switch, thermistor, fan, and compressor before chiller is started.
2) Diagnostics shall include the ability to review a list of the 30 most recent alarms with clear language descriptions of the alarm event. Display of alarm codes without the ability for clear language descriptions shall be prohibited.
3) An alarm history buffer shall allow the user to store no less than 30 alarm events with clear language descriptions, time and date stamp event entry.
4) The chiller controller shall include multiple connection ports for communicating with the local equipment network, the Carrier Comfort Network® (CCN) system and access to chiller control functions from any point on the chiller.
5) The control system shall allow software upgrade without the need for new hardware modules.

d. Crankcase heater failure.

4. Safeties:
a. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the unit with the following protections:
1) Reverse rotation.
2) Low chilled fluid temperature.
3) Motor overtemperature.
4) High pressure.
5) Electrical overload.
6) Thermal overload.
7) Loss of refrigerant charge.

b. Condenser fan motors shall have internal overcurrent protection.

I. Operating Characteristics:
1. Standard tier units, without modification, shall be capable of starting and running at outdoor ambient temperatures from 0°F to 125.6°F for units employing variable speed condenser fans and from 32°F to 120°F for units that do not employ variable speed condenser fans.
2. Unit shall be capable of starting up with 95°F entering fluid temperature to the evaporator.
3. After power restoration, and with the Capacity Recovery™ feature enabled, unit shall be capable of full capacity recovery in less than 4 minutes provided the required chilled water flow is available and no safety/control manual reset items or alarms are in effect.

J. Motors:
1. Condenser fan motors shall be totally enclosed, air over, 3-phase type with permanently lubricated bearings and Class F insulation.
2. Fans shall be 8-pole for fixed speed units and 6-pole for variable speed units.

K. Electrical Requirements:
1. Unit primary electrical power supply shall enter the unit at a single location (all chiller voltage/ size combinations shall have the ability to accommodate 2 power supplies to meet job specific requirements).

2. Primary electrical power supply shall be rated to operate up to 125.6°F ambient temperature for all models.
3. Unit shall operate on 3-phase power at the voltage shown in the equipment schedule.
4. Control points shall be accessed through terminal block.
5. Unit shall be shipped with factory control and power wiring installed.
6. Unit shall have a standard SCCR (short circuit current rating) value of 10 kA for all voltages.

L. Chilled Water Circuit:
1. Chilled water circuit shall be rated for 300 psig.
2. Thermal dispersion proof of flow switch shall be factory installed and wired.

M. Additional Features:
1. High-efficiency variable condenser fans:
a. All fans on the unit shall have variable speed fan motors to provide higher part load efficiency and reduced acoustic levels. Each fan circuit shall have a factory-installed, independent, variable speed drive with display. Variable speed drives are UL Listed. The use of this option, with the addition of antifreeze in the evaporator circuit and wind baffles or hail guards, shall allow running with outdoor ambient temperatures down to –20°F. Variable speed condenser fans also allow the chiller to operate at ambient temperatures as high as 125.6°F and starting as low as –13°F
2. Unit-Mounted Non-Fused Disconnect:
a. Unit shall be supplied with factory-installed, non-fused electrical disconnect for main power supply.
3. Hot Gas Bypass:
a. Unit shall be equipped with factory or field-installed, microprocessor-controlled, hot gas bypass shall permit unit operation down to a minimum of 10% capacity (varies with unit size). This option or accessory is not available on applications with leaving fluid temperature less than 38°F.
4. Security Grilles (Sides) and Hail Guard (Ends):
a. Unit shall be equipped with a factory or field-installed option consisting of louvered panels on the ends of the machine and security grilles on the sides of the machine. These coverings shall firmly fasten to the machine frame and provide coverage from the top to the bottom of the unit.
5. Suction Line Insulation:
a. Insulation shall be tubular closed-cell insulation. This option shall be required on applications with leaving fluid temperatures below 30°F and recommended for areas with high dewpoints, where condensation may be a concern.
6. Pressure Relief Valve:
a. Unit shall be provided with reseating-type pressure relief valves on the suction and discharge lines. The use of these valves meets Chicago code requirements on all unit sizes.
7. Compressor Blankets:
a. Unit shall be equipped with factory or field-installed option compressor sound reduction blanket, which reduces unit sound levels by providing an acoustic blanket on each compressor.
8. GFI Convenience Outlet:
a. Shall be factory or field-installed and mounted with easily accessible 115-v female receptacle and shall include a 4-amp GFI receptacle.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolators.

D. Connect to electrical service.

E. Connect to chilled water piping.

F. Arrange piping for easy dismantling to permit tube cleaning and removal.

3.02 MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Location: At project site.

3.04 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

END OF SECTION 236423

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SECTION 237313
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular Central Station Air-Handling Units

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

D. AMCA 99 - Standards Handbook; 2016.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

F. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

H. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

I. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

J. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation with size, location and installation of service utilities.

B. Coordinate with the required rail height for proper condensate trapping.

C. Coorinate concrete equipment pads and blocks for proper unit support.

D. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
   2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
   4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
   5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

C. Specimen Warranty: Submit sample of manufacturer's warranty.

D. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

E. Manufacturer's Instructions: Include installation instructions.

F. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fan Belts: One set for each unit.
   2. Extra Filters: One set for each unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.07 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. New Products: AHU-1 through AHU-7.

2.02 MANUFACTURERS

A. Carrier Corporation: www.carrier.com/#sle.

2.03 GENERAL

A. The contractor shall receive (unload from truck and store) and install the listed equipment. Coordinate schedule, receiving logistics and startup with the owner and equipment manufacturer's representative. The contractor shall provide all controls and accessories to make a complete and operable system. The contractor shall receive, inspect, install owner purchased equipment and shall be responsible for complying with the manufacturer's requirements to maintain the equipment warranty.

B. Unit shall be a factory-assembled, single-piece central station air handler. Unit may consist of a fan and coil section with factory-installed chilled water or direct expansion coil, preheat or reheat coil, heating coil section, filter section, mixing box or combination filter/mixing box, or access section as indicated on the equipment schedules. Unit base rail shall be 14 gage galvanized steel.

2.04 CABINET

A. Unit panels shall be constructed of 20 gage galvanized steel. Casing panels shall be removable for easy access to the unit. All panels shall be gasketed to ensure a tight seal.

B. Hinged access doors shall be double wall with 1.5 lb dual-density fiberglass between galvanized steel panels.

C. Insulation for casing panels on unit shall be 1-in. minimum thickness dual-density fiberglass insulation with a nominal density of not less than 1.5 lb per cubic foot.

D. Insulation shall be secured to casing with waterproof adhesive.

E. Condensate drain pans shall be sloped to prevent standing water and constructed of stainless steel; they shall have double wall construction with threaded drain connection.

2.05 FAN SECTION

A. Fan sections shall be constructed of galvanized steel and shall have a formed channel base for integral mounting of fan, motor, and casing panels. Fan scroll, wheel, shaft, and bearings are to be rigidly secured to the base unit.

B. Each unit shall have a single fan wheel and scroll. Fans shall be double width, double inlet type, with forward-curved blades. Wheels shall be bonderized steel with baked enamel, or galvanized steel.

C. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed, and shall be statically and dynamically balanced as an assembly.

D. Fan shafts shall be solid steel, turned, ground and polished.

E. Fan bearings shall be self-aligning, pillow-block regreasable ball type selected for an average life of 200,000 hours at design operation conditions, per ANSI Code B3.15.

F. Fan motor shall be mounted within the fan section casing on slide rails having 2 adjusting screws. Motor shall be NEMA (National Electrical Manufacturing Association) Design B with sizes and electrical characteristics as shown on the equipment schedule.

G. Fan drive shall be designed for a 1.5 service factor and shall be factory mounted and aligned. Belt drive shall be variable or fixed-pitch type.

2.06 COIL SECTIONS

A. All coils shall have mill galvanized casings. Coils shall be factory leak tested at 450 psig air pressure.

B. Chilled water coils shall have aluminum plate fins with belled collars bonded to $^1/_2$-in. minimum OD copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 300 psig at 200°F. Coils shall be drainable and have non-trapping circuits. No turbulence- promoting devices will be permitted inside the tubes. Headers shall have drain and vent connections.

C. Hot water coils shall have aluminum plate fins with belled collars bonded to copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 175 psig at 400°F. Headers shall have drain and vent connections.

2.07 FILTER SECTIONS

A. Each filter section shall be designed and constructed to house the specific type of filter specified on the equipment schedule.

B. Flat filter sections shall accept filters of standard sizes. Sections shall include side access slide rails and hinged door access. Flat filter section shall be arranged with minimum depth in direction of airflow.

2.08 ADDITIONAL FEATRUES

A. Variable Frequency Drives. Factory wired to motors.
   1. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 24-month warranty from date of commissioning or 30 months from date of sale, whichever occurs first.
   2. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.

PART 3 EXECUTION

3.01 COORDINATION

A. The contractor shall receive (unload from truck and store) and install the listed equipment.

B. Coordinate schedule, receiving logistics and startup with the owner and equipment manufacturer's representative.

C. The contractor shall provide all controls and accessories to make a complete and operable system.

D. The contractor shall receive, inspect, install owner purchased equipment and shall be responsible for complying with the manufacturer's requirements to maintain the equipment warranty.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Isolate fan section with flexible duct connections.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

D. Provide fixed sheaves required for final air balance.

E. Make connections to coils with unions or flanges.

3.03 FIELD QUALITY CONTROL

A. Final Acceptance Requirements:
   1. Use dial indicator gauges to demonstrate fan and motor are aligned.

3.04 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

END OF SECTION 237313

SECTION 238200
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit heaters.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Manufacturer's Instructions: Indicate installation instructions and recommendations.

C. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

A. Provide 5 year manufacturer's warranty for _____.

PART 2 PRODUCTS

2.01 HYDRONIC UNIT HEATERS

A. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

B. Perform factory run test under normal operating conditions, water, and steam flow rates.

C. Casing: Minimum 20 gauge sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 20 gauge sheet steel top and bottom plates for vertical projection models.

D. Finish: Factory applied baked enamel of color as selected.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

F. Air Outlet: Adjustable pattern diffuser on vertical projection models and two or four way louvers on horizontal projection models.

G. Control: Local solid state disconnect switch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Do not damage equipment or finishes.

C. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
   2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

END OF SECTION 238200

SECTION 238219
FAN COIL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ducted fan coil units and accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members or floor support to which fan coil units will be attached.
   3. Method of attaching hangers or supports to building structure.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fan coil units to include in emergency, operation, and maintenance manuals.
   1. In addition to general project requirements, include the following:
      a. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.05 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. Fan Coil Unit Filters: Furnish two spare filters for each filter installed.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.07 COORDINATION

A. Coordinate layout and installation of fan coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fan coil units that fail in materials or workmanship within one year of substantial completion.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. New Products: All Fan Coil Units (FCU).

2.02 MANUFACTURERS

A. Subject to compliance with project requirements, provide products by one of the following manufacturers.
   1. Carrier

2.03 G

A.

2.04 CONFIGURATION

A. Factory assembled direct drive blower coil units complete with coil, fan, motor, drain pan, and all required wiring, piping and controls.

B. Cabinet shall be made of heavy 18 gauge galvanized steel.

C. The interior surfaces shall be lined with: 1 in. standard fiberglass with perforated double wall insulation. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation.

D. Adhesive shall be certified according to the GREENGUARD Indoor Air Quality (IAQ) Certification for Low Emitting Products. Reference Standard: GGPS.001 GREENGUARD IAQ Standard for Building Materials, Finishes, and Furnishings. Reference Standard: GGPS.002 GREENGUARD Children and Schools Standard[1].

E. Units shall have a removable, double-sloped stainless steel drain pan extending the entire width of the coil, with "tell-tale" second drain connection. Primary drain connection shall be 3/4 in. male NPT and "tell-tale" connection shall be 1/2 in. male NPT stainless steel fittings. Primary and secondary drain connections shall be located on the same end as coil connections.

F. Stainless steel pans shall be externally coated with 2-part closed cell foam insulation.

G. Units shall have 4 in. pleated MERV 13 filter.

H. DH Horizontal Direct Drive Units:
   1. Units shall be supplied with a duct collar for supply duct connection.
   2. Access panels on both sides of the cabinet shall be removable without tools.

I. Filter shall be removable from either side of the filter rack. Additional access shall be bottom filter access.
   1. Units shall have holes for through-hanger rods located at top and bottom four corners of the cabinet.

2.05 CERTIFICATION

A. Units shall be listed by ETL indicating the units comply with the minimum requirements of the U.S. and Canadian national product safety standard, ANSI/UL Standard 1995, and with CAN/CSA C22.2 No. 236.

B. Blower coil capacities are certified and listed under AHRI Standard 440-2019.

2.06 MATERIALS:

A. Coils:
   1. All coils shall have 1/2 in. copper tubes, automatic air vent(s), and aluminum fins, galvanized end sheets, aluminum fins, stainless steel end sheets, copper fins, stainless steel end sheets, 10 fins per inch spacing. Coil fins shall be mechanically bonded to copper tubes.

2. Copper tubes must comply with ASTM B-75.
3. Fin thickness shall be 0.0045 in.
4. Tube thickness shall be 0.016 in.
5. Coil rows shall be indicated on the drawings.

B. Blowers:
1. Blowers shall be direct-driven with centrifugal forward-curved wheel.
2. Blower wheels shall be statically and dynamically balanced.
3. Blower housing shall be isolated from the cabinet and motor.
4. Bearings shall be ball bearing type (no sleeve bearings allowed), permanently lubricated and sealed for life.

C. Motors:
1. Motors shall be three speed electronically communicated type, open drip proof, NEMA frame motor. Motor size 1/2 HP and 1 HP shall have integrated control module with thermal overload protection. Motor size 1-1/2 HP and 3 HP shall have remote mounted control with thermal overload protection. Motor control module is mounted in cabinet interior.
2. Motors shall be factory wired to unit control box with quick connect electrical plugs.
3. Motors shall be RPM controlled, UL Recognized or equivalent, continuous duty rated.
4. Motor service access shall be on same side as coil connections.
5. Unit shall be furnished with proportional fan control wired directly to motor and configured to adjust RPM/cfm based on 0-10VDC signal from controller.

D. 24V Controls by others

PART 3 EXECUTION

3.01 COORDINATION

A. The contractor shall receive (unload from truck and store) and install the listed equipment.

B. Coordinate schedule, receiving logistics and startup with the owner and equipment manufacturer's representative.

C. The contractor shall provide all controls and accessories to make a complete and operable system.

D. The contractor shall receive, inspect, install owner purchased equipment and shall be responsible for complying with the manufacturer's requirements to maintain the equipment warranty.

3.02 EXAMINATION

A. Examine areas, with Installer present, to receive fan coil units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan coil unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install fan coil units level and plumb.

B. Install fan coil units to comply with NFPA 90A.

C. Install on spring vibration isolators.

D. Install new filters in each fan coil unit within two weeks after Substantial Completion.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as

follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect piping to fan coil unit factory hydronic piping package.
3. Connect condensate drain to indirect waste.
    a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Connect supply-air and return-air ducts to fan coil units with flexible duct connectors. Comply with safety requirements in UL 1995 for duct connections.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:
    1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

END OF SECTION 238219

SECTION 260010
GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work included in this Contract is shown on the drawings and described in these specifications. It consists of furnishing all labor, material, services, supervision and connection of all systems shown and/or specified including the requirements of:
   1. DIVISION 00 - BIDDING AND CONTRACT REQUIREMENTS
   2. DIVISION 01 - GENERAL REQUIREMENT
   3. DIVISION 26,28 - ELECTRICAL REQUIREMENT

B. Contractor is responsible to review and understand all drawings and all work of all trades to ensure a complete and thorough project.

C. Provide all labor, tools, materials, equipment, coordination, and plans necessary for installation and proper operation of the electrical systems.

D. Contract drawings and specifications are complementary and must be so used to ascertain all requirements of the work.

1.02 DEFINITIONS

A. Provide, furnish, install, and furnish and install shall have the same meaning. That is, the Contractor shall purchase, transport to the site and install all required components of the work unless specifically stated otherwise in the contract documents.

B. Wiring pertains to raceway, fittings, conductors, terminations, hangers, supports, etc. as required to form a complete system.

1.03 DRAWINGS AND SPECIFICATIONS

A. The plans are diagrammatic and indicate only the sizes and general arrangement of conduit, devices, and equipment; exact locations of all elements shall be determined as work progresses, in cooperation with the work of other trades. It is not intended to show every item of work or minor piece of equipment, but every item shall be furnished and installed without additional remuneration as necessary to complete the system in accordance with the best practice of the trade.

B. As previously stated, the exact locations of electrical devices and equipment are diagrammatic. The owner may request for any devices or equipment to be installed at different locations than what is indicated on the drawings in a specific area or room. It is the responsibility of the Electrical Contractor to coordinate the locations of devices in all areas prior to installation.

1.04 PRODUCT EQUIVALENTS

A. Refer to Section "Substitution Procedures".

1.05 APPLICABLE STANDARDS

A. All equipment shall bear the UL label.

B. The latest edition of the following minimum standards shall apply wherever applicable:
   1. American Standards Association
   2. American Society for Testing Materials
   3. Electrical Testing Laboratories, Inc.
   4. Institute of Electrical and Electronic Engineers
   5. Insulated Power Cable for Engineers Association
   6. Occupational Safety and Health Act
   7. National Electrical Code
   8. National Electrical Manufacturers Association
   9. National Electrical Safety Code

10. National Fire Protection Association
11. Underwriters Laboratories, Inc.
12. Power company standards and regulations.
13. Local and state codes.
14. Johnston County Schools Guide Specifications

C. In the event there are conflicts between specifications and standards, standards shall govern unless specifications are in excess of standards.

1.06 PERMITS AND INSPECTIONS

A. Permits: The Contractor shall apply for and pay the cost for any local permits necessary for the work of this contract.

B. Inspections: The Contractor shall be responsible for obtaining a 3rd party electrical inspection of and the certificate by the approved inspection agency for the entire electrical system.

C. The undertaking of periodic inspections by the Owner or Engineer shall not be construed as supervision of actual construction. The Owner or Engineer is not responsible for providing a safe place of work for the Contractor, Contractor's employees, suppliers or subcontractors for access, visits, use, work, travel or occupancy by any person.

1.07 CODES AND REGULATIONS

A. Comply with all applicable rules and regulations of the municipal laws and ordinances and latest revisions thereof. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Modifications required by the above authorities will be made without additional charges to the Owner. Where alterations to and/or deviations from the Contract Documents are required by the authorities, report the requirements to the Engineer and secure approval before work is started.

B. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Obtain all permits, licenses, and inspections and pay all legal and proper fees and charges in this connection.

C. Should any work shown or specified be of lighter or smaller material than Code requires, same shall be executed in strict accordance with the regulations.

D. Heavier or larger size material than Code requires shall be furnished and installed, if required by the Plans and Specifications.

E. This Contractor shall have the electrical work inspected from time to time by authorized inspectors and shall pay all expense incurred by same. At the completion of the work, the Contractor shall furnish a Certificate of Approval, in triplicate, indicating full approval of the work furnished and installed in this Contract from the local authority having jurisdiction.

F. Equipment and components parts thereof shall bear manufacturer's name-plate, giving manufacturer's name, size, type and model number or serial number, electrical characteristic to facilitate maintenance and replacements. Name plates of distributors or contractors are not acceptable.

G. Engineer will have privilege of stopping any work or use of any material that in his opinion is not being properly installed and each Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed by the Engineer, at no additional cost to Owner.

H. If equipment or materials are installed before proper approvals have been obtained, each Contractor shall be liable for their removal and replacement including work of other trades affected by such work, at no additional cost to Owner, if such items do not meet intent of the Drawings and Specifications.

1.08 RECORD DRAWINGS

A. The Electrical Contractor shall keep an accurate location record of all underground and concealed piping, and of all changes from the original design. He is required to furnish this information to the Engineer prior to his application for final payment.
   1. Submit prior to final acceptance inspection, one complete marked-up set of reproducible engineering design drawings.
      a. Fully illustrate all revisions made by all crafts in course of work.
      b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders.
      c. Exact location of raceways, equipment and devices.
      d. Exact size and location of underground and under floor raceways, grounding conductors and duct banks.
      e. These drawings shall be for record purposes for Owner's use and are not considered shop drawings.

B. At completion of the project, all changes and deviations from the Contract Documents shall be recorded by the Contractor.

C. Four (4) corrected sets of all operating and maintenance instructions and complete parts lists bound in hard covers shall be furnished to the Owner.

1.09 SLEEVES

A. Sleeves: furnished, set in Electrical Work; built-in under General Construction Work.

B. Sleeves shall be as follows:
   1. Sleeves in floors and partitions shall be galvanized steel with lock seam joints or a manufactured conduit floor seal.
   2. Sleeves of extra heavy cast iron pipe or galvanized steel pipe shall be used in outside walls, foundations, and footing or manufactured compression-type wall seal (waterproof).
   3. Conduit sleeves shall be two (2) sizes larger than the conduit passing through it.
   4. Terminate sleeves flush with walls, partitions, and ceilings. Sleeves in floor shall terminate 1/4" above floors.
   5. Fill space between sleeve and conduit in foundation walls with oakum and caulk with lead on both sides of wall. When using pipe sleeves, fill space between sleeve and pipe with fiberglass blanket insulation when sleeve does not occur in a foundation wall.
   6. An approved fire stop seal shall be used when conduits penetrate fire stopping walls and floors (between fire zone).

C. Set sleeves, obtain review of their locations in ample time to permit pouring of concrete or progressing of other construction work as scheduled.

1.10 CLEANING CONDUIT, EQUIPMENT

A. Conduit, equipment: thoroughly cleaned of dirt, cuttings, other foreign substances. Should any conduit, other part of systems be stopped by any foreign matter, disconnect, clean wherever necessary for purpose of locating, removing obstructions. Repair work damaged in course of removing obstructions.

1.11 VIBRATION ISOLATION

A. Vibration isolators shall prevent, as far as practicable, transmission of vibration, noise or hum to any part of building.

B. Design isolators to suit vibration frequency to be absorbed; provide isolator units of area, distribution to obtain proper resiliency under machinery load, impact.

C. Wiring and other electrical connections to equipment mounted on vibration isolators; made flexible with minimum 180 degree loop of "greenfield" in order to avoid restraining equipment and short circuiting vibration isolator.

1.12 BALANCED LOAD

A. It is intended that design and features of the work as indicated will provide balanced load on the feeders and main service. Contractor shall provide material and installation to provide this balance load insofar as possible.

B. Contractor shall take current and voltage measurements at all panels of at least 1/2 hour. Reconnections of loads shall be made when deemed necessary by the Engineers.

1.13 JOB CONDITIONS

A. The Contractor shall notify the "NC call before you dig" at 811 and the Owner's Construction Coordinator before any excavations are begun. Upon completion of locating underground utilities, the Contractor shall be responsible for recording and maintaining these locations on the record drawings for future reference for duration of project.

B. Examine site related work and surfaces before starting work of any Section. Failure to do so shall in no way relieve the Contractor of the responsibility to properly install the new work.
   1. Report to the Engineer, in writing, conditions, which will prevent proper provision of this work ten (10) days prior to bid date, in time for an addendum to be issued .
   2. Beginning work of any Section without reporting unsuitable conditions to the Engineer constitutes acceptance of conditions by the Contractor.
   3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
   4. The Contractor is responsible for performing routine maintenance and cleaning of any existing equipment where he is making connections to new work and to the building where his work adds debris.

C. Connections to existing work:
   1. Install new work and connect to existing work with minimum interference to existing facilities.
   2. Provide temporary shutdowns of existing services only with written consent of Owner at no additional charges and at time not to interfere with normal operation of existing facilities.
   3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
   4. Do not interrupt alarm and emergency systems.
   5. Connect new work to existing work in neat and acceptable manner.
   6. Restore existing disturbed work to original condition including maintenance of wiring and continuity as required. Replace damaged or rusted conduit to which new equipment is being installed and connected.

D. Removal and relocation of existing work.
   1. Disconnect, remove or relocate electrical material, equipment and other work noted and required by removal or changes in existing construction.
   2. Provide new material and equipment required for relocated equipment.
   3. Disconnect load and line end of conductors feeding existing equipment.
   4. Remove conductors from existing raceways to be rewired.
   5. Remove conductors and cap outlets on raceways to be abandoned.
   6. Cut and cap abandoned floor raceways flush with concrete floor or behind walls and ceilings.
   7. Dispose of removed raceways and wire.
   8. Dispose of removed electrical equipment as directed by Owner. The Owner shall provide a list of equipment of the Contractor of equipment to be delivered to the Owner.

1.14 SPECIAL TOOLS AND LOOSE ITEMS

A. Furnish to Owner at completion of work:
   1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.

2. "Special Tools": Those not normally found in possession of mechanics or maintenance personnel.
3. Keys
4. Redundant components and spare parts.

B. Deliver items to Owner and obtain receipt prior to approval of final payment.

1.15 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representative of the Engineer.
   1. Contractor is to uncover all concealed areas during inspections if requested.

B. Advise Architect and Engineer that work is ready for review at following times:
   1. Prior to backfilling buried work.
   2. Prior to concealment of work in walls and above ceilings.
   3. When all requirements of contract have been completed.

C. Neither backfill nor conceal work without Engineer's consent.

1.16 SHOP DRAWING SUBMITTALS

A. Submit required shop drawings, samples and product information in accordance with Division 1, requirements and as required in the various sections of these specifications.

B. Submittals shall show evidence of checking by the Contractor for accuracy. Product information (catalog sheets) shall indicate complete catalog number, color, accessories, etc., as well as, name of manufacturer and local distributor or manufacturer’s representative.

C. Submit for review detailed coordination drawings 3/8" or larger scale plans for all major electrical equipment and any areas of conflicts by drafting location of equipment, lighting fixtures, cable trays and conduits larger than 1-1/2" trade size. Contractor shall refer to Division 1 for preparing coordination drawings.

D. Incomplete submittals will be rejected.

E. Additionally, the Contractor will submit data on the following:
   1. All electrical equipment including all panelboards and switching devices (disconnects, switches, occupancy sensors, etc.).
   2. Fire stop seals used for wall penetrations.
   3. Any proposed variation in specified wiring plans and circuitry.
   4. All special items and panels, made or constructed specifically for this project, including wiring diagrams, component layout and component data or materials list.
   5. All settings of installed equipment, such as overcurrent protection, overload settings, temperature settings, time settings, etc. This includes equipment provided by other contractors or subcontractors and connected and tested by this Contractor.

F. All submittals of NON SPECIFIED equipment and components will be reviewed. It is the submitting Contractor's responsibility to prove compliance and not the Architect/Engineer to prove non-compliance. The submitting Contractor will be charged the prevailing wage of the reviewing Engineer for all submittals requiring over one (1) hour to review that were not originally specified.

G. It is the Contractor’s responsibility to provide submittals in an organized and timely manner so as not to delay the project schedule and hamper the work of other trades.

1.17 OPERATING INSTRUCTIONS

A. It shall be the Contractor’s responsibility to insure that the Owner’s representative is given adequate instruction on the operation of all equipment prior to final payment.

B. Test and demonstrate all systems described in this Division in the presence of the Owner or a designated representative upon completion of the work. Demonstrate that the installation is in accordance with Contract Documents.

C. Provide to the Owner all instructions on maintenance and operation of all systems and equipment provided. Provide all necessary tools and personnel to thoroughly demonstrate and present those instructions.

1.18 TEMPORARY POWER

A. The Contractor shall provide all temporary power to all trades throughout all phases of construction throughout the duration of this project. This will include but not be limited to temporary lighting, power outlets, temporary elevator operation, controls for temporary heating, and job trailers. Contractor shall be responsible for providing temporary power via adjacent building(s) and/or a temporary diesel fired generator and associated fuel costs. Contractor shall coordinate temporary power source with project manager prior to demolition. Contractor is responsible for all costs associated with temporary power.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials and equipment shall be new and as specified or of equal or better quality.

B. Basic hardware and miscellaneous items shall meet existing trade standards of quality and shall carry UL or FM listings where applicable.

C. All equipment supplied shall be the standard equipment of the manufacturer.

D. Multiple items such as panelboards, wiring devices, switches, breakers, raceways, etc., shall be from the same manufacturer.

E. Drawings and specifications are based on specific manufacturer's equipment. Therefore, the Contractor shall assume all responsibility, cost and coordination involved in making any necessary revisions to apply another manufacturer's equipment, even though it may be approved as an "equal" item by the Engineer.

PART 3 EXECUTION

3.01 COORDINATION OF WORK

A. All work shall be executed in accordance with recognized standards of workmanship. All work shall be installed in a neat and orderly manner.

B. The Contractor shall exchange information with other Contractors and the Owner in order to insure orderly progress of the work.

C. The Contractor must contact the Owner's representative and schedule all work ten (10) days prior to start.

D. The Contractor shall check for possible interference before installing any items. If any work is installed, and later develops interference with other features of the design, the Contractor will be responsible to make such changes to eliminate the interference.

3.02 CEILING REMOVAL

A. Existing ceilings which must be removed for the installation of new work or demolition of existing conditions shall be done by the Contractor. No ceiling shall be removed without prior approval of the Owner. Ceilings which must be removed shall be restored to their original condition as soon as practical and prior to final payment.

B. The removed tile of lay-in type ceilings shall be stored either in the ceiling space or at a designated space in the building. No tiles shall be stored in the occupied space.

C. The Contractor shall take all necessary precautions to prevent damage to the existing ceilings. All damaged ceilings shall be replaced with new ceiling construction to match the existing and to the Owner's satisfaction.

END OF SECTION 260010

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 260505

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Oxide inhibiting compound.

F. Wire pulling lubricant.

G. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

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

K. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

L. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

M. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

N. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

O. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.

P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size: 12 AWG.
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 6 AWG and larger may have black insulation color coded using vinyl color coding electrical tape within 2 inches of each end of the conductor.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.
      e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
      f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.

c. General Cable Technologies Corporation: www.generalcable.com/#sle.
d. Service Wire Co: www.servicewire.com/#sle.
e. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
2. Size 10 AWG and Smaller: Solid.
3. All wiring within flexible conduit shall be flexible stranded.
4. Size 8 AWG and Larger: Stranded.
5. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Installed Underground: Type XHHW-2.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Joints in solid conductors shall be spliced using Ideal "wire nuts", 3M Company "Scotchlock" or T&B connectors in junction boxes, outlet boxes and lighting fixtures.

D. Sta-Kon", “Piggy”, or other permanent type crimp connectors shall not be used for #10 AWG and smaller conductors.

E. Joints in stranded conductors shall be spliced by approved mechanical connectors that are insulated with gum rubber tape and insulating tape. Permanent compression connectors for splices and taps, provided with UL-approved insulating covers, may be used instead of mechanical connectors plus tape. Power Distribution Blocks may be used where listed for the enclosure size and available fault current.

F. Conductors, in all cases, shall be continuous from outlet to outlet and no splicing shall be made except within outlet or junction boxes, troughs and gutters.
1. No splices are allowed in panels.

2.05 ACCESSORIES

A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy LLC: www.burndy.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.

E. Cable Ties: Material and tensile strength rating suitable for application.
   1. Manufacturers:
      a. Burndy LLC: www.burndy.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned or noted otherwise, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:

a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
b. Increase size of conductors as required to account for ampacity derating.
c. Size raceways, boxes, etc. to accommodate conductors.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Install conductors with a minimum of 12 inches of slack at each outlet and junction box.
1. All junction boxes are to have slack for future use as opposed to having wires pulled right through boxes.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Identify conductors and cables in accordance with Section 26 0553.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

Q. Where wiring is relocated from one cabinet to another, the complete circuit and conduit shall be rerouted to the new location and not pass through the original cabinet.

R. Where a portion of a circuit, feeder or system is interrupted, the existing portions shall be rerouted and reconnected together to maintain the original integrity.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

C. All current carrying phase conductors and neutrals of low voltage systems rated 1000 volts or below shall be tested for insulation resistance and accidental grounds. For new installations, testing shall be initiated upon completion of cable installation and prior to final terminations. For retrofit installations when the electrical load-center (panel, switchboard, etc.) is to be replaced and where associated feeders and service conductors remain without replacement, test associated conductor insulation. Insulation resistance testing shall be performed with a 500-volt insulation tester. The procedures listed below shall be followed:
   1. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG wire and smaller, 250,000 ohms or more for #4 AWG wire or larger, between conductors and between conductor and the grounding conductor.
   2. After all fixtures, devices and equipment are installed and all connections completed to each panel, the Contractor shall disconnect the neutral feeder conductor from the neutral bar and take a reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. The Contractor shall then individually test each branch circuit interconnection with the panel and until the source of low readings are found. The Contractor shall then correct the cause of the low resistance troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
   3. At final SCO inspection, the Contractor shall, upon request, furnish an insulation tester and show the Engineers and State Construction Office representatives that the conductor

insulation complies with the above requirements. The Contractor shall also furnish a clamp-on type ammeter and voltmeter to take current and voltage readings as directed by the representatives.

4. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2022.

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

E. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

a. Provide continuous grounding electrode conductors without splice or joint.
b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
a. Bond the following conduits to each other, the housing can, and ground bus with a #3/0 insulated copper ground wire and grounding bushings.
1) All conduits entering any freestanding enclosure, transformers, or other equipment.
2) All conduits entering main service device.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with 8-inch long bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal air ducts.
8. Provide bonding for metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Manufacturers - Mechanical and Compression Connectors:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   3. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 0553.

E. Boxes with concentric, eccentric, or over-sized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250.122 and lugged to the box.

END OF SECTION 260526

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SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

B. Installer's Qualification Statement: Include evidence of compliance with specified requirements.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported at 5 times the applied force. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Components for Vibration Isolation and/or Seismic Controls: Comply with Section 260548.

C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.
2. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Thomas & Betts Corporation: www.tnb.com/#sle.
   c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
   e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Busway Supports: 1/2 inch diameter.
   c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
   d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
   e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
   f. Outlet Boxes: 1/4 inch diameter.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts or expansion anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Plastic and lead anchors are not permitted.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Comply with MFMA-4.
   b. Channel Material: Use galvanized steel.
   c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
10. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
11. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc; _____: www.us.hilti.com/#sle.
    b. ITW Red Head, a division of Illinois Tool Works, Inc; _____: www.itwredhead.com/#sle.
    c. Powers Fasteners, Inc; _____: www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc; _____: www.strongtie.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 260533.13.

K. Box Support and Attachment: Also comply with Section 260533.16.

L. Interior Luminaire Support and Attachment: Also comply with Section 265100.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners according to manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Intermediate metal conduit (IMC).
C. Flexible metal conduit (FMC).
D. Liquidtight flexible metal conduit (LFMC).
E. Electrical metallic tubing (EMT).
F. Rigid polyvinyl chloride (PVC) conduit.
G. Conduit fittings.
H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
I. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
J. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
K. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
L. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

F. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

G. Exposed, Interior, Subject to Physical Damage: Use intermediate metal conduit (IMC).
1. Locations subject to physical damage include, but are not limited to:
a. Where exposed below 6 feet, except within electrical and communication rooms or closets.

H. Exposed, Exterior: Use galvanized steel rigid metal conduit.

I. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

J. Buried, Exterior: Use Use rigid PVC conduit.

K. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
1. Maximum Length: 6 feet.

L. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Minimum Length: 2 feet unless otherwise indicated.
4. Maximum Length: 6 feet unless otherwise indicated.
5. Vibrating equipment includes, but is not limited to:
a. Transformers.
b. Motors.

c. HVAC equipment..

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 1/2 inch trade size.
2. Branch Circuit Homeruns: 1/2 inch trade size.
3. Flexible Connections to Luminaires: 3/8 inch trade size, 6 foot maximum length to individual luminaires. Motor and equipment: ½" trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
4. Connectors and Couplings: Use compression type (gland) fittings only. Threadless set screw type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular.com/#sle.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular/#sle.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel.
4. Connectors and Couplings: Use compression (gland) type.
    a. Do not use indenter type connectors and couplings.
    b. Do not use set-screw type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc: www.cantexinc.com/#sle.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
3. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

D. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.

c. Within joists in areas with no ceiling.

5. Unless otherwise approved or indicated on associated documents, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet between pull points.
9. Route conduits above water and drain piping where possible.
10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
12. Group parallel conduits in the same area together on a common rack.
13. Any conduit or flex exposed on interior or exterior which is accessible from finished grade or floor surface is subject to physical abuse and must be installed in such a manner so as to limit this installation from becoming a safety hazard in the future.
14. Conduit runs shall not be coupled with flexible conduit without a junction box, and then only for hook-up of vibrating or appliance connections. Exception: dry type transformers.

G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   a. Conduits shall be supported on not more than 8'-0" centers when concealed and 5'-0" centers when exposed.
   b. All vertical conduit runs not supported by walls are to be secured at floor and ceiling. Conduits are to be secured at the floor by means of a flange secured to the floor by expansion bolts. Connections to the equipment are to be by means of a "tee" conduit fitting and flexible conduit.
2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 0548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

H. Connections and Terminations:

1. Use approved conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. No flexible conduit is to penetrate any wall or other partition.
4. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
5. Conceal bends for conduit risers emerging above ground.
6. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Install firestopping to preserve fire resistance rating of partitions and other elements.

J. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 48 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

M. Provide pull string (70# test nylon cord) in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end. Empty conduit ends shall be corked or capped. Both ends of conduit shall be clearly identified

as to where the other end is terminated.

N. Provide grounding and bonding in accordance with Section 26 0526.
   1. Where concentric, eccentric, or over-sized knockouts are encountered, a grounding-type insulated bushing shall be provided.

O. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

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

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

B. Samples:
   1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

C. Project Record Documents: Record actual locations for pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
   4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   5. Use suitable concrete type boxes where flush-mounted in concrete.
   6. Use suitable masonry type boxes where flush-mounted in masonry walls.

7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch by 2-1/8 inches by 2-1/8 inches deep unless otherwise noted.
16. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes and condulet bodies so that covers are accessible and removable. Provide access panels.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
      b. Communications Systems Outlets: See drawings.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
   9. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
      a. Receptacle boxes on science tabletops are to be bolted to support and not solely dependent on a nipple for support.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches deep.
   2. Flush-mount enclosures located in concrete or paved areas.
   3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.

4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 26 0526.

Q. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

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SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).

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

C. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

D. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

E. UL 9691 - Recommended Practice for Nameplates for Use in Electrical Installations

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Mechanically-attached nameplates, materials and fasteners, shall comply with UL 9691.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesive, and inks used by label printers, shall comply with UL 969.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares using pencil .
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
a. Minimum Size: 3.5 by 5 inches.
b. Service Equipment: Include the following information in accordance with NFPA 70.
1) Nominal system voltage.
2) Available fault current.
3) Clearing time of service overcurrent protective device(s).
4) Date label applied.
4. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
5. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Boxes:
1. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings, where identification shall also include branch circuit designation.
2. Use identification labels to identify circuits enclosed.
a. For exposed boxes in public areas, use only identification labels.
3. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

D. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

2. Factory Pre-Marked Wallplates: Comply with Section 26 2726.
3. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label to identify serving branch circuit for all receptacles.
5. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved Helvetica medium style text; double-stick adhesive tape/foarm is prohibited.
      a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
   3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text, helvetica medium style. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: See detail on drawings.
      a. Equipment designation or other approved description.
   3. Text: Helvetica medium style, all capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/8"
      a. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
   5. Color:
      a. Normal Power System:
         1) 480Y/277 V, 3 Phase Equipment: White core laminated bakelite with red finish.
         2) 208Y/120 V, 3 Phase Equipment: White core laminated bakelite with black finish.

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: Helvetica medium style, all capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch.
   5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches by 4 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: Helvetica medium style, all capitalized unless otherwise indicated.

4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: Helvetica medium style, all capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on white background.

2.03 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum or rigid plastic signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Enclosure front.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Branch Devices: Adjacent to device.
5. Interior Components: Legible from the point of access.
6. Boxes: Outside face of cover.
7. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates with two-part epoxy, self-tapping stainless-steel screws with the screw sharp end protected, non-corrosive machine screws, or rivets.
1. In outdoor locations, labels shall be applied using two-part epoxy that is weatherproof and sunlight resistant.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade, minimum 24" above the buried conduit or cable.

G. Secure rigid signs using stainless steel screws.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

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SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Daylighting controls.

C. Emergency Lighting Relays.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
   1. Includes finish requirements for wall controls specified in this section.

F. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

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

D. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
2. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
3. Sensor Switch Inc; _____: www.sensorswitch.com/#sle.
4. WattStopper; _____: www.wattstopper.com/#sle.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
   b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
   c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
      c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
      d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      e. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
   2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      c. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
      d. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
   2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

E. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
   a. Description: Low profile occupancy sensors designed for ceiling installation.
   b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
   d. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
   b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

F. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
   a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   b. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

G. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.

H. Accessories:

2.03 DAYLIGHTING CONTROLS

A. Manufacturers:
1. Hubbell Control Solutions; _____: www.hubbell.com/hubbellcontrolsolutions/en/#sle.Hubbell Control Solutions; _____:
2. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
3. Sensor Switch Inc; _____: www.sensorswitch.com/#sle.
4. WattStopper; _____: www.wattstopper.com/#sle.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles.
   b. Atrium Photo Sensors: 200 to 2,500 footcandles.
   c. Skylight Photo Sensors: 1,000 to 6,000 footcandles.
3. Finish: White unless otherwise indicated.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   3. Control Capability:

F. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
   3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
   4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
   5. Output Voltage: Compatible with specified dimming ballasts.

G. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.
   3. Load Ratings: As required to control the load indicated on drawings.

H. Accessories:
   1. Where indicated, provide compatible accessory wall switches for manual override control.

2.04 EMERGENCY LIGHTING RELAY / GENERATOR TR

A. Description: Allow local switching and/or dimming of designated luminaires under normal operation. when loss of normal power is sensed on the lighting branch circuit, the transfer device shall bypass the local controls and power the fixture to full on condition directly to the emergency lighting circuit / battery back up regardless of local

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
   1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 260553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION 260923

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SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
   1. Includes requirements for the seismic qualification of equipment specified in this section.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

G. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; _____: www.eaton.com/#sle.

B. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
      b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating as indicated on the drawings.
   2. Listed series ratings are not acceptable.

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide 200 percent rated neutral bus and lugs where indicated.
   3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Provide separate isolated/insulated ground bus where indicated.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R Type 3R and Type 4X as indicated on drawings
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide removable end walls for NEMA Type 1 enclosures.
      d. Provide painted steel boxes for surface-mounted panelboards where exposed to public view, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

M. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
   1. Ampere Rating: Not less than ampere rating of panelboard bus.
   2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
   3. Coil Voltage: As required for connection to control system indicated.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

O. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type for circuit breakers frame sizes 125A and smaller
   2. Provide bolt-on type for circuit breakers frame sizes 125A and larger; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide door-in-door trim with full lengthed piano hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with full lengthed piano hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
   1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
   2. Fuse Clips: As required to accept indicated fuses.

a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.

B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 22,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 25,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

9. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 260526.
    1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
    2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

K. Install all field-installed branch devices, components, and accessories.

L. Provide fuses complying with Section 262813 for fusible switches as indicated.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
    1. Fire detection and alarm circuits.

Q. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

B. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.16 - Boxes for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.

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

F. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.

G. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.

H. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

I. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.

C. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.
   1. Final color and finish shall be selected by Architect at submittal review.

B. Wiring Devices, Unless Otherwise Indicated: Ivory with stainless steel wall plate.

C. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover.

2.03 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.04 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Jumbo (minimum).
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

D. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in

use with attachment plugs connected and identified as extra-duty type.

1. Nonmetallic covers are not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
    a. Mount receptacles occurring over countertops horizontally.
2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Receptacles shall be secured to the outlet box without depending on the cover to pull them tight.

L. Back-to-back receptacles shall be offset a minimum of 24 inches O.C. (no thru-wall boxes shall be used).

M. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

N. Do not share neutral conductor on branch circuits utilizing wall dimmers.

O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Identify wiring devices in accordance with Section 26 0553.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 262413 - Switchboards: Fusible switches.

C. Section 262419 - Motor-Control Centers: Fusible switches.

D. Section 262513 - Low-Voltage Busways: Fusible switches.

E. Section 262816.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

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

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Switchboards: See Section 262413.
      b. Fusible Switches for Motor Control Centers: See Section 262419.
      c. Fusible Switches for Busway: See Section 262501.
      d. Fusible Enclosed Switches: See Section 262816.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

C. General Purpose Branch Circuits: Class RK1, time-delay.

D. Individual Motor Branch Circuits: Class RK1, time-delay.

E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

F. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class L Fuses: Comply with UL 248-10.

I. Class CC Fuses: Comply with UL 248-4.

J. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.

2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.04 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION 262813

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SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 262513 - Low-Voltage Busways: Fusible switch busway plug-in units.

F. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and

installed features and accessories.
1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Project Record Documents: Record actual locations of enclosed switches.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the

drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 22,000 rms symmetrical amperes.
      b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 4X, stainless steel.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

P. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.
   3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
   4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

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SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 233600 - Air Terminal Units: Air distribution accessories for air handling luminaires.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 260923 - Lighting Control Devices.

G. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

H. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

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

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

L. UL 1598 - Luminaires; Current Edition, Including All Revisions.

M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitutionas part or lighting submittals.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Samples:
   1. Provide one sample(s) of each luminaire proposed for substitution upon request.
   2. Provide one sample(s) of each product finish illustrating color and texture upon request.

E. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

F. Field quality control reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year full warranty for batteries for emergency lighting units. Life time warrenty for LEDs.

D. Provide 3-year fill warranty and seven year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements except where individual luminaire type(s) are designated with substitutions not permitted.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

K. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free Nickel metal hydride (NiMH) unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

1. Self-Powered Exit Signs:
    a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
    b. Battery: Sealed, maintenance-free, Nickel metal hydride (NiMH) unless otherwise indicated.
    c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
    d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
    e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

C. Accessories:
1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.05 DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
    a. Wall Dimmers: See Section 262726.
    b. Daylighting Controls: See Section 260923.

2.06 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Fire-Rated Luminaire Enclosures:
1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

M. Exit Signs:
   1. Install lock-on device on branch circuit breaker serving units.

N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, LED's or drivers that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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SECTION 284601
FIRE ALARM SYSTEM (EXISTING SYSTEM)

PART 1 - GENERAL

1.01 SCOPE & RELATED DOCUMENTS

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the modifications and additions to the existing Fire Alarm System(s) as shown on the drawings and as herein specified.

B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

C. The complete installation is to conform to the applicable sections of NFPA-72, NFPA-71, Local Code Requirements and National Electrical Code with particular attention to Article 760.

D. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of the SBCCI Standard Building Code.

E. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

F. The contractor shall provide all required modifications and additions to the existing Fire Alarm System for the removal, relocation of existing devices and addition of new devices. This shall include all additional wiring, devices, modifications to the existing control panel, additional components and modules, addressable cards, testing, troubleshooting and instructions to the owner.

1.02 QUALITY ASSURANCE

A. Each and all items of the Fire Alarm System shall be listed compatible with the existing system under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable

B. All items shall match and be of the same manufacturer as the existing system.

C. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type (software driven) of equipment for at least ten (10) years, and has a fully-equipped service organization within thirty-five (35) miles of the installation.

D. All control equipment must have transient protection devices to comply with UL864 requirements.

E. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.

F. Supplier shall provide documentation that fire alarm technicians are NICET LEVEL 2 certified (minimum of four).

G. Suppliers' service organization must have been established in the local area for a minimum of ten (10) years with ten (10) years experience on specific equipment brand supplied.

1.03 SUBMITTALS

A. Submit shop drawings for each piece of equipment specified including complete wiring and connection diagrams.

B. All submittals shall be submitted in a single complete brochure, which shall be in the form of a soft cover binder with each group separated be an identified index tab.

C. Submittals that fail to comply with the above requirements will automatically be rejected.

D. It is the Contractor's responsibility to provide submittals in an organized and timely manner in order so as not to delay the project schedule and hamper the work of other trades.

E. Submit certificate of Fire Alarm System operating tests.

PART 2 PRODUCTS

2.01 PERIPHERAL DEVICES

A. The Contractor shall furnish and install addressable devices that are compatible with the existing Simplex 4100U Fire Alarm System.

B. Devices Required but not limited to:
1. Manual Pull Stations
2. Smoke Detectors
3. Duct Smoke Detectors
4. Heat Detectors
5. Combination Speaker/Strobe Stations
6. Visual Alarm (Strobe) Stations
7. Auxiliary contacts on devices where indicated on drawings.
8. Magnetic fire door holds
9. Power Supplies
10. Addressable Relay modules

2.02 MAGNETIC DOOR HOLDERS

A. Description: Units shall be listed to UL 228. Units shall be equipped for wall or floor mounting as indicated on plans and are complete with matching door plate and extension arms as required. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source from fire alarm panel. Magnets must develop a minimum of 25 lbs. holding force for any of these voltages.

B. Material and Finish: Match door hardware. All final hardware material and finishes must be coordinate with the GC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and install all devices in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor.
1. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.

B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

C. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

D. The manufacturer's authorized representative shall provide on-site supervision of installation.

3.02 TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.

3.03 WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION 284601

SECTION 323113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Posts, rails, and frames.

B. Wire fabric.

C. Concrete.

D. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022a.

B. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.

C. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Line Posts: 2-1 inch diameter.

B. Corner and Terminal Posts: 3 inch diameter.

C. Gate Posts: 4-1/2 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.

F. Fabric: 2 inch diamond mesh interwoven wire, 6 gauge, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

G. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.

H. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

A. Posts, Rails, and Frames: _____:
   1. Line Posts: Type I round in accordance with FS RR-F-191/1D.
   2. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.

B. Wire Fabric: _____:

C. Concrete: _____:
   1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; ____ inch nominal size aggregate.

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.

C. Privacy Slats: Aluminum strips, sized to fit fabric weave.
   1. Products:
      a. PrivacyLink; Aluminum Slats: www.eprivacylink.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.04 FINISHES

A. Accessories: Same finish as framing.

B. Color(s): To be selected by Architect from manufacturer's standard range.

C. Color(s): Medium green.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris and _____.

3.02 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

3.03 TOLERANCES

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

3.05 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION 323113

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