EDMUNDS SCHOOL

ENCLOSURE REPAIRS &
MECHANICAL SYSTEM UPGRADES

CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS

July 2023

BGS Project Number: 3355

ISSUED FOR BID
NOT FOR CONSTRUCTION

DuBois & King inc.

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Section name *number of pages*

Section name *number of pages*

DIVISION 01 □ GENERAL REQUIREMENTS

DIVISION 22 □ PLUMBING

DIVISION 23 □ HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

DIVISION 26 □ ELECTRICAL

00 11 13
Notice to Contractors

Edmunds School Enclosure Repairs & Mechanical Systems Upgrades

BGS Project No. 3355

Building enclosure & mechanical systems upgrades at the Edmunds School in Edmunds Township, Maine.

The cost of the work is approximately $ 1,000,000. The contract shall designate the Substantial Completion Date on or before *30 August 2024*, and the Contract Final Completion Date on or before *16 August 2024*.

1. Submit bids on a completed Contractor Bid Form, plus bid security when required, all scanned and included as an attachment to an email with the subject line marked "**Bid for *Edmunds School Enclosure Repair & Mechanical Systems Upgrades***" and addressed to the Bid Administrator at: BGS.Architect@Maine.gov, so as to be received no later than **2:00:00 p.m.** on ***August 15, 2023 opening***.

   Bid submissions will be opened and read aloud at the time and date noted above at the Bureau of General Services office, accessible as a video conference call. Those who wish to participate in the call must submit a request for access to BGS.Architect@Maine.gov.

   Any bid received after the noted time will not be considered a valid bid and will remain unopened. Any bid submitted by any other means will not be considered a valid bid. The Bid Administrator may require the Bidder to surrender a valid paper copy of the bid form or the bid security document in certain circumstances.

   Questions on the bid opening process shall be addressed to the Bid Administrator: Joseph H. Ostwald, Director, Division of Planning, Design & Construction, Bureau of General Services, 77 State House Station, Augusta, Maine 04333-0077, BGS.Architect@Maine.gov.

2. The bid shall be submitted on the Contractor Bid Form (section 00 41 13) provided in the Bid Documents. The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.

3. Bid security *is required* on this project.
   If noted above as required, the Bidder shall include a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with the completed bid form submitted to the Owner. The Bid Bond form is available on the BGS website.

4. Performance and Payment Bonds *are required* on this project.
   If noted above as required, or if any combination of Base Bid and Alternate Bids amounts selected in the award of the contract exceeds $125,000.00, the selected Contractor shall furnish a 100% contract Performance Bond (section 00 61 13.13) and a 100% contract Payment Bond (section 00 61 13.16) in the contract amount to cover the execution of the Work. Bond forms are available on the BGS website.

5. Filed Sub-bids *are not required* on this project.

00 11 13
Notice to Contractors

6. There *are no* Pre-qualified General Contractors on this project.
   If Pre-qualified General Contractors are identified for this project, the name of each company, with their city and state, are listed below.

7. An on-site pre-bid conference *will* be conducted for this project.
   If a pre-bid conference is scheduled, it is *optional* for General Contractors and optional for Subcontractors and suppliers. Contractors who arrive late or leave early for a mandatory meeting may be prohibited from participating in this meeting and bidding. *August 3, 2023 at 2 p.m. at the Edmunds School in Edmunds Township, Maine*.

8. Bid Documents - full sets only - will be available on or about *July 24, 2023* and may be obtained from:
   Print Bangor
   8 Central Street
   Bangor, Maine 04401e
   Electronic contract documents (PDFs) can be obtained free-of-charge from DuBois & King Inc. at www.dubois-king.com/projects-bidding-active

9. Bid Documents may be examined at:
   AGC Maine
   188 Whitten Road
   Augusta, ME 04330
   Phone 207-622-4741 Fax 207-622-1625

   Construction Summary
   734 Chestnut Street
   Manchester, NH 03104
   Phone 603-627-8856 Fax 603-627-4524

00 21 13
Instructions to Bidders

1. Bidder Requirements

1.1 A bidder is a Contractor which is evidently qualified, or has been specifically pre-qualified by the Bureau of General Services, to bid on the proposed project described in the Bid Documents.

1.2 Contractors and Subcontractors bidding on projects that utilize Filed Sub-bids shall follow the requirements outlined in these Bid Documents for such projects. See Section 00 22 13 for additional information.

1.3 Contractors and Subcontractors are not eligible to bid on the project when their access to project design documents prior to the bid period distribution of documents creates an unfair bidding advantage. Prohibited access includes consultation with the Owner or with design professionals engaged by the Owner regarding cost estimating, constructability review, or project scheduling. This prohibition to bid applies to open, competitive bidding or pre-qualified contractor bidding or Filed Sub-bidding. The Bureau may require additional information to determine if the activities of a Contractor constitute an unfair bidding advantage.

1.4 Each bidder is responsible for becoming thoroughly familiar with the Bid Documents prior to submitting a bid. The failure of a bidder to review evident site conditions, to attend available pre-bid conferences, or to receive, examine, or act on addenda to the Bid Documents shall not relieve that bidder from any obligation with respect to their bid or the execution of the work as a Contractor.

1.5 Prior to the award of the contract, General Contractor bidders or Filed Sub-bidders may be required to provide documented evidence to the Owner or the Bureau showing compliance with the provisions of this section, their business experience, financial capability, or performance on previous projects.

1.6 The selected General Contractor bidder will be required to provide proof of insurance before a contract can be executed.

1.7 Contracts developed from this bid shall not be assigned, sublet or transferred without the written consent of the Owner.

1.8 By submitting a bid the Contractor attests that it has not been declared ineligible to bid on State of Maine projects. The Director of the Bureau of General Services may disallow award of this contract to any Contractor if there is evidence that the Contractor or any of its Subcontractors, through their own fault, have been terminated, suspended for cause, debarred from bidding, agreed to refrain from bidding as part of a settlement, have defaulted on a contract, or had a contract completed by another party.

1.9 The Contractor attests that it is not presently indicted for or otherwise criminally or civilly charged by a Federal, State or local government entity with commission of any of the following offenses and has not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction, or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

1.10 The Contractor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs or State of Maine projects.

2. Authority of Owner

2.1 The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.

2.2 Subject to the Owner's stated right to accept or reject any or all bids, the Contractor shall be selected on the basis of the lowest dollar value of an acceptable Base Bid, or any combination of Base Bid plus Alternate Bids, as well as other limited cost modifications the Owner determines may best serve the interests of the Owner. An acceptable bid is a duly submitted bid from a responsive and responsible bidder.

2.3 The Owner reserves the right to require Bid Bonds or Performance and Payment Bonds for any project of any contract value.

3. Submitting Bids and Bid Requirements

3.1 Each bid shall be submitted on the forms provided in the Bid Documents.

3.2 Each bid shall be valid for a period of thirty calendar days following the Project bid closing date and time. The bid expiration date may be extended in unusual circumstances by mutual consent of the Bidder and the Owner. The bid amount shall not be modified due to the bid expiration date extension.

3.3 Any provision contained in a bid which shows cost escalation, or any modification of schedule or other requirements shall not be accepted. Such a provision causes the bid to be invalid, or, at the discretion of the Owner and BGS, that element of the bid submission may be disregarded for the purpose of awarding the contract without that provision.

3.4 Bidders shall include a Bid Bond or other approved bid security with the bid form submitted to the Owner when the bid form indicates such bid security is required. The bond value shall be 5% of the bid amount. The form of bond is shown in section 00 43 13.

3.5 Bidders recognize that inclusion of contract bonds and the cost of those bonds is dependent on the awarded contract dollar value. Therefore, a Base Bid, or any combination of Base Bid plus Alternate Bids, as well as other limited cost modifications, resulting in a contract award shall include the cost of Performance and Payment Bonds in the submitted bid amount when the construction contract value is over $125,000.00. Similarly, the cost of Performance and Payment Bonds is excluded in the submitted bid amount when the construction contract value is $125,000.00 or less unless bonds are specifically required by the Bid Documents. When required for the project, the selected Contractor shall provide these bonds before a contract can be executed, pursuant to 14 M.R.S.A., Section 871, Public Works Contractors' Surety Bond Law of 1971, subsection 3. The form of bonds is shown in section 00 61 13.13 and 00 61 13.16.

3.6 Bidders may modify bids in writing, by the same means as the original bid submission, prior to the bid closing time. Such written amendments shall not disclose the amount of the initial bid. If so disclosed, the entire bid is considered invalid.

3.7 Bidders implicitly acknowledge all Addenda issued when they submit the bid form. By usual practice the Consultant shall not issue Addenda less than 72 hours prior to the bid closing time, to allow ample time for bidders to incorporate the information. However, some information, such as extending the bid due date and time, may be issued with shorter notice. Addenda shall be issued to all companies who are registered holders of Bid Documents.

3.8 A bid may be withdrawn without penalty if a written request by the bidder is presented to the Owner prior to the bid closing time. Such written withdrawal requests are subject to verification as required by the Bureau.

A bid may be withdrawn without penalty after the bid closing time if, in the determination of the Bureau, evidence provided by the Contractor shows an apparent unintended error such as a miscalculation, or an erroneous number on estimating documents, was the cause of an inaccurate bid. The Bureau may allow withdrawal in consideration of the bid bond or, without utilizing a bid bond, if the Bureau considers documented evidence provided by the Contractor shows factual errors had been made on the bid form.

3.9 In the event State of Maine Offices unexpectedly close on the published date of a public bid opening in the location of that bid opening, prior to the time of the scheduled deadline, the new deadline for the public bid opening will be the following business day at the originally scheduled hour of the day, at the original location. Official closings are posted on the State of Maine government website.

3.10 The Owner may require, in a Notice of Intent to Award letter to the apparent low bidder, a Schedule of Values, Project Schedule, and List of Subcontractors and Suppliers as both a demonstration of capability of the Bidder and as a condition of award.

3.11 Projects which require a State of Maine wage determination will include that schedule as part of the Bid Documents. See section 00 73 46, if such rates are required.

3.12 Projects which require compliance with the Davis-Bacon Act are subject to the regulations contained the Code for Federal Regulations and the federal wage determination which is made a part of the Bid Documents. See section 00 73 46, if such rates are required.

3.13 The Owner is exempt from the payment of Maine State sales and use taxes as provided in 36 M.R.S. §1760 (1). The Contractor and Subcontractors shall not include taxes on exempt items in the construction contract.

00 41 13
Contractor Bid Form

Edmunds School Building Enclosure Repairs & Mechanical Systems Upgrades

BGS No. 3355

Bid Form submitted by: *email only to email address below*

Bid Administrator:
Jill Instasi BGS.Architect@Maine.gov
Bureau of General Services
111 Sewall Street, Cross State Office Building, 4th floor
77 State House Station
Augusta, Maine 04333-0077

Bidder:

Signature: _____

Printed name and title: _____

Company name: _____

Mailing address: _____

City, state, zip code: _____

Phone number: _____

Email address: _____

State of incorporation, if a corporation: _____

List of all partners, if a partnership: _____

The Bidder agrees, if the Owner offers to award the contract, to provide any and all bonds and certificates of insurance, as well as Schedule of Values, Project Schedule, and List of Subcontractors and Suppliers if required by the Owner, and to sign the designated Construction Contract within twelve calendar days after the date of notification of such acceptance, except if the twelfth day falls on a State of Maine government holiday or other closure day, or a Saturday, or a Sunday, in which case the aforementioned documents must be received before 12:00 noon on the first available business day following the holiday, other closure day, Saturday, or Sunday.

As a guarantee thereof, the Bidder submits, together with this bid, a bid bond or other acceptable instrument as and if required by the Bid Documents.

00 41 13
Contractor Bid Form

1. The Bidder, having carefully examined the *Edmunds School Enclosure Repairs & Mechanical Systems Upgrades* Project Manual dated *July 21, 2023*, prepared by *DuBois & King Inc.*, as well as Specifications, Drawings, and any Addenda, the form of contract, and the premises and conditions relating to the work, proposes to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this project for the **Base Bid** amount of:

   $ _____ .00

2. Allowances *are not included* on this project.
   No Allowances

   $ *0*.00

3. Alternate Bids *are not included* on this project.
   No Alternate Bids
   Any dollar amount line below that is left blank by the Bidder shall be read as a bid of **$0.00**.

   1 *not used* $ _____ .00

   2 *not used* $ _____ .00

   3 *not used* $ _____ .00

   4 *not used* $ _____ .00

4. Bid security *is required* on this project.
   If noted above as required, or if the Base Bid amount exceeds $125,000.00, the Bidder shall include with this bid form a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with this completed bid form submitted to the Owner.

5. Filed Sub-bids *are not required* on this project.
   If noted above as required, the Bidder shall include with this bid form a list of each Filed Sub-bidder selected by the Bidder on the form provided (section 00 41 13F).

00 43 13
Contractor Bid Bond

Bond No.: **insert bond number**

We, the undersigned, ***insert company name of Contractor***, ***select type of entity*** of ***insert name of municipality*** in the State of ***insert name of state*** as principal, and ***insert name of surety*** as Surety, are hereby held and firmly bound unto ***select title of obligee*** in the penal sum of ***five percent of the bid amount***, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the same date as that of the first specified bid due date, or subsequent bid due date revised by addendum.

The condition of the above obligation is such that whereas the principal has submitted to the Owner, or State of Maine, to a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the construction of ***insert name of project as designated in the contract documents***

Now therefore:

If said bid shall be rejected, or, in the alternate,

If said bid shall be accepted and the principal shall execute and deliver a contract in the form of contract attached hereto, properly completed in accordance with said bid, and shall furnish a bond for the faithful performance of said contract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time within which the Obligee may accept such bid and said Surety does hereby waive notice of any such extension.

00 43 13
Contractor Bid Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the first specified bid due date, or subsequent bid due date revised by addendum.

Contractor

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

Surety

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

AdvantageME CT# _____

S□□□□ □□M□□□□
CONSTRUCTION CONTRACT

Large Construction Project

This form is used when the Contract value is $50,000 or greater.
The Project Manual, Specifications and Drawings, and any Addenda are considered part of this Contract.

Agreement entered into by and between the ***insert contracting entity name*** hereinafter called the ***Owner*** and ***insert Contractor company name*** hereinafter called the ***Contractor***.

BGS Project No.: ***insert number assigned by BGS*** Other Project No.: _____

For the following Project: ***title of project shown on documents*** at ***facility or campus name***, ***municipality***, Maine.

The Specifications and the Drawings have been prepared by ***firm name***, acting as Professional-of-Record and named in the documents as the Consultant Architect or Engineer.

The *Owner* and *Contractor* agree as follows:

ARTICLE 1 COMPENSATION AND PAYMENTS

1.1 The Owner shall pay the Contractor to furnish all labor, equipment, materials and incidentals necessary for the construction of the Work described in the Specifications and shown on the Drawings the Contract Amount as shown below.

Base Bid	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Total Contract Amount	***$0.00***

1.2 The Contractor's requisition shall contain sufficient detail and supporting information for the Owner to evaluate and support the payment requested.

1.2.1 Payments are due and payable twenty-five working days from the date of receipt of a Contractor requisition which is approved by the Owner.

1.2.2 Provisions for late payments are governed by 5 M.R.S. Chapter 144, *Payment of Invoices Received from Business Concerns,* and interest shall be calculated at 1% per month.

ARTICLE 2 COMMENCEMENT AND COMPLETION DATES

2.1 The Work of this Contract shall commence no sooner than the date this document is executed by the approval authority, or a subsequent date designated in the contract documents.

2.2 The Substantial Completion Date shall be ***15 December 2023***.

2.3 The Work of this Contract shall be completed on or before the Contract Final Completion Date of ***31 December 2023***.

2.4 The Contract Expiration Date shall be ***29 February 2024***. (This date is the Owner's deadline for internal management of contract accounts. The Contract Expiration Date does not directly relate to any contract obligation of the Contractor.)

ARTICLE 3 INELIGIBLE BIDDER

3.1 By signing this contract the Contractor attests that it has not been declared ineligible to bid on State of Maine projects. The Bureau of General Services may disallow award of this contract to any Contractor if there is evidence that the Contractor or any of its Subcontractors, through their own fault, have been terminated, suspended for cause, debarred from bidding, agreed to refrain from bidding as part of a settlement, have defaulted on a contract, or had a contract completed by another party.

3.2 By signing this contract the Contractor attests that it is not presently indicted for or otherwise criminally or civilly charged by a Federal, State or local government entity with commission of any of the following offenses and has not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction, or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

3.3 The Contractor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs or State of Maine projects.

ARTICLE 4 CONTRACTOR'S RESPONSIBILITIES

4.1 On this project, the Contractor ***shall*** furnish the Owner the appropriate contract bonds in the amount of 100% of the Contract Sum. Contract bonds are mandated if the Contract Sum exceeds $125,000, or if bonds are specifically required by the Contract Documents.

4.2 The Contractor shall comply with all laws, codes and regulations applicable to the Work.

4.3 The Contractor shall acquire all permits and third-party approvals applicable to the Work not specifically identified as provided by the Owner. Costs for Contractor-provided permits and third-party approvals shall be included in the Contract Sum identified in Section 1.1 above.

4.4 The Contractor shall remain an independent agent for the duration of this Contract, shall not become an employee of the State of Maine, and shall assure that no State employee will be compensated by, or otherwise benefit from, this Contract.

4.5 The Contractor shall be responsible for any design cost, construction cost, or other cost incurred on the Project to the extent caused by the negligent acts, errors or omissions of the Contractor or their Subcontractors in the performance of Work under this Contract.

ARTICLE 5 OWNER'S RESPONSIBILITIES

5.1 The Owner shall provide full information about the objectives, schedule, constraints and existing conditions of the project. The Owner has established a budget with reasonable contingencies that meets the project requirements.

5.2 By signing this contract, the Owner attests that all State of Maine procurement requirements for this contract have been met, including the solicitation of competitive bids.

ARTICLE 6 INSTRUMENTS OF SERVICE

6.1 The Contractor's use of the drawings, specifications and other documents known as the Consultant's Instruments of Service is limited to the execution of the Contractor's scope of work of this project unless the Contractor receives the written consent of the Owner and Consultant for use elsewhere.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 This Contract shall be governed by the laws of the State of Maine.

7.2 The Owner and Contractor, respectively, bind themselves, their partners, successors, assigns and legal representatives to this Contract. Neither party to this Contract shall assign the Contract as a whole without written consent of the other party, which consent the Owner may withhold without cause.

7.3 Notwithstanding any other provision of this Agreement, if the Owner does not receive sufficient funds to fund this Agreement or funds are de-appropriated, or if the Owner does not receive legal authority from the Maine State Legislature or Maine Courts to expend funds intended for this Agreement, then the Owner is not obligated to make payment under this Agreement; provided, however, the Owner shall be obligated to pay for services satisfactorily performed prior to any such non-appropriation in accordance with the termination provisions of this Agreement. The Owner shall timely notify the Contractor of any non-appropriation and the effective date of the non-appropriation.

ARTICLE 8 CONTRACT DOCUMENTS

8.1 The Project Manual, Specifications and Drawings, and any Addenda, together with this agreement, form the contract. Each element is as fully a part of the Contract as if hereto attached or herein repeated.

8.2 Specifications: ***indicate date of issuance of project manual***

8.3 Drawings: ***note each sheet number and title***

8.4 Addenda: ***note each addenda number and date, or "none"***

BGS Project No.: _____

The Contract is effective as of the date executed by the approval authority.

OWNER	CONTRACTOR
Signature *Date* *name and title* *name of contracting entity* *address* *telephone* *email address*	*Signature* *Date* *name and title* *name of contractor company* *address* *telephone* *email address* *Vendor Number*

Indicate the names of the review and approval individuals appropriate to the approval authority.

select proper approval authority	
Reviewed by:	Approved by:
Signature *Date* *insert name*	*Signature* *Date* *Joseph H. Ostwald*
Project Manager/ Contract Administrator	*Director, Planning, Design & Construction*

00 61 13.13
Contractor Performance Bond

Bond No.: **insert bond number**

We, the undersigned, ***insert company name of Contractor***, ***select type of entity*** of ***insert name of municipality*** in the State of ***insert name of state*** as principal, and ***insert name of surety*** as Surety, are hereby held and firmly bound unto ***select title of obligee*** in the penal sum of the Contract Price $ ***insert the Contract Price in numbers*** for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly and faithfully perform the contract entered into this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract, for the construction of ***insert name of project as designated in the contract documents***, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

00 61 13.13
Contractor Performance Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract.

Contractor

_____

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

Surety

_____

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 61 13.16
Contractor Payment Bond

Bond No.: **insert bond number**

We, the undersigned, ***insert company name of Contractor***, ***select type of entity*** of ***insert name of municipality*** in the State of ***insert name of state*** as principal, and ***insert name of surety*** as Surety, are hereby held and firmly bound unto ***select title of obligee*** in the penal sum of the Contract Price $ ***insert the Contract Price in numbers*** for the use and benefit of claimants, defined as an entity having a contract with the principal or with a subcontractor of the principal for labor, materials, or both labor and materials, used or reasonably required for use in the performance of the contract, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly satisfy all claims and demands incurred for all labor and materials, used or required by the principal in connection with the work described in the contract entered into this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract, for the construction of ***insert name of project as designated in the contract documents***, and shall fully reimburse the obligee for all outlay and expense with said obligee may incur in making good any default of said principal, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

00 61 13.16
Contractor Payment Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this ***insert date, i.e.: 8th*** day of ***select month***, ***select year***, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract.

Contractor

_____

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

Surety

_____

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 71 00
Definitions

1. Definitions

1.1 *Addendum*: A document issued by the Consultant that amends the Bid Documents. Addenda shall not be issued less than seventy-two hours prior to the specified bid opening time.

1.2 *Allowance*: A specified dollar amount for a particular scope of work or service included in the Work that is identified in the Bid Documents and included in each Bidder's Bid. The Contractor shall document expenditures for an Allowance during the Project. Any unused balance shall be credited to the Owner. The Contractor is responsible for notifying the Owner of anticipated expenses greater than the specified amount and the Owner is responsible for those additional expenses.

1.3 *Alternate Bid*: The Contractor's written offer of a specified dollar amount, submitted on the Bid Form, for the performance of a particular scope of work described in the Bid Documents. The Owner determines the low bidder based on the sum of the base Bid and any combination of Alternate Bids that the Owner selects.

1.4 *Architect*: A Consultant acting as, or supporting, the Professional-of-Record who is responsible for the design of the Project. Equivalent to "Consultant" in State of Maine contract forms.

1.5 *Architectural Supplemental Instruction (ASI)*: A written instruction from the Architect for the purpose of clarification of the Contract Documents. An ASI does not alter the Contract Price or Contract Time. ASIs may be responses to RFIs and shall be issued by the Architect in a timely manner to avoid any negative impact on the Schedule of the Work.

1.6 *Bid*: The Contractor's written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of the Work. A Bid may include bonds or other requirements. A base Bid is separate and distinct from Alternate Bids, being the only cost component necessary for the award of the contract, and representing the minimum amount of Work that is essential for the functioning of the Project.

1.7 *Bid Bond*: The security designated in the Bid Documents, furnished by Bidders as a guaranty of good faith to enter into a contract with the Owner, should a contract be awarded to that Bidder.

1.8 *Bidder*: Any business entity, individual or corporation that submits a bid for the performance of the work described in the Bid Documents, acting directly or through a duly authorized representative. See also *Responsive and Responsible Bidder*.

1.9 *Bid Documents*: The drawings, procurement and contracting requirements, general requirements, and the written specifications -including all addenda, that a bidder is required to reference in the submission of a bid.

1.10 *Bureau*: The State of Maine Bureau of General Services, or BGS, in the Department of Administrative and Financial Services.

1.11 *Calendar days*: Consecutive days, as occurring on a calendar, taking into account each day of the week, month, year, and any religious, national or local holidays. Calendar days are used for changes in Contract Time.

1.12 *Certificate of Substantial Completion*: A document developed by the Consultant that describes the final status of the Work and establishes the date that the Owner may use the facility for its intended purpose. The Certificate of Substantial Completion may also include a provisional list of items - a "punch list" - remaining to be completed by the Contractor. The Certificate of Substantial Completion identifies the date from which the project warranty period commences.

1.13 *Certificate of Occupancy*: A document developed by a local jurisdiction such as the Code Enforcement Officer that grants permission to the Owner to occupy a building.

1.14 *Change Order (CO)*: A document that modifies the contract and establishes the basis of a specific adjustment to the Contract Price or the Contract Time, or both. Change Orders may address correction of omissions, errors, and document discrepancies, or additional requirements. Change Orders should include all labor, materials and incidentals required to complete the work described. A Change Order is not valid until signed by the Contractor, Owner and Consultant and approved by the Bureau.

1.15 *Change Order Proposal (COP) (see also Proposal)*: Contract change proposed by the Contractor regarding the contract amount, requirements, or time. The Contractor implements the work of a COP after it is accepted by all parties. Accepted COPs are incorporated into the contract by Change Order.

1.16 *Clerk of the Works*: The authorized representative of the Consultant on the job site. Clerk of the Works is sometimes called the Architect's representative.

1.17 *Construction Change Directive (CCD)*: A written order prepared by the Consultant and signed by the Owner and Consultant, directing a change in the Work prior to final agreement with the Contractor on adjustment, if any, in the Contract Price or Contract Time, or both.

1.18 *Contract*: A written agreement between the Owner and the successful bidder which obligates the Contractor to perform the work specified in the Contract Documents and obligates the Owner to compensate the Contractor at the mutually accepted sum, rates or prices.

1.19 *Contract Bonds (also known as Payment and Performance Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.

1.20 *Contract Documents*: The drawings and written specifications (including all addenda), Standard General Conditions, and the contract (including all Change Orders subsequently incorporated in the documents).

1.21 *Contract Expiration Date*: Date determined by the Owner as a deadline for internal management of contract accounts. This allows time after the Contract Final Completion Date for processing the final Requisition for Payment. The Contract Expiration Date does not directly relate to any contract obligation of the Contractor.

1.22 *Contract Final Completion Date*: Point of time when the Work is fully completed in compliance with the Contract Documents, as certified by the Consultant. Final payment to the Contractor is due upon Final Completion of the Project.

1.23 *Contract Price*: The dollar amount of the construction contract, also called *Contract Sum*.

1.24 *Contract Time*: The designated duration of time to execute the Work of the contract, with a specific date for completion.

1.25 *Contractor*: Also called the "General Contractor" or "GC" the individual or entity undertaking the execution of the general contract work under the terms of the contract with the Owner, acting directly or through a duly authorized representative. The Contractor is responsible for the means, methods and materials utilized in the execution and completion of the Work.

1.26 *Consultant*: The Architect or Engineer acting as Professional-of-Record for the Project. The Consultant is responsible for the design of the Project.

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

1.28 *Engineer*: A Consultant acting as, or supporting, the Professional-of-Record who is responsible for the design of the Project. Equivalent to “Consultant” in State of Maine contract forms.

1.29 *Filed Sub-bid*: The designated major Subcontractor's (or, in some cases, Contractor’s) written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of a particular portion of the Work. A Filed Sub-bid may include bonds or other requirements.

1.30 *General Requirements*: The on-site overhead expense items the Contractor provides for the Project, typically including, but not limited to, building permits, construction supervision, Contract Bonds, insurance, field office, temporary utilities, rubbish removal, and site fencing. Overhead expenses of the Contractor's general operation are not included. Sometimes referred to as the Contractor's General Conditions.

1.31 *Owner*: The State agency which is represented by duly authorized individuals. The Owner is responsible for defining the scope of the Project and compensation to the Consultant and Contractor.

1.32 *Owner’s Representative*: The individual or entity contracted by the Owner to be an advisor and information conduit regarding the Project.

1.33 *Overhead*: General and administrative expenses of the Contractor’s principal and branch offices, including payroll costs and other compensation of Contractor employees, deductibles paid on any insurance policy, charges against the Contractor for delinquent payments, and costs related to the correction of defective work, and the Contractor’s capital expenses, including interest on capital used for the work.

1.34 *Performance and Payment Bonds (also known as Contract Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.

1.35 *Post-Bid Addendum*: Document issued by the Consultant that defines a potential Change Order prior to signing of the construction contract. The Post-Bid Addendum allows the Owner to negotiate

contract changes with the Bidder submitting the lowest valid bid, only if the negotiated changes to the Bid Documents result in no change or no increase in the bid price.

A Post-Bid Addendum may also be issued after a competitive construction Bid opening to those Bidders who submitted a Bid initially, for the purpose of rebidding the Project work without re-advertising.

1.36 *Project*: The construction project proposed by the Owner to be constructed according to the Contract Documents. The Project, a public improvement, may be tied logistically to other public improvements and other activities conducted by the Owner or other contractors.

1.37 *Proposal (see also Change Order Proposal)*: The Contractor's written offer submitted to the Owner for consideration containing a specified dollar amount or rate, for a specific scope of work, and including a schedule impact, if any. A proposal shall include all costs for overhead and profit. The Contractor implements the work of a Proposal after it is accepted by all parties. Accepted Proposals are incorporated into the contract by Change Order.

1.38 *Proposal Request (PR)*: An Owner's written request to the Contractor for a Change Order Proposal.

1.39 *Punch List*: A document that identifies the items of work remaining to be done by the Contractor at the Close Out of a Project. The Punch List is created as a result of a final inspection of the work only after the Contractor attests that all of the Work is in its complete and permanent status.

1.40 *Request For Information (RFI)*: A Contractor's written request to the Consultant for clarification, definition or description of the Work. RFIs shall be presented by the Contractor in a timely manner to avoid any negative impact on the Schedule of the Work.

1.41 *Request For Proposal (RFP)*: An Owner's written request to the Contractor for a Change Order Proposal.

1.42 *Requisition for Payment*: The document in which the Contractor certifies that the Work described is, to the best of the Contractor's knowledge, information and belief, complete and that all previous payments have been paid by the Contractor to Subcontractors and suppliers, and that the current requested payment is now due. See *Schedule of Values.*

1.43 *Responsive and Responsible Bidder*: A bidder who complies, when submitting a bid on a given project, with the following *responsive* standards, as required by the Bid Documents:
- submits specific qualifications to bid the project, if required;
- attends mandatory pre-bid conferences, if required;
- submits a bid prior to the close of the bid period;
- submits a complete bid form;
- submits a bid without indications of intent contrary to the stated requirements;
- submits other materials and information, such as bid security, as required;

and, meets the following minimums regarding these *responsible* standards:
- sustains a satisfactory record of project performance;
- maintains a permanent place of business in a known physical location;
- possesses the financial means for short- and long-term operations;
- possesses the appropriate technical experience and capabilities;
- employs adequate personnel and subcontractor resources;

maintains the equipment needed to perform the work;
complies with the proposed implementation schedule;
complies with the insurance and bonding requirements;
provides post-construction warranty coverage;
and other criteria which can be considered relevant to the contract.

1.44 *Retainage*: The amount, calculated at five percent (5%) of the contract value or a scheduled value, that the Owner shall withhold from the Contractor until the work or portion of work is declared substantially complete or otherwise accepted by the Owner. The Owner may, if requested, reduce the amount withheld if the Owner deems it desirable and prudent to do so. (See Title 5 M.R.S.A., Section 1746.)

1.45 *Sample*: A physical example provided by the Contractor which illustrates materials, equipment or workmanship and establishes standards by which the Work will be judged.

1.46 *Schedule of the Work*: The document prepared by the Contractor and approved by the Owner that specifies the dates on which the Contractor plans to begin and complete various parts of the Work, including dates on which information and approvals are required from the Owner.

1.47 *Schedule of Values*: The document prepared by the Contractor and approved by the Owner before the commencement of the Work that specifies the dollar values of discrete portions of the Work equal in sum to the contract amount. The Schedule of Values is used to document progress payments of the Work in regular (usually monthly) requisitions for payment. See *Requisition for Payment*.

1.48 *Shop Drawings*: The drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

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

1.50 *Subcontractor*: An individual or entity undertaking the execution of any part of the Work by virtue of a written agreement with the Contractor or any other Subcontractor. Also, an individual or entity retained by the Contractor or any other Subcontractor as an independent contractor to provide the labor, materials, equipment or services necessary to complete a specific portion of the Work.

1.51 *Substantial Completion Date*: Point of time when the Work or a designated portion of the Work is sufficiently complete in compliance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended purpose without unscheduled disruption. Substantial Completion is documented by the date of the Certificate of Substantial Completion signed by the Owner and the Contractor.

1.52 *Superintendent*: The representative of the Contractor on the job site, authorized by the Contractor to receive and fulfill instructions from the Consultant.

1.53 *Surety*: The individual or entity that is legally bound with the Contractor and Subcontractor to insure the faithful performance of the contract and for the payment of the bills for labor, materials and equipment by the Contractor and Subcontractors.

1.54 *Work*: The construction and services, whether completed or partially completed, including all labor, materials, equipment and services provided or to be provided by the Contractor and Subcontractors to fulfill the requirements of the Project as described in the Contract Documents.

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General Conditions

Table of Contents of this General Conditions Section

1. Preconstruction Conference

1.1 The Contractor shall, upon acceptance of a contract and prior to commencing work, schedule a preconstruction conference with the Owner and Consultant. The purpose of this conference is as follows.

1.1.1 Introduce all parties who have a significant role in the Project, including:
Owner (State agency or other contracting entity)
Owner's Representative
Consultant (Architect or Engineer)
Subconsultants
Clerk-of-the-works
Contractor (GC)
Superintendent
Subcontractors
Other State agencies
Construction testing company
Commissioning agent
Special Inspections agent
Bureau of General Services (BGS);

1.1.2 Review the responsibilities of each party;

1.1.3 Review any previously-identified special provisions of the Project;

1.1.4 Review the Schedule of the Work calendar submitted by the Contractor to be approved by the Owner and Consultant;

1.1.5 Review the Schedule of Values form submitted by the Contractor to be approved by the Owner and Consultant;

1.1.6 Establish routines for Shop Drawing approval, contract changes, requisitions, et cetera;

1.1.7 discuss jobsite issues;

1.1.8 Discuss Project close-out procedures;

1.1.9 Provide an opportunity for clarification of Contract Documents before work begins; and

1.1.10 Schedule regular meetings at appropriate intervals for the review of the progress of the Work.

2. Intent and Correlation of Contract Documents

2.1 The intent of the Contract Documents is to describe the complete Project. The Contract Documents consist of various components; each component complements the others. What is shown as a requirement by any one component shall be inferred as a requirement on all corresponding components.

2.2 The Contractor shall furnish all labor, equipment and materials, tools, transportation, insurance, services, supplies, operations and methods necessary for, and reasonably incidental to, the construction and completion of the Project. Any work that deviates from the Contract Documents which appears to be required by the exigencies of construction or by inconsistencies in the Contract Documents, will be determined by the Consultant and authorized in writing by the Consultant, Owner and the Bureau prior to execution. The Contractor shall be responsible for requesting clarifying information where the intent of the Contract Documents is uncertain.

2.3 The Contractor shall not utilize any apparent error or omission in the Contract Documents to the disadvantage of the Owner. The Contractor shall promptly notify the Consultant in writing of such errors or omissions. The Consultant shall make any corrections or clarifications necessary in such a situation to document the true intent of the Contract Documents.

3. Additional Drawings and Specifications

3.1 Upon the written request of the Contractor, the Owner shall provide, at no expense to the Contractor, up to five sets of printed Drawings and Specifications for the execution of the Work.

3.2 The Consultant shall promptly furnish to the Contractor revised Drawings and Specifications, for the area of the documents where those revisions apply, when corrections or clarifications are made by the Consultant. All such information shall be consistent with, and reasonably inferred from, the Contract Documents. The Contractor shall do no work without the proper Drawings and Specifications.

4. Ownership of Contract Documents

4.1 The designs represented on the Contract Documents are the property of the Consultant. The Drawings and Specifications shall not be used on other work without consent of the Consultant.

5. Permits, Laws, and Regulations

5.1 The Owner is responsible for obtaining any zoning approvals or other similar local project approvals necessary to complete the Work, unless otherwise specified in the Contract Documents.

5.2 The Owner is responsible for obtaining Maine Department of Environmental Protection, Maine Department of Transportation, or other similar state government project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.

5.3 The Owner is responsible for obtaining any federal agency project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.

5.4 The Owner is responsible for obtaining all easements for permanent structures or permanent changes in existing facilities.

5.5 The Contractor is responsible for obtaining and paying for all permits and licenses necessary for the implementation of the Work. The Contractor shall notify the Owner of any delays, variance or restrictions that may result from the issuing of permits and licenses.

5.6 The Contractor shall comply with all ordinances, laws, rules and regulations and make all required notices bearing on the implementation of the Work. In the event the Contractor observes disagreement between the Drawings and Specifications and any ordinances, laws, rules and regulations, the Contractor shall promptly notify the Consultant in writing. Any necessary changes shall be made as provided in the contract for changes in the work. The Contractor shall not perform any work knowing it to be contrary to such ordinances, laws, rules and regulations.

5.7 The Contractor shall comply with local, state and federal regulations regarding construction safety and all other aspects of the Work.

5.8 The Contractor shall comply with the Maine Code of Fair Practices and Affirmative Action, 5 M.R.S. §784 (2).

6. Taxes

6.1 The Owner is exempt from the payment of Maine State sales and use taxes as provided in 36 M.R.S. §1760 (1). The Contractor and Subcontractors shall not include taxes on exempt items in the construction contract.

6.2 Section 1760 further provides in subsection 61 that sales to a construction contractor or its subcontractor of tangible personal property that is to be physically incorporated in, and become a permanent part of, real property for sale to or owned by the Owner, are exempt from Maine State sales and use taxes. Tangible personal property is defined in 36 M.R.S. §1752 (17).

6.3 The Contractor may contact Maine Revenue Services, 24 State House Station, Augusta, Maine 04333 for guidance on tax exempt regulations authorized by 36 M.R.S. §1760 and detailed in Rule 302 (18-125 CMR 302).

7. Labor and Wages

7.1 The Contractor shall conform to the labor laws of the State of Maine, and all other laws, ordinances, and legal requirements affecting the work in Maine.

7.2 The Consultant shall include a wage determination document prepared by the Maine Department of Labor in the Contract Documents for state-funded contracts in excess of $50,000. The document shows the minimum wages required to be paid to each category of labor employed on the project.

7.3 On projects requiring a Maine wage determination, the Contractor shall submit monthly payroll records to the Owner ("the contracting agency") showing the name and occupation of all workers and all independent contractors employed on the project. The monthly submission must also include the Contractor's company name, the title of the project, hours worked, hourly rate or other method of remuneration, and the actual wages or other compensation paid to each person.

7.4 The Contractor shall not reveal, in the payroll records submitted to the Owner, personal information regarding workers and independent contractors, other than the information described above. Such information shall not include Social Security number, employee identification number, or employee address or phone number, for example.

7.5 The Contractor shall conform to Maine statute (39-A M.R.S. §105-A (6)) by providing to the Workers' Compensation Board a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes.

7.6 The Contractor shall enforce strict discipline and good order among their employees at all times, and shall not employ any person unfit or unskilled to do the work assigned to them.

7.7 The Contractor shall promptly pay all employees when their compensation is due, shall promptly pay all others who have billed and are due for materials, supplies and services used in the Work, and shall promptly pay all others who have billed and are due for insurance, workers compensation coverage, federal and state unemployment compensation, and Social Security

charges pertaining to this Project. Before final payments are made, the Contractor shall furnish to the Owner affidavits that all such payments described above have been made.

7.8 The Contractor may contact the Maine Department of Labor, 54 State House Station, Augusta, Maine 04333 for guidance on labor issues.

7.9 The Contractor may contact the Maine Workers' Compensation Board, 27 State House Station, Augusta, Maine 04333 for guidance on workers' compensation issues.

8. Indemnification

8.1 The Contractor shall indemnify and hold harmless the Owner and its officers and employees from and against any and all damages, liabilities, and costs, including reasonable attorney's fees, and defense costs, for any and all injuries to persons or property, including claims for violation of intellectual property rights, to the extent caused by the negligent acts or omissions of the Contractor, its employees, agents, officers or subcontractors in the performance of work under this Agreement. The Contractor shall not be liable for claims to the extent caused by the negligent acts or omissions of the Owner or for actions taken in reasonable reliance on written instructions of the Owner.

8.2 The Contractor shall notify the Owner promptly of all claims arising out of the performance of work under this Agreement by the Contractor, its employees or agents, officers or subcontractors.

8.3 This indemnity provision shall survive the termination of the Agreement, completion of the project or the expiration of the term of the Agreement.

9. Insurance Requirements

9.1 The Contractor shall provide, with each original of the signed Contract, an insurance certificate or certificates acceptable to the Owner and BGS. The Contractor shall submit insurance certificates to the Owner and BGS at the commencement of this Contract and at policy renewal or revision dates. The certificates shall identify the project name and BGS project number, and shall name the Owner as certificate holder and as additional insured for general liability and automobile liability coverages. The submitted forms shall contain a provision that coverage afforded under the insurance policies will not be canceled or materially changed unless at least ten days prior written notice by registered letter has been given to the Owner and BGS.

9.2 The Owner does not warrant or represent that the insurance required herein constitutes an insurance portfolio which adequately addresses all risks faced by the Contractor or its Subcontractors. The Contractor is responsible for the existence, extent and adequacy of insurance prior to commencement of work. The Contractor shall not allow any Subcontractor to commence work until all similar insurance required of the Subcontractor has been confirmed by the Contractor.

9.3 The Contractor shall procure and maintain primary insurance for the duration of the Project and, if written on a Claims-Made basis, shall also procure and maintain Extended Reporting Period (ERP) insurance for the period of time that any claims could be brought. The Contractor shall ensure that all Subcontractors they engage or employ will procure and maintain similar insurance

in form and amount acceptable to the Owner and BGS. At a minimum, the insurance shall be of the types and limits set forth herein protecting the Contractor from claims which may result from the Contractor's execution of the Work, whether such execution be by the Contractor or by those employed by the Contractor or by those for whose acts they may be liable. All required insurance coverages shall be placed with carriers authorized to conduct business in the State of Maine by the Maine Bureau of Insurance.

9.3.1 The Contractor shall have Workers' Compensation insurance for all employees on the Project site in accordance with the requirements of the Workers' Compensation law of the State of Maine. Minimum acceptable limits for Employer's Liability are:

Bodily Injury by Accident.....$500,000
Bodily Injury by Disease.....$500,000 Each Employee
Bodily Injury by Disease.....$500,000 Policy Limit

9.3.2 The Contractor shall have Commercial General Liability insurance providing coverage for bodily injury and property damage liability for all hazards of the Project including premise and operations, products and completed operations, contractual, and personal injury liabilities. The policy shall include collapse and underground coverage as well as explosion coverage if explosion hazards exist. Aggregate limits shall apply on a location or project basis. Minimum acceptable limits are:

General aggregate limit.....$2,000,000
Products and completed operations aggregate $1,000,000
Each occurrence limit.....$1,000,000
Personal injury aggregate.....$1,000,000

9.3.3 The Contractor shall have Automobile Liability insurance against claims for bodily injury, death or property damage resulting from the maintenance, ownership or use of all owned, non-owned and hired automobiles, trucks and trailers. Minimum acceptable limit is:

Any one accident or loss $500,000

9.3.4 For the portion of a project which is new construction, the Contractor shall procure and maintain Builder's Risk insurance naming the Owner, Contractor, and any Subcontractor as insureds as their interest may appear. Covered causes of loss form shall be all Risks of Direct Physical Loss, endorsed to include flood, earthquake, transit and sprinkler leakage where sprinkler coverage is applicable. Unless specifically authorized in writing by the Owner, the limit of insurance shall not be less than the initial contract amount, for the portion of the project which is new construction, and coverage shall apply during the entire contract period and until the work is accepted by the Owner.

9.3.5 The Contractor shall have Owner's Protective Liability insurance for contract values $50,000 and above, naming the Owner as the Named Insured. Minimum acceptable limits are:

General aggregate limit.....$2,000,000
Each occurrence limit.....$1,000,000

10. Contract Bonds

10.1 When noted as required in the Bid Documents, the Contractor shall provide to the Owner a Performance Bond and a Payment Bond, or "contract bonds", upon execution of the contract. Each bond value shall be for the full amount of the contract and issued by a surety company authorized to do business in the State of Maine as approved by the Owner. The bonds shall be

executed on the forms furnished in the Bid Documents. The bonds shall allow for any subsequent additions or deductions of the contract.

10.2 The contract bonds shall continue in effect for one year after final acceptance of the contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials and to assure settlement of claims for the payment of all bills for labor, materials and equipment by the Contractor.

11. Patents and Royalties

11.1 The Contractor shall, for all time, secure for the Owner the free and undisputed right to the use of any patented articles or methods used in the Work. The expense of defending any suits for infringement or alleged infringement of such patents shall be borne by the Contractor. Awards made regarding patent suits shall be paid by the Contractor. The Contractor shall hold the Owner harmless regarding patent suits that may arise due to installations made by the Contractor, and to any awards made as a result of such suits.

11.2 Any royalty payments related to the work done by the Contractor for the Project shall be borne by the Contractor. The Contractor shall hold the Owner harmless regarding any royalty payments that may arise due to installations made by the Contractor.

12. Surveys, Layout of Work

12.1 The Owner shall furnish all property surveys unless otherwise specified.

12.2 The Contractor is responsible for correctly staking out the Work on the site. The Contractor shall employ a competent surveyor to position all construction on the site. The surveyor shall run the axis lines, establish correct datum points and check each line and point on the site to insure their accuracy. All such lines and points shall be carefully preserved throughout the construction.

12.3 The Contractor shall lay out all work from dimensions given on the Drawings. The Contractor shall take measurements and verify dimensions of any existing work that affects the Work or to which the Work is to be fitted. The Contractor is solely responsible for the accuracy of all measurements. The Contractor shall verify all grades, lines, levels, elevations and dimensions shown on the Drawings and report any errors or inconsistencies to the Consultant prior to commencing work.

13. Record of Documents

13.1 The Contractor shall maintain one complete set of Contract Documents on the jobsite, in good order and current status, for access by the Owner and Consultant.

13.2 The Contractor shall maintain, continuously updated, complete records of Requests for Information, Architectural Supplemental Instructions (or equivalent), Information Bulletins, supplemental sketches, Change Order Proposals, Change Orders, Shop Drawings, testing reports, et cetera, for access by the Owner and Consultant.

14. Allowances

14.1 The Contract Price shall include all allowances described in the Contract Documents. The Contractor shall include all overhead and profit necessary to implement each allowance in their Contract Price.

14.2 The Contractor shall not be required to employ parties for allowance work against whom the Contractor has a reasonable objection. In such a case, the Contractor shall notify the Owner in writing of their position and shall propose an alternative party to complete the work of the allowance.

15. Shop Drawings

15.1 The Contractor shall administer Shop Drawings prepared by the Contractor, Subcontractors, suppliers or others to conform to the approved Schedule of the Work. The Contractor shall verify all field measurements, check and authorize all Shop Drawings and schedules required by the Work. The Contractor is the responsible party and contact for the Contractor's work as well as that of Subcontractors, suppliers or others who provide Shop Drawings.

15.2 The Consultant shall review and acknowledge Shop Drawings, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents.

15.3 The Contractor shall provide monthly updated logs containing: requests for information, information bulletins, supplemental instructions, supplemental sketches, change order proposals, change orders, submittals, testing and deficiencies.

15.4 The Contractor shall make any corrections required by the Consultant, and shall submit a quantity of corrected copies as may be needed. The acceptance of Shop Drawings or schedules by the Consultant shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless the Contractor has called such deviations to the attention of the Consultant at the time of submission and secured the Consultant’s written approval. The acceptance of Shop Drawings or schedules by the Consultant does not relieve the Contractor from responsibility for errors in Shop Drawings or schedules.

16. Samples

16.1 The Contractor shall furnish for approval, with reasonable promptness, all samples as directed by the Consultant. The Consultant shall review and approve such samples, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents. The subsequent work shall be in accord with the approved samples.

17. Substitutions

17.1 The Contractor shall furnish items and materials described in the Contract Documents. If the item or material specified describes a proprietary product, or uses the name of a manufacturer, the term “or approved equal” shall be implied, if it is not included in the text. The specific item or material specified establishes a minimum standard for the general design, level of quality, type, function, durability, efficiency, reliability, compatibility, warranty coverage, installation factors

and required maintenance. The Drawing or written Specification shall not be construed to exclude other manufacturers products of comparable design, quality, and efficiency.

17.2 The Contractor may submit detailed information about a proposed substitution to the Consultant for consideration. Particular models of items and particular materials which the Contractor asserts to be equal to the items and materials identified in the Contract Documents shall be allowed only with written approval by the Consultant. The request for substitution shall include a cost comparison and a reason or reasons for the substitution.

17.3 The Consultant may request additional information about the proposed substitution. The approval or rejection of a proposed substitution may be based on timeliness of the request, source of the information, the considerations of minimum standards described above, or other considerations. The Consultant should briefly state the rationale for the decision. The decision shall be considered final.

17.4 The duration of a substitution review process can not be the basis for a claim for delay in the Schedule of the Work.

18. Assignment of Contract

18.1 The Contractor shall not assign or sublet the contract as a whole without the written consent of the Owner. The Contractor shall not assign any money due to the Contractor without the written consent of the Owner.

19. Separate Contracts

19.1 The Owner reserves the right to create other contracts in connection with this Project using similar General Conditions. The Contractor shall allow the Owner's other contractors reasonable opportunity for the delivery and storage of materials and the execution of their work. The Contractor shall coordinate and properly connect the Work of all contractors.

19.2 The Contractor shall promptly report to the Consultant and Owner any apparent deficiencies in work of the Owner's other contractors that impacts the proper execution or results of the Contractor. The Contractor’s failure to observe or report any deficiencies constitutes an acceptance of the Owner's other contractors work as suitable for the interface of the Contractor’s work, except for latent deficiencies in the Owner's other contractors work.

19.3 Similarly, the Contractor shall promptly report to the Consultant and Owner any apparent deficiencies in their own work that would impact the proper execution or results of the Owner's other contractors.

19.4 The Contractor shall report to the Consultant and Owner any conflicts or claims for damages with the Owner's other contractors and settle such conflicts or claims for damages by mutual agreement or arbitration, if necessary, at no expense to the Owner.

19.5 In the event the Owner's other contractors sue the Owner regarding any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at the Contractor's expense. The Contractor shall pay or satisfy any judgment that may arise against the Owner, and pay all other costs incurred.

20. Subcontracts

20.1 The Contractor shall not subcontract any part of this contract without the written permission of the Owner.

20.2 The Contractor shall submit a complete list of named Subcontractors and material suppliers to the Consultant and Owner for approval by the Owner prior to commencing work. The Subcontractors named shall be reputable companies of recognized standing with a record of satisfactory work.

20.3 The Contractor shall not employ any Subcontractor or use any material until they have been approved, or where there is reason to believe the resulting work will not comply with the Contract Documents.

20.4 The Contractor, not the Owner, is as fully responsible for the acts and omissions of Subcontractors and of persons employed by them, as the Contractor is for the acts and omissions of persons directly or indirectly employed by the Contractor.

20.5 Neither the Contract Documents nor any Contractor-Subcontractor contract shall indicate, infer or create any direct contractual relationship between any Subcontractor and the Owner.

21. Contractor-Subcontractor Relationship

21.1 The Contractor shall be bound to the Subcontractor by all the obligations in the Contract Documents that bind the Contractor to the Owner.

21.2 The Contractor shall pay the Subcontractor, in proportion to the dollar value of the work completed and requisitioned by the Subcontractor, the approved dollar amount allowed to the Contractor no more than seven days after receipt of payment from the Owner.

21.3 The Contractor shall pay the Subcontractor accordingly if the Contract Documents or the subcontract provide for earlier or larger payments than described in the provision above.

21.4 The Contractor shall pay the Subcontractor for completed and requisitioned subcontract work, less retainage, no more than seven days after receipt of payment from the Owner for the Contractor's approved Requisition for Payment, even if the Consultant fails to certify a portion of the Requisition for Payment for a cause not the fault of the Subcontractor.

21.5 The Contractor shall not make a claim for liquidated damages or penalty for delay in any amount in excess of amounts that are specified by the subcontract.

21.6 The Contractor shall not make a claim for services rendered or materials furnished by the Subcontractor unless written notice is given by the Contractor to the Subcontractor within ten calendar days of the day in which the claim originated.

21.7 The Contractor shall give the Subcontractor an opportunity to present and to submit evidence in any progress conference or disputes involving subcontract work.

21.8 The Contractor shall pay the Subcontractor a just share of any fire insurance payment received by the Contractor.

21.9 The Subcontractor shall be bound to the Contractor by the terms of the Contract Documents and assumes toward the Contractor all the obligations and responsibilities that the Contractor, by those documents, assumes toward the Owner.

21.10 The Subcontractor shall submit applications for payment to the Contractor in such reasonable time as to enable the Contractor to apply for payment as specified.

21.11 The Subcontractor shall make any claims for extra cost, extensions of time or damages, to the Contractor in the manner provided in these General Conditions for like claims by the Contractor to the Owner, except that the time for the Subcontractor to make claims for extra cost is seven calendar days after the receipt of Consultant's instructions.

22. Supervision of the Work

22.1 During all stages of the Work the Contractor shall have a competent superintendent, with any necessary assistant superintendents, overseeing the project. The superintendent shall not be reassigned without the consent of the Owner unless a superintendent ceases to be employed by the Contractor due to unsatisfactory performance.

22.2 The superintendent represents the Contractor on the jobsite. Directives given by the Consultant or Owner to the superintendent shall be as binding as if given directly to the Contractor's main office. All important directives shall be confirmed in writing to the Contractor. The Consultant and Owner are not responsible for the acts or omissions of the superintendent or assistant superintendents.

22.3 The Contractor shall provide supervision of the Work equal to the industry's highest standard of care. The superintendent shall carefully study and compare all Contract Documents and promptly report any error, inconsistency or omission discovered to the Consultant. The Contractor may not necessarily be held liable for damages resulting directly from any error, inconsistency or omission in the Contract Documents or other instructions by the Consultant that was not revealed by the superintendent in a timely way.

23. Observation of the Work

23.1 The Contractor shall allow the Owner, the Consultant and the Bureau continuous access to the site for the purpose of observation of the progress of the work. All necessary safeguards and accommodations for such observations shall be provided by the Contractor.

23.2 The Contractor shall coordinate all required testing, approval or demonstration of the Work. The Contractor shall give sufficient notice to the appropriate parties of readiness for testing, inspection or examination.

23.3 The Contractor shall schedule inspections and obtain all required certificates of inspection for inspections by a party other than the Consultant.

23.4 The Consultant shall make all scheduled observations promptly, prior to the work being concealed or buried by the Contractor. If approval of the Work is required of the Consultant, the Contractor shall notify the Consultant of the construction schedule in this regard. Work concealed or buried prior to the Consultant's approval may need to be uncovered at the Contractor's expense.

23.5 The Consultant may order reexamination of questioned work, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to conform to the Contract Documents, the Owner shall pay the expense of the reexamination and remedial work. If the work is found to not conform to the Contract Documents, the Contractor shall pay the expense, unless the defect in the work was caused by the Owner's Contractor, whose responsibility the reexamination expense becomes.

23.6 The Bureau shall periodically observe the Work during the course of construction and make recommendations to the Contractor or Consultant as necessary. Such recommendations shall be considered and implemented through the usual means for changes to the Work.

24. Consultant's Status

24.1 The Consultant represents the Owner during the construction period, and observes the work in progress on behalf of the Owner. The Consultant has authority to act on behalf of the Owner only to the extent expressly provided by the Contract Documents or otherwise demonstrated to the Contractor. The Consultant has authority to stop the work whenever such an action is necessary, in the Consultant's reasonable opinion, to ensure the proper execution of the contract.

24.2 The Consultant is the interpreter of the conditions of the contract and the judge of its performance. The Consultant shall favor neither the Owner nor the Contractor, but shall use the Consultant's powers under the contract to enforce faithful performance by both parties.

24.3 In the event of the termination of the Consultant's employment on the project prior to completion of the work, the Owner shall appoint a capable and reputable replacement. The status of the new Consultant relative to this contract shall be that of the former Consultant.

25. Management of the Premises

25.1 The Contractor shall place equipment and materials, and conduct activities on the premises in a manner that does not unreasonably hinder site circulation, environmental stability, or any long term effect. Likewise, the Consultant's directions shall not cause the use of premises to be impeded for the Contractor or Owner.

25.2 The Contractor shall not use the premises for any purpose other than that which is directly related to the scope of work. The Owner shall not use the premises for any purpose incompatible with the proposed work simultaneous to the work of the Contractor.

25.3 The Contractor shall enforce the Consultant's instructions regarding information posted on the premises such as signage and advertisements, as well as activities conducted on the premises such as fires, and smoking.

25.4 The Owner may occupy any part of the Project that is completed with the written consent of the Contractor, and without prejudice to any of the rights of the Owner or Contractor. Such use or occupancy shall not, in and of itself, be construed as a final acceptance of any work or materials.

26. Safety and Security of the Premises

26.1 The Contractor shall designate, and make known to the Consultant and the Owner, a safety officer whose duty is the prevention of accidents on the site.

26.2 The Contractor shall continuously maintain security on the premises and protect from unreasonable occasion of injury all people authorized to be on the job site. The Contractor shall also effectively protect the property and adjacent properties from damage or loss.

26.3 The Contractor shall take all necessary precautions to ensure the safety of workers and others on and adjacent to the site, abiding by applicable local, state and federal safety regulations. The Contractor shall erect and continuously maintain safeguards for the protection of workers and others, and shall post signs and other warnings regarding hazards associated with the construction process, such as protruding fasteners, moving equipment, trenches and holes, scaffolding, window, door or stair openings, and falling materials.

26.4 The Contractor shall restore the premises to conditions that existed prior to the start of the project at areas not intended to be altered according to the Contract Documents.

26.5 The Contractor shall protect existing utilities and exercise care working in the vicinity of utilities shown in the Drawings and Specifications or otherwise located by the Contractor.

26.6 The Contractor shall protect from damage existing trees and other significant plantings and landscape features of the site which will remain a permanent part of the site. If necessary or indicated in the Contract Documents, tree trunks shall be boxed and barriers erected to prevent damage to tree branches or roots.

26.7 The Contractor shall repair or replace damage to the Work caused by the Contractor's or Subcontractor's forces, including that which is reasonably protected, at the expense of the responsible party.

26.8 The Contractor shall not load, or allow to be loaded, any part of the Project with a force which imperils personal or structural safety. The Consultant may consult with the Contractor on such means and methods of construction, however, the ultimate responsibility lies with the Contractor.

26.9 The Contractor shall not jeopardize any work in place with subsequent construction activities such as blasting, drilling, excavating, cutting, patching or altering work. The Consultant must approve altering any structural components of the project. The Contractor shall supervise all construction activities carried out by others on site to ensure that the work is neatly done and in a manner that will not endanger the structure or the component parts.

26.10 The Contractor may act with their sole discretion in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Contractor may negotiate with the Owner for compensation for expenses due to such emergency work.

26.11 The Contractor and Subcontractors shall have no responsibility for the identification, discovery, presence, handling, removal or disposal of, or exposure of persons to, hazardous materials in any form at the project site. The Contractor shall avoid disruption of any hazardous materials or toxic substances at the project site and promptly notify the Owner in writing on the occasion of such a discovery.

26.12 The Contractor shall keep the premises free of any unsafe accumulation of waste materials caused by the work. The Contractor shall regularly keep the spaces "broom clean". See the Close-out of the Work provisions of this section regarding cleaning at the completion of the project.

27. Changes in the Work

27.1 The Contractor shall not proceed with extra work without an approved Change Order or Construction Change Directive. A Change Order which has been properly signed by all parties shall become a part of the contract.

27.2 A Change Order is the usual document for directing changes in the Work. In certain circumstances, however, the Owner may utilize a Construction Change Directive to direct the Contractor to perform changes in the Work that are generally consistent with the scope of the project. The Owner shall use a Construction Change Directive only when the normal process for approving changes to the Work has failed to the detriment of the Project, or when agreement on the terms of a Change Order cannot be met, or when an urgent situation requires, in the Owner's judgment, prompt action by the Contractor.

27.3 The Consultant shall prepare the Construction Change Directive representing a complete scope of work, with proposed Contract Price and Contract Time revisions, if any, clearly stated.

27.4 The Contractor shall promptly carry out a Construction Change Directive which has been signed by the Owner and the Consultant. Work thus completed by the Contractor constitutes the basis for a Change Order. Changes in the Contract Price and Contract Time shall be as defined in the Construction Change Directive unless subsequently negotiated with some other terms.

27.5 The method of determining the dollar value of extra work shall be by:
- .1 an estimate of the Contractor accepted by Owner as a lump sum, or
- .2 unit prices named in the contract or subsequently agreed upon, or
- .3 cost plus a designated percentage, or
- .4 cost plus a fixed fee.

27.6 The Contractor shall determine the dollar value of the extra work for both the lump sum and cost plus designated percentage methods so as not to exceed the following rates. The rates include all overhead and profit expenses.
- .1 Contractor - for any work performed by the Contractor's own forces, up to 20% of the cost;
- .2 Subcontractor - for work performed by Subcontractor's own forces, up to 20% of the cost;
- .3 Contractor - for work performed by Contractor's Subcontractor, up to 10% of the amount due the Subcontractor.

27.7 The Contractor shall keep and provide records as needed or directed for the cost plus designated percentage method. The Consultant shall review and certify the appropriate amount which

includes the Contractor's overhead and profit. The Owner shall make payments based on the Consultant's certificate.

27.8 Cost reflected in Change Orders shall be limited to the following: cost of materials, cost of delivery, cost of labor (including Social Security, pension, Workers' Compensation insurance, and unemployment insurance), and cost of rental of power tools and equipment. Labor cost may include a pro-ratio share of a foreman's time only in the case of an extension of contract time granted due to the Change Order.

27.9 Overhead reflected in Change Orders shall be limited to the following: bond premium, supervision, wages of clerks, time keepers, and watchmen, small tools, incidental expenses, general office expenses, and all other overhead expenses directly related to the Change Order.

27.10 The Contractor shall provide credit to the Owner for labor, materials, equipment and other costs but not overhead and profit expenses for those Change Order items that result in a net value of credit to the contract.

27.11 The Owner may change the scope of work of the Project without invalidating the contract. The Owner shall notify the Contractor of a change of the scope of work for the Owner's Contractors, which may affect the work of this Contractor, without invalidating the contract. Change Orders for extension of the time caused by such changes shall be developed at the time of directing the change in scope of work.

27.12 The Consultant may order minor changes in the Work, not involving extra cost, which is consistent with the intent of the design or project.

27.13 The Contractor shall immediately give written notification to the Consultant of latent conditions discovered at the site which materially differ from those represented in the Drawings or Specifications, and which may eventually result in a change in the scope of work. The Contractor shall suspend work until receiving direction from the Consultant. The Consultant shall promptly investigate the conditions and respond to the Contractor's notice with direction that avoids any unnecessary delay of the Work. The Consultant shall determine if the discovered conditions warrant a Change Order.

27.14 The Contractor shall, within ten calendar days of receipt of the information, give written notification to the Consultant if the Contractor claims that instructions by the Consultant will constitute extra cost not accounted for by Change Order or otherwise under the contract. The Consultant shall promptly respond to the Contractor's notice with direction that avoids any unnecessary delay of the Work. The Consultant shall determine if the Contractor's claim warrants a Change Order.

28. Correction of the Work

28.1 The Contractor shall promptly remove from the premises all work the Consultant declares is non-conforming to the contract. The Contractor shall replace the work properly at no expense to the Owner. The Contractor is also responsible for the expenses of others whose work was damaged or destroyed by such remedial work.

28.2 The Owner may elect to remove non-conforming work if it is not removed by the Contractor within a reasonable time, that time defined in a written notice from the Consultant. The Owner may elect to store removed non-conforming work not removed by the Contractor at the Contractor's expense. The Owner may, with ten days written notice, dispose of materials which the Contractor does not remove. The Owner may sell the materials and apply the net proceeds, after deducting all expenses, to the costs that should have been borne by the Contractor.

28.3 The Contractor shall remedy any defects due to faulty materials or workmanship and pay for any related damage to other work which appears within a period of one year from the date of substantial completion, and in accord with the terms of any guarantees provided in the contract. The Owner shall promptly give notice of observed defects to the Contractor and Consultant. The Consultant shall determine the status of all claimed defects. The Contractor shall perform all remedial work without unjustifiable delay in either the initial response or the corrective action.

28.4 The Consultant may authorize, after a reasonable notification to the Contractor, an equitable deduction from the contract amount in lieu of the Contractor correcting non-conforming or defective work.

29. Owner's Right to do Work

29.1 The Owner may, using other contractors, correct deficiencies attributable to the Contractor, or complete unfinished work. Such action shall take place only after giving the Contractor three days written notice, and provided the Consultant approves of the proposed course of action as an appropriate remedy. The Owner may then deduct the cost of the remedial work from the amount due the Contractor.

29.2 The Owner may act with their sole discretion when the Contractor is unable to take action in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Owner shall inform the Contractor of the emergency work performed, particularly where it may affect the work of the Contractor.

30. Termination of Contract and Stop Work Action

30.1 The Owner may, owing to a certificate of the Consultant indicating that sufficient cause exists to justify such action, without prejudice to any other right or remedy and after giving the Contractor and the Contractor’s surety seven days written notice, terminate the employment of the Contractor. At that time the Owner may take possession of the premises and of all materials,

tools and appliances on the premises and finish the work by whatever method the Owner may deem expedient. Cause for such action by the Owner includes:

.1 the contractor is adjudged bankrupt, or makes a general assignment for the benefit of its creditors, or

.2 a receiver is appointed due to the Contractor's insolvency, or

.3 the Contractor persistently or repeatedly refuses or fails to provide enough properly skilled workers or proper materials, or

.4 the Contractor fails to make prompt payment to Subcontractors or suppliers of materials or labor, or

.5 the Contractor persistently disregards laws, ordinances or the instructions of the Consultant, or is otherwise found guilty of a substantial violation of a provision of the Contract Documents.

30.2 The Contractor is not entitled, as a consequence of the termination of the employment of the Contractor as described above, to receive any further payment until the Work is finished. If the unpaid balance of the contract amount exceeds the expense of finishing the Work, including compensation for additional architectural, managerial and administrative services, such balance shall be paid to the Contractor. If the expense of finishing the Work exceeds the unpaid balance, the Contractor shall pay the difference to the Owner. The Consultant shall certify the expense incurred by the Contractor's default. This obligation for payment shall continue to exist after termination of the contract.

30.3 The Contractor may, if the Work is stopped by order of any court or other public authority for a period of thirty consecutive days, and through no act or fault of the Contractor or of anyone employed by the Contractor, with seven days written notice to the Owner and the Consultant, terminate this contract. The Contractor may then recover from the Owner payment for all work executed, any proven loss and reasonable profit and damage.

30.4 The Contractor may, if the Consultant fails to issue a certificate for payment within seven days after the Contractor's formal request for payment, through no fault of the Contractor, or if the Owner fails to pay to the Contractor within 30 days after submission of any sum certified by the Consultant, with seven days written notice to the Owner and the Consultant, stop the Work or terminate this Contract.

31. Delays and Extension of Time

31.1 The completion date of the contract shall be extended if the work is delayed by changes ordered in the work which have approved time extensions, or by an act or neglect of the Owner, the Consultant, or the Owner's Contractor, or by strikes, lockouts, fire, flooding, unusual delay in transportation, unavoidable casualties, or by other causes beyond the Contractor's control. The Consultant shall determine the status of all claimed causes.

31.2 The contract shall not be extended for delay occurring more than seven calendar days before the Contractor's claim made in writing to the Consultant. In case of a continuing cause of delay, only one claim is necessary.

31.3 The contract shall not be extended due to failure of the Consultant to furnish drawings if no schedule or agreement is made between the Contractor and the Consultant indicating the dates

which drawings shall be furnished and fourteen calendar days has passed after said date for such drawings.

31.4 This article does not exclude the recovery of damages for delay by either party under other provisions in the Contract Document.

32. Payments to the Contractor

32.1 As noted under *Preconstruction Conference* in this section, the Contractor shall submit a Schedule of Values form, before the first application for payment, for approval by the Owner and Consultant. The Consultant may direct the Contractor to provide evidence that supports the correctness of the form. The approved Schedule of Values shall be used as a basis for payments.

32.2 The Contractor shall submit an application for each payment ("Requisition for Payment") on a form approved by the Owner and Consultant. The Consultant may require receipts or other documents showing the Contractor's payments for materials and labor, including payments to Subcontractors.

32.3 The Contractor shall submit Requisitions for Payment as the work progresses not more frequently than once each month, unless the Owner approves a more frequent interval due to unusual circumstances. The Requisition for Payment is based on the proportionate quantities of the various classes of work completed or incorporated in the Work, in agreement with the actual progress of the Work and the dollar value indicated in the Schedule of Values.

32.4 The Consultant shall verify and certify each Requisition for Payment which appears to be complete and correct prior to payment being made by the Owner. The Consultant may certify an appropriate amount for materials not incorporated in the Work which have been delivered and suitably stored at the site. The Contractor shall submit bills of sale, insurance certificates, or other such documents that will adequately protect the Owner's interests prior to payments being certified.

32.5 In the event any materials delivered but not yet incorporated in the Work have been included in a certified Requisition for Payment with payment made, and said materials thereafter are damaged, deteriorated or destroyed, or for any reason whatsoever become unsuitable or unavailable for use in the Work, the full amount previously allowed shall be deducted from subsequent payments unless the Contractor satisfactorily replaces said material.

32.6 The Contractor may request certification of an appropriate dollar amount for materials not incorporated in the Work which have been delivered and suitably stored away from the site. The Contractor shall submit bills of sale, insurance certificates, right-of-entry documents or other such documents that will adequately protect the Owner's interests. The Consultant shall determine if the Contractor's documentation for the materials is complete and specifically designated for the Project. The Owner may allow certification of such payments.

32.7 Subcontractors may request, and shall receive from the Consultant, copies of approved Requisitions for Payment showing the amounts certified in the Schedule of Values.

32.8 Certified Requisitions for Payment, payments made to the Contractor, or partial or entire occupancy of the project by the Owner shall not constitute an acceptance of any work that does

not conform to the Contract Documents. The making and acceptance of the final payment constitutes a waiver of all claims by the Owner, other than those arising from unsettled liens, from faulty work or materials appearing within one year from final payment or from requirements of the Drawings and Specifications, and of all claims by the Contractor, except those previously made and still unsettled.

33. Payments Withheld

33.1 The Owner shall retain five percent of each payment due the Contractor as part security for the fulfillment of the contract by the Contractor. The Owner may make payment of a portion of this "retainage" to the Contractor temporarily or permanently during the progress of the Work. The Owner may thereafter withhold further payments until the full amount of the five percent is reestablished. The Contractor may deposit with the Maine State Treasurer certain securities in place of retainage amounts due according to Maine Statute (5 M.R.S. §1746).

33.2 The Consultant may withhold or nullify the whole or a portion of any Requisitions for Payment submitted by the Contractor in the amount that may be necessary, in his reasonable opinion, to protect the Owner from loss due to any of the following:

.1 defective work not remedied;
.2 claims filed or reasonable evidence indicating probable filing of claims;
.3 failure to make payments properly to Subcontractors or suppliers;
.4 a reasonable doubt that the contract can be completed for the balance then unpaid;
.5 liability for damage to another contractor.

The Owner shall make payment to the Contractor, in the amount withheld, when the above circumstances are removed.

34. Liens

34.1 The Contractor shall deliver to the Owner a complete release of all liens arising out of this contract before the final payment or any part of the retainage payment is released. The Contractor shall provide with the release of liens an affidavit asserting each release includes all labor and materials for which a lien could be filed. Alternately, the Contractor, in the event any Subcontractor or supplier refuses to furnish a release of lien in full, may furnish a bond satisfactory to the Owner, to indemnify the Owner against any lien.

34.2 In the event any lien remains unsatisfied after all payments to the Contractor are made by the Owner, the Contractor shall refund to the Owner all money that the latter may be compelled to pay in discharging such lien, including all cost and reasonable attorney's fees.

35. Workmanship

35.1 The Contractor shall provide materials, equipment, and installed work equal to or better than the quality specified in the Contract Documents and approved in submittal and sample. The installation methods shall be of the highest standards, and the best obtainable from the respective trades. The Consultant's decision on the quality of work shall be final.

35.2 The Contractor shall know local labor conditions for skilled and unskilled labor in order to apply the labor appropriately to the Work. All labor shall be performed by individuals well skilled in their respective trades.

35.3 The Contractor shall perform all cutting, fitting, patching and placing of work in such a manner to allow subsequent work to fit properly, whether that be by the Contractor, the Owner's Contractors or others. The Owner and Consultant may advise the Contractor regarding such subsequent work. Notwithstanding the notification or knowledge of such subsequent work, the Contractor may be directed to comply with this standard of compatible construction by the Consultant at the Contractor's expense.

35.4 The Contractor shall request clarification or revision of any design work by the Consultant, prior to commencing that work, in a circumstance where the Contractor believes the work cannot feasibly be completed at the highest quality, or as indicated in the Contract Documents. The Consultant shall respond to such requests in a timely way, providing clarifying information, a feasible revision, or instruction allowing a reduced quality of work. The Contractor shall follow the direction of the Consultant regarding the required request for information.

35.5 The Contractor shall guarantee the Work against any defects in workmanship and materials for a period of one year commencing with the date of the Certificate of Substantial Completion, unless specified otherwise for specific elements of the project. The Work may also be subdivided in mutually agreed upon components, each defined by a separate Certificate of Substantial Completion.

36. Close-out of the Work

36.1 The Contractor shall remove from the premises all waste materials caused by the work. The Contractor shall make the spaces “broom clean” unless a more thorough cleaning is specified. The Contractor shall clean all windows and glass immediately prior to the final inspection, unless otherwise directed.

36.2 The Owner may conduct the cleaning of the premises where the Contractor, duly notified by the Consultant, fails to adequately complete the task. The expense of this cleaning may be deducted from the sum due to the Contractor.

36.3 The Contractor shall participate in all final inspections and acknowledge the documentation of unsatisfactory work, customarily called the "punch list", to be corrected by the Contractor. The Consultant shall document the successful completion of the Work in a dated Certificate of Substantial Completion, to be signed by Owner, Consultant, and Contractor.

36.4 The Contractor shall not call for final inspection of any portion of the Work that is not completely and permanently installed. The Contractor may be found liable for the expenses of individuals called to final inspection meetings prematurely.

36.5 The Contractor and all major Subcontractors shall participate in the end-of-warranty-period conference, typically scheduled close to one year after the Substantial Completion date.

37. Date of Completion and Liquidated Damages

37.1 The Contractor may make a written request to the Owner for an extension or reduction of time, if necessary. The request shall include the reasons the Contractor believes justifies the proposed completion date. The Owner may grant the revision of the contract completion date if the Work was delayed due to conditions beyond the control and the responsibility of the Contractor. The Contractor shall not conduct unauthorized accelerated work or file delay claims to recover alleged damages for unauthorized early completion.

37.2 The Contractor shall vigorously pursue the completion of the Work and notify the Owner of any factors that have, may, or will affect the approved Schedule of the Work. The Contractor may be found responsible for expenses of the Owner or Consultant if the Contractor fails to make notification of project delays.

37.3 The Project is planned to be done in an orderly fashion which allows for an iterative submittal review process, construction administration including minor changes in the Work and some bad weather. The Contractor shall not file delay claims to recover alleged damages on work the Consultant determines has followed the expected rate of progress.

37.4 The Consultant shall prepare the Certificate of Substantial Completion which, when signed by the Owner and the Contractor, documents the date of Substantial Completion of the Work or a designated portion of the Work. The Owner shall not consider the issuance of a Certificate of Occupancy by an outside authority a prerequisite for Substantial Completion if the Certificate of Occupancy cannot be obtained due to factors beyond the Contractor's control.

37.5 Liquidated Damages may be deducted from the sum due to the Contractor for each calendar day that the Work remains uncompleted after the completion date specified in the Contract or an approved amended completion date. The dollar amount per day shall be calculated using the Schedule of Liquidated Damages table shown below.

If the original contract amount is:	The per day Liquidated Damages shall be:
Less than $100,000	$250
$100,000 to less than $2,000,000	$750
$2,000,000 to less than $10,000,000	$1,500
$10,000,000 and greater	$1,500 plus $250 for each $2,000,000 over $10,000,000

38. Dispute Resolution

38.1 Mediation

38.1.1 A dispute between the parties which arises under this Contract which cannot be resolved through informal negotiation, shall be submitted to a neutral mediator jointly selected by the parties.

38.1.2 Either party may file suit before or during mediation if the party, in good faith, deems it to be necessary to avoid losing the right to sue due to a statute of limitations. If suit is filed before good faith mediation efforts are completed, the party filing suit shall agree to stay all proceedings in the lawsuit pending completion of the mediation process, provided such stay is without prejudice.

38.1.3 In any mediation between the Owner and the Consultant, the Owner has the right to consolidate related claims between Owner and Contractor.

38.2 Arbitration

38.2.1 If the dispute is not resolved through mediation, the dispute shall be settled by arbitration. The arbitration shall be conducted before a panel of three arbitrators. Each party shall select one arbitrator; the third arbitrator shall be appointed by the arbitrators selected by the parties. The arbitration shall be conducted in accordance with the Maine Uniform Arbitration Act (MUAA), except as otherwise provided in this section.

38.2.2 The decision of the arbitrators shall be final and binding upon all parties. The decision may be entered in court as provided in the MUAA.

38.2.3 The costs of the arbitration, including the arbitrators' fees shall be borne equally by the parties to the arbitration, unless the arbitrator orders otherwise.

38.2.4 In any arbitration between the Owner and the Consultant, the Owner has the right to consolidate related claims between Owner and Contractor.

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Wage Determination Schedule

PART 1- GENERAL

1.1 Related Documents
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

1.2 Summary
A. This Section includes the wage determination requirements for Contractors as issued by the State of Maine Department of Labor Bureau of Labor Standards or the United States Department of Labor.

1.3 Requirements
A. Conform to the wage determination schedule for this project which is shown on the following page.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

THIS DOCUMENT MUST BE CLEARLY POSTED AT ALL CONSTRUCTION SITES FUNDED IN PART WITH STATE FUNDS

State of Maine
Department of Labor
Bureau of Labor Standards
Augusta, Maine 04333-0045
Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRS §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid to laborers and workers employed on the below titled project.

2023 Fair Minimum Wage Rates
Building 2 Washington County
(other than 1 or 2 family homes)

Occupational Title	Minimum Wage	Minimum Benefit	Total
Brickmasons And Blockmasons	$31.52	$5.05	$36.57
Bulldozer Operator	$30.00	$7.29	$37.29
Carpenter	$25.00	$4.75	$29.75
Cement Masons And Concrete Finisher	$21.00	$3.90	$24.90
Construction And Maintenance Painters	$20.00	$0.50	$20.50
Construction Laborer	$20.00	$1.98	$21.98
Control And Valve Installers And Repairers - Except Mechanical Door	$31.00	$9.86	$40.86
Crane And Tower Operators	$30.50	$10.69	$41.19
Drywall And Ceiling Tile Installers	$26.00	$2.12	$28.12
Earth Drillers - Except Oil And Gas	$28.25	$4.94	$33.19
Electrical Power - Line Installer And Repairers	$52.21	$29.35	$81.56
Electricians	$33.90	$0.00	$33.90
Elevator Installers And Repairers	$65.62	$43.13	$108.75
Excavating And Loading Machine And Dragline Operators	$25.00	$0.00	$25.00
Excavator Operator	$28.00	$2.40	$30.40
Fence Erectors	$24.00	$4.59	$28.59
Floor Layers - Except Carpet/Wood/Hard Tiles	$24.00	$6.32	$30.32
Glaziers	$45.00	$0.00	$45.00
Grader/Scraper Operator	$24.76	$3.96	$28.72
Hazardous Materials Removal Workers	$19.00	$0.84	$19.84
Heating And Air Conditioning And Refrigeration Mechanics And Installers	$29.00	$4.73	$33.73
Heavy And Tractor - Trailer Truck Drivers	$19.00	$0.14	$19.14
Industrial Machinery Mechanics	$33.43	$2.38	$35.81
Insulation Worker - Mechanical	$22.50	$3.63	$26.13
Ironworker - Ornamental	$27.22	$5.55	$32.77
Light Truck Or Delivery Services Drivers	$22.00	$3.17	$25.17
Millwrights	$34.00	$9.13	$43.13
Mobile Heavy Equipment Mechanics - Except Engines	$25.00	$4.32	$29.32
Operating Engineers And Other Equipment Operators	$26.63	$7.17	$33.80
Pipelayers	$25.50	$3.54	$29.04
Plasterers And Stucco Masons	$31.00	$15.28	$46.28
Plumbers Pipe Fitters And Steamfitters	$27.00	$5.94	$32.94
Reinforcing Iron And Rebar Workers	$22.50	$5.86	$28.36
Riggers	$28.00	$9.74	$37.74
Roofers	$23.25	$2.14	$25.39
Sheet Metal Workers	$24.88	$6.56	$31.44
Structural Iron And Steel Workers	$29.02	$6.72	$35.74
Tapers	$28.00	$4.18	$32.18
Telecommunications Equipment Installers And Repairers - Except Line Installers	$28.00	$8.78	$36.78
Telecommunications Line Installers And Repairers	$24.00	$4.13	$28.13
Tile And Marble Setters	$25.00	$5.05	$30.05

Welders are classified as the trade to which welding is incidental (e.g. welding structural steel is Structural Iron and Steel Worker)

Apprentices – The minimum wage rates for registered apprentices are the rates recognized in the sponsorship agreement for registered apprentices working in the pertinent classification.

For any other specific trade on this project not listed above, contact the Bureau of Labor Standards for further clarification.

Title 26 §1310 requires that a clearly legible statement of all fair minimum wage and benefits rates to be paid the several classes of laborers, workers and mechanics employed on the construction on the public work must be kept posted in a prominent and easily accessible place at the site by each contractor and subcontractor subject to sections 1304 to 1313.

Appeal – Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates.

A true copy

Attest: Scott R. Cotnoir

Scott R. Cotnoir
Wage & Hour Director
Bureau of Labor Standards

Expiration Date: 12-31-2023

SECTION 01100

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Edmunds School Enclosure Repairs & Mechanical System Upgrades

B. Owner's Name: Maine Department of Education

C. Owner's Contact: Richard Colpitts, Director of State Schools, 207-624-6895, Richard.colpitts maine.gov.

D. Engineer's Name: DuBois & King, Inc.; Matthew Healey, P.E., 802-878-7661.

E. This project consists of building enclosure repairs & mechanical systems upgrades at the Edmunds School in Edmunds Township, Maine.

1.02 RELATED SECTIONS

A. None

1.03 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in these Contract Documents.

1.04 DESCRIPTION OF WORK

A. Scope of new construction work is shown in the Contract Documents. The work required by these Contract Documents shall include furnishing all labor, tools, equipment and materials and performing all necessary activities for completion of the Project, as shown in the Contract Documents.

1.05 OWNER OCCUPANCY

A. Owner will occupy the project site throughout the construction period. Contractor shall coordinate and maintain good communications with staff continually throughout the construction period. Contractor shall arrange work to enable staff to perform their duties and responsibilities to maintain the successful operation of the existing and upgraded facility at all times.

1.06 PROJECT/SITE CONDITIONS

A. The Drawings indicate the presence of existing pipelines and structures based on best available information, but the Contractor shall perform whatever field testing and verification is required to allow pipeline crossings or tie-ins, excavations, or other similar work tasks to be completed in the areas of existing buried equipment systems without damage to or interruption of operation.

A.07 CONTRACTOR USE OF SITE

A. Time Restrictions:

1. Limit work hours to begin no earlier than 7:00 am except for emergency work or as otherwise approved in writing by the Owner.

B. Limit shutdown of utility services to normal work hours, arranged at least 48 hours in advance with Owner, and schedule/plan the work to minimize the impacts to facility functions and operations.

1.08 SUGGESTED WORK SEQUENCE

A. Coordinate construction schedule and operations with Engineer.

1. All work should be coordinated with Engineer and Owner daily.
2. Limit work hours to begin no earlier than 7:00 am except for emergency work or as otherwise approved in writing by the Owner.
3. Work may not occur on weekends and legal holidays without prior written permission from Owner.

1.08 OMISSIONS

A. The Contractor is responsible for the complete, fully functional, code-compliant installation of this project. Items, materials and activities commonly considered essential for completion of this type of work shall be provided by the Contractor at no additional cost to the Owner even if not specifically identified or shown in the Contract Documents.

1.09 QUALITY

A. Notwithstanding the quality requirements described in the Contract Documents, every aspect of the project shall be completed with good workmanship. All materials and equipment shall be new unless specifically stated otherwise in the Contract Documents. If the grade or quality of materials or equipment is not specified, it shall be of a quality sufficient for long-term reliable operation of the project.

1.10 PROTECTION TO PERSONS OR PROPERTY

A. The Contractor shall take every reasonable precaution against and assume all responsibility and liability for injury to persons and damage to public or private property caused directly or indirectly by the Contractor. Damages caused directly or indirectly by the Contractor shall be remediated by the Contractor at no additional cost to the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section covers the requirements for measurements and records for payment purposes, and describes the items under which payments will be made for all work performed under this Contract.

B. Items not specified to be measured or paid for shall be included in an appropriate unit price item or in a Lump-sum item.

1.02 MEASUREMENT REQUIREMENTS

A. Where payments will be made for removing rock and existing materials, notify Engineer so that he may inspect the materials to be removed, so that he may witness the measuring, and so that he may approve the record of measurements. All materials removed without conforming to the above procedures, and which Engineer cannot verify or substantiate, will not be paid for.

B. Maintain complete, neat, clean, and legible field notes for all measured items. Notes shall contain spaces for Contractor's and Engineer's signatures plus additional space for comments. An original and a copy shall be made for all notes and one copy shall be turned over to Engineer daily. The Engineer's signature shall not be construed as an acceptance of the Work, or the measurements made, but shall mean that he was present when the measurements were made.

1.03 SUBMITTALS

A. See Section 01300.

B. Field notes of all measurements for payment purposes delivered to Engineer daily.

C. Copies of all invoices required for payments out of cash allowance(s).

D. Monthly Applications for Payment, on the forms included under contract forms.

1.04 SCHEDULING

A. Notify Engineer, as far in advance as possible, of the making of measurements so that the Engineer may observe existing conditions, work being performed, and measurements being made.

B. Allow for and afford Engineer ample time, space and equipment to observe measurements and to verify measurements and elevations.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all labor, materials, facilities, levels, measuring devices and all other equipment and items necessary to properly and accurately perform all measurements for payment purposes.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS & STIPULATIONS

A. Perform all measuring required under this Section.

B. No separate payments will be made for work under this Contract except for the pay items stipulated in this PART 3. All costs in connection with the Work shall be included in one or more of the pay items as appropriate.

C. Each pay item shall be full compensation for all costs in connection with the item including but not limited to:
   1. The furnishing of all materials, labor, equipment, tools, and all incidentals.
   2. The installation of all materials, equipment, facilities, accessories and appurtenant items.
   3. The proper share of overhead and profit.
   4. Any excavation, trenching, backfilling, dewatering, shoring or testing required.
   5. The restoration of unpaved surfaces.
   6. Any temporary facilities or controls required including flaggers and/or uniformed traffic officers.
   7. All erosion and dust control measures.
   8. All related and incidental work and items necessary or required to complete the Work and to provide completely connected, operational and approved, code-compliant systems capable of performing as required.
   9. Clearing and grubbing.

D. Each pay item which specifically involves excavation shall be considered to include full compensation for:
   1. Excavation in earth.
   2. Disposal of any surplus.
   3. Handling of water as specified.
   4. Installation and removal of sheeting and bracing.

E. If solid rock excavation is required, additional compensation will be paid under the item Rock Excavation and Disposal, with the exception of items which specifically include payment for rock excavation.

3.02 MEASUREMENT & PAYMENT ITEMS

A. The names of the following items are abbreviated forms of the Bid Items as contained on the Price Schedule in the Bid Form. The names, as shown below or on the Bid Form, shall not be construed to represent a complete description of all of the Work included under such items and are provided only as a means of identification and for ease of conversation.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Site mobilization meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Progress photographs.

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

G. Number of copies of submittals.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. EJCDC C-700 Contract Documents - General Conditions.

B. EJCDC C-800 Contract Documents - Supplementary Conditions.

C. Section 01100 - Summary.

D. Section 01700 - Execution Requirements: Additional coordination requirements.

E. Section 01780 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

A. Project Coordinator: Engineer's Construction Manager and/or Resident Engineer.

B. Coordinate with Owner representative in identification of mobilization and storage areas, field office locations, site access, traffic, and parking facilities.

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

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

E. Make the following types of submittals to Engineer:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Closeout submittals.
   11. Operation and Maintenance Manuals.
   12. Record Drawings and Field Ties.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

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

B. Attendance Required:
   1. Representative of Owner.
   2. Engineer's manager and Resident Project Representative.
   3. Contractor's Project manager and Superintendent.
   4. Representative of Funding Agency.

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, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.
   8. Other Contract Document or construction coordination items, as required.

D. Engineer will record minutes and distribute copies within seven days after meeting to participants, and those affected by decisions made.

3.02 SITE MOBILI□ATION MEETING

A. Owner will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor's Superintendent.
   2. Owner Representative.
   3. Resident Project Representative.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements.
   3. Construction facilities.
   4. Temporary utilities.
   5. Security and housekeeping procedures.

D. Resident Project Representative will record minutes and distribute copies within three days after meeting to participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Engineer will schedule and administer meetings throughout progress of the Work at regular intervals.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Contractor's project manager and superintendent, major Subcontractors and suppliers, Owner Representative, and Engineer's project manager and Resident Project Representative.

D. Agenda:

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

E. Engineer will record minutes and distribute copies within seven days after meeting to participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Submit preliminary schedule at the Preconstruction Meeting defining planned operations for the first 30 days of Work, with a general outline for remainder of Work.

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

C. Within 10 days after review of preliminary schedule, submit proposed complete schedule for review.

D. Submit updated schedule with each Application for Payment.

E. Submit updated Schedule with each Change Order.

3.05 PROGRESS PHOTOGRAPHS

A. Provide photographs of site and construction throughout progress of Work.

B. Take photographs each month on the following:
1. Site clearing.
2. Excavations.
3. Final completion.

C. Take photographs as evidence of existing project conditions. Photos shall be stored in electronic file format, in a digital .jpg file format. Files shall be organized by date and/or activity.

D. Digital photo files shall be made available to the Engineer, at the Engineer□s request.

F. Deliver all digital photo files to Engineer with project record documents. Catalog and index files in chronological sequence; provide table of contents.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. Provide copies in accordance with SUBMITTAL PROCEDURES article below.

3.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit to Engineer for Record Purposes.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Spare Parts Lists and Tools.
4. Warranties.
5. Bonds.
6. Other types as indicated.

B. Submit to Engineer for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
1. Small Size Sheets, Not Larger Than 11 x 17 inches (280 x 432mm): Submit the number of copies which the Contractor requires, plus four which will be retained by the Engineer.
2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit one reproducible transparency.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: See Section 01780

D. Samples: Submit the number specified in individual specification sections;
1. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES

A. Transmit each submittal with the Contractor's standard project submittal cover page form that includes the information or identification noted below.

B. Sequentially number the submittal form. Revise submittals with original number and a sequential alphabetic suffix.

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

D. Apply Contractor's stamp on each copy of each submittal, signed or initialed certifying that the product is in accordance with the requirements of the Work and Contract Documents. The stamp shall have the following wording: "I hereby certify that I have carefully examined the enclosed submittal(s) and have determined and verified all field measurements, construction criteria, materials, catalog numbers and similar data,

coordinated the submittal(s) with other submissions and the work of other trades and contractors, and that to the best of my knowledge and belief, the enclosed submittal(s) is/are in full compliance with the Contract requirements, except as follows (enter NONE if there are no exceptions):"

E. Deliver submittals to Engineer by email in pdf file format or consult Engineer for approval of an alternative method of sending.

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

G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

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

I. Provide space for Engineer's review stamp.

J. Submit copies that are clear and legible. Copies will be returned unreviewed if this requirement is not met.

K. When revised for resubmission, identify all changes made since previous submission.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

M. Submittals not requested will not be recognized or processed.

N. Engineer will review and comment on each submission. Engineer's review will be only for conformance with the design concept of the Project and will be confined to general arrangement and compliance with the Contract Documents only, and will not be for the purpose of checking dimensions, weights, clearances, fitting, tolerances, interferences, or coordination of trades or contractors. The acceptance of a separate item does not represent acceptance of an assembly in which the item functions. Engineer's review and comments will in no way relieve Contractor of any of his responsibilities under the Contract.

O. Engineer will mark Submittals as follows:
   1. Accepted - Submittal appears to conform to Contract Documents and Contractor may proceed with ordering and installation.
   2. Accepted As Noted - Same as "Accepted", except it is accepted on the basis that the modifications or notes added to the submittal by Engineer will be complied with by Contractor.
   3. Revise and Resubmit - Submission is not acceptable and shall be revised and resubmitted by Contractor.
   4. Rejected - Submission is unacceptable as it does not appear to conform to the Contract Documents. A completely new submission of other equipment or different materials is required.
   5. Not Reviewed □ Submission has not been reviewed by the Engineer for conformance to the Contract Documents.
   6. For Record Only □ Submission was not required for product for review by Engineer, or, submission was not reviewed by Engineer prior to installation but is marked for Record for conformance with Contract Documents.

P. No payment will be made on any item for which a submission is required if such submission:
   1. has not been made,
   2. has been made but was not stamped "Accepted" by Engineer,
   3. has been made and stamped "Accepted As Corrected," but Contractor has not

complied with Engineer's notes marked on the submittal,

4. has been made and stamped "Accepted," but item provided does not conform to the shop drawing nor to the Contract Documents.

Q. Engineer's acceptance of submittals shall not relieve Contractor of responsibility for any deviation from the requirements of the Contract Documents unless Contractor has informed Engineer, in writing, of such deviation at the time of submission and Engineer has given written acceptance to the specific deviation, nor shall Engineer's acceptance relieve Contractor from responsibility for errors or omissions in the submittals.

R. No portion of the Work requiring a submission shall be commenced until the submission has been accepted by Engineer.

END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance submittals.

B. Mock-ups.

C. Control of installation.

D. Tolerances.

E. Inspection services.

F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Section 01300 - Administrative Requirements: Submittal procedures.

B. Section 01425 - Reference Standards.

C. Section 01600 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2001.

B. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2003a.

C. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Unit Masonry; 1995 (Reapproved 2001).

D. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2001.

E. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction; 2003.

F. ASTM E 543 - Standard Practice for Agencies Performing Nondestructive Testing; 2002.

G. ASTM E 548 - Standard Guide for General Criteria used for Evaluating Laboratory Competence; 1994.

1.04 SUBMITTALS

A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time personnel with their listed certifications and responsible officer.

B. Test Reports: After each test/inspection, promptly submit two copies of report to Engineer.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.

f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Conformance with Contract Documents.
k. When requested by Engineer, provide interpretation of results.

2. Test reports are submitted for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and/or installation/application subcontractor to Engineer.
1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

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

E. Manufacturer's Field Reports: Submit reports for Engineer's benefit as contract administrator or for Owner.
1. Submit report in duplicate within 10 days of observation to Engineer.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

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

1.05 REFERENCES AND STANDARDS - S□□ S□□□□□□ 01425

1.06 TESTING AND INSPECTION AGENCIES

A. **C□□□□□□□□□□□□□□ □□□ □□□ □□□ □□□□□□□□□□ □□□□ □□□□□□□□□□□□□□□□ □□□□□□ □□ □□□□□□ □□□□□□□□ □□□□□□.**

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

C. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, ASTM C 1093, and ASTM D 3740.
2. Laboratory: Authorized to operate in State in which Project is located.
3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer 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 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING

A. See individual specification sections for testing required.

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

C. Limits on Testing Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used which 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.
   b. To obtain and handle samples at the site or at source of Products to be

tested.
c. To facilitate tests.
d. To provide storage and curing of test samples.

4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples and tests, required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer. Payment for re testing shall be paid by the Contractor.

3.04 MANUFACTURERS FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to instruct Owner in proper operation and Maintenance procedures and requirements.

B. Submit qualifications of observer to Engineer 15 days in advance of required observations.
1. Observer subject to approval of Engineer.

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

D. Submit a "Certificate of Compliance" attached hereto, or reasonable facsimile.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Contractor shall propose an appropriate remedy for review and acceptance by Engineer, or if acceptable to Owner, accept an adjustment in payment.

END OF SECTION

SECTION 01425

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

B. Reference standards full title and edition date.

1.02 RELATED SECTIONS

A. EJCDC C-700 Contract Document - General Conditions.

B. EJCDC C-800 Contract Document Supplementary General Conditions

1.03 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Contract Document, 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. Conform to reference standard of date of issue current on date for receiving bids or specified in the individual specification, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by the Contract Documents.

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 the Engineer before proceeding.

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

PART 2 CONSTRUCTION INDUSTRY ORGANI ATION DOCUMENTS

2.01 ABBREVIATIONS AND ORGANI ATIONS

A. The following is a partial list of abbreviations that may be used in the Specifications and the organizations to which they refer:

AA -- ALUMINUM ASSOCIATION, INC.

AAN -- AMERICAN ASSOCIATION OF NURSERYMEN

AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

ACI -- AMERICAN CONCRETE INSTITUTE

AGA -- AMERICAN GAS ASSOCIATION

AIA -- AMERICAN INSTITUTE OF ARCHITECTS

AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

AISI -- AMERICAN IRON AND STEEL INSTITUTE

AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

AREA -- AMERICAN RAILWAY ENGINEERING ASSOCIATION

ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE

ASA -- ACOUSTICAL SOCIETY OF AMERICA

ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ASTM -- AMERICAN SOCIETY FOR TESTING AND MATERIALS

AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

AWS -- AMERICAN WELDING SOCIETY

AWWA -- AMERICAN WATER WORKS ASSOCIATION

CBM -- CERTIFIED BALLAST MANUFACTURERS

DHUD -- U.S. DEPARTMENT OF HOUSING & URBAN DEVELOPMENT

EIA -- ELECTRONIC INDUSTRIES ASSOCIATION

EPA -- U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA)

ETL -- ETL TESTING LABORATORY

FM -- FACTORY MUTUAL RESEARCH CORPORATION

FmHA -- FARMERS HOME ADMINISTRATION, U.S. DEPARTMENT OF AGRICULTURE

FS -- FEDERAL SPECIFICATION

IBR -- INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS

IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

IPCEA -- INSULATED POWER CABLE ENGINEERS ASSOCIATION

NBFU -- NATIONAL BOARD OF FIRE UNDERWRITERS

NBS -- NATIONAL BUREAU OF STANDARDS

NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

NEWWA -- NEW ENGLAND WATER WORKS ASSOCIATION

NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

NSF -- NSF INTERNATIONAL (National Sanitation Foundation)

OSHA -- U.S. OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION

PCA -- PORTLAND CEMENT ASSOCIATION

PCI -- PRECAST/PRESTRESSED CONCRETE INSTITUTE

PS -- PRODUCT STANDARD

SCS -- U.S. SOIL CONSERVATION SERVICE

SDI -- STEEL DOOR INSTITUTE

SJI -- STEEL JOIST INSTITUTE

UBC -- UNIFORM BUILDING CODE

UL -- UNDERWRITERS LABORATORIES, INC.

WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

END OF SECTION

SECTION 01450

ABBREVIATIONS AND SYMBOLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Common abbreviations and symbols and their meanings which are used throughout the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01425 - Reference Standards.

1.03 OTHER REFERENCES

A. Other abbreviations and symbols may be found in legends and elsewhere on the Drawings. Piping material abbreviations are contained in the piping Sections.

B. Should an abbreviation or symbol not be specifically defined, it shall carry the standard definition commonly used in the industry.

C. Whenever any doubt arises as to what an abbreviation or symbol means, notify Engineer and he will issue a definition in writing.

1.04 ABBREVIATIONS

A. The following is a list of commonly used abbreviations which may be found in the Contract Documents, and the meanings ascribed to them:

A.C. or ac	Alternating Current
a or A	Amperes
AFF	Above Finished Floor
amp or AMP	Amperes
Alum.	Aluminum
Asph.	Asphalt
Aux.	Auxiliary
AWG	American or Brown and Sharp Wire Gage
Bit. Conc.	Bituminous Concrete
Btu	British Thermal Unit
CB	Circuit Breaker
Cl.	Class
cm	Centimeter
C.O.	Cleanout
Conc.	Concrete
Cont.	Continuous
Cu.	Cubic
cc	Cubic Centimeters
C.F.	Cubic Feet
CFM or cfm	Cubic Feet Per Minute
CFS or cfs	Cubic Feet Per Second
C.Y.	Cubic Yards
CT	Current Transformer
D.C. or dc	Direct Current
Dia.	Diameter
DWG. or Dwg.	Drawing
Dr.	Drive
Ea. or ea.	Each

EF	Each Face
EW	Each Way
Eff. or eff.	Efficiency
El. or Elev.	Elevation
Fin. Gr.	Finished Grade
fps	Feet Per Second
Ft. or ft.	Feet
ftg.	Footing
g.	Grams
Ga. or ga.	Gauge
Gal. or gal.	Gallon
Galv.	Galvanized
GPD or gpd	Gallons Per Day
GPM or gpm	Gallons Per Minute
H-O-A	Hand-off-automatic
Hz. or hz.	Hertz
I.D.	Inside Diameter
Inv.	Invert
IP	Instrument Panel
KVA or kva	Kilovolts-amperes
Kw or kw	Kilowatts
Kwh or KWH	Kilowatt-hours
Lbs. or lbs.	Pounds
L.F.	Linear Feet
LPA	Lighting Panel "A"
L.S.	Lump Sum
m.	Meters
mA.	Milliamperes
Max. or max.	Maximum
MCC	Motor Control Center
Mfbm	Thousand Foot-Board Measure
mg.	Milligrams
MGD or mgd	Million Gallons Per Day
mi.	Miles
Min. or min.	Minimum
mm	Millimeters
No. or no.	Number
nom.	Nominal
NPT	National Pipe Thread
N.T.S.	Not to Scale
O.D.	Outside Diameter
OS&Y	Outside Screw and Yoke
Oz. or oz.	Ounce
pb	Pushbutton
PPD	Pounds Per Day
P/B	Pullbox
pri.	Primary
psf	Pounds Per Square Foot
psi	Pounds Per Square Inch
psig	Pounds Per Square Inch, Gauge Pressure
PT	Potential Transformer
Pvt. or Pvmt.	Pavement
R.	Radius
R.O.W.	Right-of-Way

scfm	Standard Cubic Feet per minute
Sch.	Schedule
sec.	Secondary or Seconds
Sq. or sq.	Square
S.F.	Square Feet
S/S/P	Stop-start-pilot Station
Std. or std.	Standard
S.Y.	Square Yards
T&B	Top and Bottom
Typ.	Typical
U.O.N.	Unless Otherwise Noted
V or v	Volts
Vac or VAC	Alternating Current Voltage
Vdc or VDC	Direct Current Voltage
V.F.	Vertical Feet
Vol.	Volume
W or w	Watts
w.c.	Water Column
WSP	Working Steam Pressure
Yd. or yd.	Yards

1.05 SYMBOLS

A. The following is a list of commonly used symbols which may be found in the Contract Documents, and the meanings as scribed to them:

	Phase, Diameter, or Round (as applicable)
□	Degrees (F. Fahrenheit C. Centigrade)
'	Feet or Minutes
"	Inches or Seconds
#	Number or Pound
/	Per or Divided By
4:1	4 horizontal to 1 vertical, slope
1 on 4	1 vertical on 4 horizontal, slope

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telephone, internet, and facsimile service.

C. Temporary sanitary facilities.

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

E. Security requirements.

F. Vehicular access and parking.

G. Traffic Control

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

1.02 RELATED REQUIREMENTS

A. None

1.03 TEMPORARY UTILITIES

A. Existing facilities may be used.

1.04 INTERNET CONNECTION

A. Not applicable

1.05 TELEPHONE SERVICE

A. Not applicable

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. New permanent facilities may not be used during construction operations.

D. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide protection for plants designated to remain. Replace damaged plants.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

A. Construction: Contractor's option.

1.09 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 INTERIOR ENCLOSURES

A. Provide temporary partitions as indicated to separate work areas from occupied areas, to prevent penetration of dust and moisture into occupied areas, and to prevent damage to existing materials and equipment.

1.11 SECURITY

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

B. Coordinate with Owner.

1.12 VEHICULAR ACCESS AND PARKING

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

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

C. Designated existing on-site roads may be used for construction traffic.

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

1.13 TRAFFIC CONTROL

A. Maintenance of Traffic
   1. Provide a minimum of one lane for two-way traffic on all public roads at all times.
   2. Provide and maintain strong, suitable and safe temporary crossings and detours over and around the Work as necessary to maintain access to public and private property and to maintain pedestrian and vehicular traffic.
   3. Fire hydrants, water holes, and other sources of water for fire protection, on or adjacent to the Project site, shall be kept accessible to fire apparatus, and no obstructions shall be placed within ten (10) feet of any such source.
   4. Notify police and fire departments in writing, with a copy to the Engineer, 24 hours in advance if the closure of a street is necessary, and cooperate with the Police Department in establishment of alternate routes.

B. Uniformed Traffic Officers and Flaggers
   1. Not applicable.

C. Warning Signs
   1. Provide warning signs, detour signs and other traffic control devices to insure the safety of the public and to adequately direct traffic around the Work.

D. Lighting
   1. Illuminate barricades, obstructions, and warning and detour signs, from sunset to sunrise.

1.14 WASTE REMOVAL

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

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

1.15 PROJECT IDENTIFICATION □ NOT REQUIRED

A. Not required

1.16 FIELD OFFICES □ NOT REQUIRED

A. Not required

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.

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

C. Restore existing facilities used during construction to original condition or better.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations and procedures.

F. Procedures for Owner-supplied products.

G. Spare parts and maintenance materials.

1.02 RELATED REQUIREMENTS

A. Section 01400 - Quality Requirements

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.

B. 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.

C. Shop Drawing Submittals: Prepared specifically for this Project.

D. 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.

E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. All products shall be new and unused. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

2.02 NEW PRODUCTS

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

B. Provide interchangeable components of the same manufacture for components being replaced.

2.03 PRODUCT OPTIONS

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

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

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

2.04 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

B. Deliver to Project site.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Engineer will consider requests for substitutions only within 30 days after date of Notice to Proceed.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

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

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

F. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Engineer will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. 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.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

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

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

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

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

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

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, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01130 - Surveys and Layouts: Not used

B. Section 01300 - Administrative Requirements: Submittals procedures.

C. Section 01400 - Quality Requirements: Testing procedures.

D. Section 01500 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01510 - Temporary Utilities: Not used

F. Section 01780 - Closeout Submittals: Project record documents, operation and maintenance manuals, warranties, and substantial and final completion requirements.

G. Individual Product Specification Sections:

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Survey work: Not applicable

C. Cutting and Patching: Submit written request in advance of cutting or alteration which 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 Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.
      g. Written permission of affected separate Contractor.
      h. Date and time work will be executed.

1.04 QUALIFICATIONS

A. For field engineering, employ a Professional Engineer of the discipline required for specific service on Project, licensed in the State of Maine.

1.05 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

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

D. 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.

E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

G. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.06 COORDINATION

A. Coordinate work of alterations and renovations to expedite completion.

B. Coordinate scheduling, submittals, and work of the various sections of the Contract Documents to ensure efficient and orderly sequence of installation of interdependent construction elements.

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

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

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

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

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 demolition is complete in alterations areas and areas are ready for installation of new work.

C. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

D. Examine and verify specific conditions described in individual specification sections.

E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.

F. Verify that utility services are available, of the correct characteristics, and in the correct locations.

G. 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. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.

E. Prepare surfaces and remove surface finishes to provide for proper installation of new

work and finishes.

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

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

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

3.03 PREINSTALLATION MEETINGS

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

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

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

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

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

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Engineer of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on Drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

H. Utilize recognized engineering survey practices.

I. 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; and other structures or piping systems.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 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.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as shown.

2. Report discrepancies to Engineer before disturbing existing installation.

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 not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. 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.

D. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finished that existing prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

E. Clean existing systems and equipment.

F. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

G. Do not begin new construction in alterations areas before demolition is complete.

H. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Execute cutting and patching to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing.

C. Employ skilled and experienced installer to perform cutting.

D. Cut rigid materials using appropriate saws or core drills. Pneumatic tools not allowed without prior approval.

E. Restore work with new products in accordance with requirements of Contract Documents.

F. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

G. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

H. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

3.09 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. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEMS STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer and owner five days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment

or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel 5 days prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified manufacturer's representative who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to substantial completion.

B. Use cleaning materials that are nonhazardous.

C. Clean surfaces exposed to view; remove temporary labels and stains and foreign substances.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean debris from roofs, exposed surfaces, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste, surplus materials, rubbish, and construction facilities from the site.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Engineer.

B. Accompany Owner and Engineer at Substantial Completion inspection to determine items to be listed for completion or correction.

C. Notify Engineer when work is considered ready for Substantial Completion.

D. Correct items of work listed in executed Certificates of Substantial Completion and

comply with requirements for access to Owner-occupied areas.

E. Accompany Owner and Engineer at Final Completion inspection.

F. Notify Engineer when work is considered finally complete.

G. Complete items of work determined by Engineer's final inspection.

END OF SECTION

SECTION 01780

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

D. Spare Parts and Materials

E. Special Tools

F. Lubricants

G. Facilities Startup

1.02 RELATED REQUIREMENTS

A. EJCDC C-700 Contract Documents □ General Conditions

B. Section 01300 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01700 - Execution Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit 1 copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten 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 ten days after acceptance, listing the date of

acceptance as the beginning of the warranty period.

D. Other Items:
   1. Spare Parts: Deliver spare parts to Owner prior to Final Completion Inspection.
   2. Special Tools: Deliver special tools to Owner prior to Final Completion Inspection.
   3. Lubricants: Deliver required lubricants to Owner prior to Final Completion Inspection.

PART 2 PRODUCTS

2.01 SPECIAL TOOLS AND SPARE PARTS

A. As recommended by the manufacture of the equipment installed as part of the Work.

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. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. 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. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

3.02 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. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. 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.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

3.03 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Binders: Commercial quality, 8-1/2 x 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.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

D. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

E. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

F. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

G. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

H. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.

b. Certificates.
c. Photocopies of warranties and bonds.

3.04 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. 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. Manual: Bind in commercial quality 8-1/2 x 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. 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.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.05 SPARE PARTS AND MATERIALS

A. Provide spare parts and materials that are normally furnished at no extra cost and that are specified to be furnished by the Specifications.

B. Deliver, handle and protect parts and materials as specified in Section 01600.

C. Distribute and store in locations as directed by the Owner.

3.06 SPECIAL TOOLS

A. Furnish one set of special tools or devices for each type of equipment that is necessary for its proper operation and/or maintenance.

B. Tools shall be high grade, smooth, forged, alloy tool-steel.

C. Grease guns shall be lever type.

3.07 LUBRICANTS AND FACILITIES STARTUP

A. Furnish one year supply of lubricants necessary for proper lubrication of all equipment.

B. Shall be as recommended by Manufacturers.

C. Furnish in approved containers and store as directed by Owner.

D. Furnish all liquids and materials required to operate and maintain the facilities for the initial startup period. Fill all units with appropriate liquids or materials as recommended by manufacturer.

E. Pay all costs associated with facilities startup and testing.

END OF SECTION

SECTION 223000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.

1.02 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

B. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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

D. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

E. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data:
   1. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Electric Water Heaters: UL listed and labeled to UL 174.
   3. 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. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
   1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
   2. Rheem Manufacturing Company: www.rheem.com/#sle.
   3. Bradford White: www.bradfordwhite.com.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Commercial Electric:
   1. Type: Factory-assembled and wired, electric, vertical storage.

2. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches polyurethane encased in corrosion-resistant steel jacket; baked-on enamel finish.
3. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 170 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
4. Accessories:
    a. Drain valve.
    b. Anode: Magnesium.
    c. Temperature and Pressure Relief Valve: ASME labeled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping to achieve operating system.

END OF SECTION 223000

SECTION 230500
BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this section.

B. 01 9113 General Commissioning Requirements.

C. Divisions 22 and 23 Drawings and Specifications in their entirety.

D. Civil, Architectural, Structural, Fire Protection, and Electrical drawings and specifications in their entirety.

1.02 SECTION INCLUDES

A. General administrative and procedural requirements for mechanical installations to expand the requirements specified in Division 01.

B. Coordination Drawings, Submittals and Shop Drawings
   1. Record Drawings
   2. Delivery Storage and Handling
   3. Operation and Maintenance Manuals
   4. Submittals and Product Substitutions
   5. Quality Assurance
   6. Painting
   7. Cutting and Patching
   8. Cleaning
   9. Guarantee

C. Division 23 covers, in broad detail, the extent of the mechanical work and the equipment to be provided and shall not be construed as a complete description of all the details of design and construction required.

D. Provide all labor, materials, equipment, articles, and tools and perform all work necessary for the complete execution of the mechanical work, as shown on the Drawings, required by the Specifications and work not specifically shown or specified, yet required to ensure the design intent inherent in the work and to comply with all applicable codes and regulations.

E. The drawings are generally diagrammatic, intended to convey the scope of the work and indicate the general arrangement of equipment, ductwork and piping and approximate sizes and locations of equipment. Do not scale Drawings. Consult and closely review existing conditions. Any discrepancies between what is shown in the bid documents versus what is found in the field must be brought to the attention of the Contract Administrator PRIOR to bidding.

F. Contractor shall make a complete survey of the existing site and specific areas of work required to assess and deliver the finished product called for in the bid documents.

1.03 SUBMITTALS

A. Refer to procedures specified in Division 01. Submittal packages shall be provided in the formats listed in this section and on the drawings.

B. Apply Contractor's stamp on each copy of each submittal, signed or initialed certifying that the product is in accordance with the requirements of the Work and Contract Documents. The stamp shall have the following wording: "I hereby certify that I have carefully examined the enclosed submittal(s) and have determined and verified all field measurements, construction criteria, materials, catalog numbers and similar data, coordinated the submittal(s) with other submissions and the work of other trades and contractors, and that to the best of my knowledge and belief, the enclosed submittal(s) is/are in full compliance with the Contract requirements, except as follows: (enter NONE if there are no exceptions)".

C. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed work.

D. Items not clearly marked will be returned for corrections prior to the initial review. Clearly mark items for submission including part numbers, accessories, options, etc. Submittals revised for resubmission shall clearly identify changes made since previous submission.

E. Engineer's acceptance of submittal(s) shall not relieve Contractor or responsibility for any deviation from the requirements of the Contract Documents unless Contractor has informed Engineer and Contract Administrator in writing, of such deviation at the time of submission and Engineer has given written acceptance to the specific deviation, nor shall Engineer's acceptance relieve Contractor from responsibility for errors or omissions in the submittal.

F. Refer to other Division Sections for equipment and materials which require individual submittals.

G. Submit shop drawings and product data grouped to include complete submittals or related systems, products and accessories in a single submittal.

H. Provide catalog cuts and shop drawings for all equipment, trim, devices and materials. Submittals shall be project specific indicating all specialties and accessories intended to be provided. Clearly indicate the precise items submitted. Contractor shall not install any equipment or material without accepted submittal. Equipment purchased without submittal approval will be done so at the financial risk of the contractor.

I. Provide installation instructions and operation and maintenance manuals for all equipment. Manuals will be submitted for review before Engineer performs punch list. See paragraph 1.08.

J. Provide all record mechanical drawings. See Division 01.

K. Provide copies of all required permits to the Contract Administrator.

L. Test & Balance Reports: Provide complete copies of air and water balancing reports. Contractor shall provide a draft copy of report with discrepancies from contract requirements clearly noted before Engineer performs punch list.

M. Scheduling: The Engineer shall review all correctly submitted Packages within a 21-day time frame beginning on day of receipt. The Prime and Mechanical Contractor shall include this period in its overall Project Schedule.

1. Items not clearly marked will be returned for corrections prior to the initial review. Submitted packages not in compliance with Paragraph ‘G’ (above) shall be returned for corrections; re-submittal due to incomplete documentation restarts the review period timeframe.

N. Pipe Testing. When testing and if necessary re-testing, has been completed, and no leaks are remaining, provide written confirmation of testing and successful completion with no remaining leaks, to the Contract Administrator prior to backfilling or covering pipe with insulation or similar.

1. All testing shall be witnessed by the Contract Administrator or its Agent. Backfilling or covering shall not be permitted until tests have been witnessed and signed off by the Contract Administrator or its Agent.

1.04 REGULATORY REQUIREMENTS

A. International Building Code (2015).

B. International Plumbing Code (2015).

C. International Mechanical Code (2015).

D. International Energy Conservation Code (2015).

E. ASHRAE and SMACNA Guidelines and Codes as required.

F. Obtain and pay for city and state permits and request inspections from authority having jurisdiction and/or as directed by the Contract Administrator.

1.05 PROJECT/SITE CONDITIONS/COORDINATION

A. In accordance with Division 01

B. Install work in all locations shown on drawings, unless prevented by Project conditions.

C. Proposed rearrangement of work to meet project conditions including changes to work specified in other trades shall be accepted by Engineer and Contract Administrator before proceeding.

D. It is the responsibility of the mechanical contractor to coordinate the work of his trade with all other trades prior to the commencement of construction. The drawings are schematic in nature, not all fittings and offsets are shown. It is the responsibility of the Contractor to provide, in his original bid, all necessary offsets, fittings, and transformations to provide a complete project. Any conflicts must be brought to the attention of the Engineer.
   1. Any work requiring removal and reinstallation due to the lack of coordination shall be the responsibility of the Contractor with no additional cost to the Owner.

1.06 RECORD DRAWINGS

A. Submit in accordance with Division 01. Submit to Contract Administrator.

B. During the progress of the work, the Contractor shall furnish and keep on file at all times a complete and separate set of black or blue line print record documents. Each shall be clearly, neatly and accurately noted, promptly, as the work progresses, all mechanical changes, revisions, additions, deletions and deviations from the work. Wherever the work was installed, other than as shown on the Contract Drawings, the changes shall be so noted. In addition to the requirements specified in Division 01, indicate the following installed conditions:
   1. Ductwork mains and branches, size and location, for both exterior and interior; locations of Dampers, other control devices; filters, boxes, and units requiring periodic maintenance.
   2. Mains and branches of piping systems, with valves, steam traps, and control devices located and numbered to correspond with installed tag numbers, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag charts; refer to Division 23 Section "MECHANICAL IDENTIFICATION." Indicate actual inverts and horizontal locations of underground piping.
   3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

C. At the completion of the work, the Contractor shall submit to the Contract Administrator for comments and/or acceptance. Final payment will be held until the record prints are received and accepted by the Contract Administrator. Contractor shall incorporate comments and provide corrected drawings and electronic files (AutoCAD .dwg format and PDF format on CD) to the Contract Administrator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Submit in accordance with Division 01, Execution Requirements.

B. Contractor shall assemble maintenance and operating manuals containing the following:
   1. Accepted shop drawings submittals for all mechanical equipment items.
   2. Name, address and telephone number of manufacturer or manufacturer's representative for each piece of mechanical equipment. Name shall include a specific contact person.
   3. Troubleshooting guides and maintenance manuals for each piece of mechanical equipment.
   4. List of recommended spare parts for each piece of mechanical equipment.
   5. A single matrix or chart detailing specific operating procedures and operating sequences for all pieces of mechanical equipment.
   6. A copy of the valve tag chart and steam trap tag charts described in Section 23 0553.

C. Maintenance manuals shall be assembled in three-ring binders. Binders shall not be filled to more than 75% capacity. Provide as many binders as required.

D. Each specific piece of mechanical equipment along with its accompanying information shall be separately tabbed within the binder.

E. The spine of each binder shall be labeled with Operating and Maintenance Manual - Book__ of __. The front cover shall have the same information as the spine. Additionally the front cover shall identify the project name and date of final acceptance by the Contract Administrator. Also identified shall be the name, address, telephone number of the contractor responsible for the mechanical work, and the name, address and telephone number of the mechanical engineer.

F. Unless otherwise directed provide (2) hard copies and (2) electronic copies on CD of the accepted Operation and Maintenance Manuals to the Contract Administrator.

1.09 SUBMITTALS AND PRODUCT SUBSTITUTIONS

A. Submit in accordance with Division 01, Product Requirements and 1.03 (above).

B. Equipment listed in the equipment schedules on the drawings is the basis of design.

C. Accepted manufacturers generally considered equals are listed in this specification. Because equipment of different manufacturers varies in physical and performance characteristics, it shall be the Contractor's sole responsibility to ensure that proposed products meet the intent and constraints of the project.

1. Changes in system performance, equipment size, weight, layout, installation, piping (above and underground), breeching, electrical, gas, water or drainage requirements, structural, and architectural will be engineered and confirmed in writing to the Contract Administrator by the Contactor. All changes shall be fully coordinated with the other applicable trades. All costs for system re-engineering (in whole or in part), impacts to other trades, and schedules are the sole responsibility of the Contractor. Proposed substitutions and subsequent modifications are at no additional cost to the Owner.

D. Equipment not listed specifically on the Drawings or in the Specifications shall be considered substitutes. Substitutions will be processed in accordance with Division 01. Products submitted as substitutions after the award of bid will be rejected, unless specific written pre-approval from the Contract Administrator is obtained. It shall be the Contractor's responsibility to ensure that substitute items meet the intent and constraints of the project.

1. The Contractor shall compensate the Engineer for time spent reviewing submittals of substitute materials and equipment. The compensation shall be based on the Engineer's published hourly rate schedule for a Senior Mechanical Engineer’s service.

1.10 QUALITY ASSURANCE

A. Equipment and appurtenances shall be designed in conformity with ANSI, ASME, IEEE, NEMA, OSHA, AGMA and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation and all other conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other accepted means. Provisions shall be made for adequate lubrication with readily accessible devices.

B. Ample clearance shall be provided for repairs, inspection and adjustment. Protruding members such as joints, corners and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

C. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI, OSHA, and local industrial codes, including but not limited to, shaft guards on all rotating shafts.

D. Before commencing work, review the project with the Local and State inspectors. Conform, in every respect, with their separate recommendations, unless the recommendations are inferior to, or in conflict with, the Contract Documents. Contract Administrator /Engineer's acceptance will be required before proceeding with any changes in the work, recommended or required by local or state inspectors.

E. All mechanical work shall be performed by mechanics who are qualified to do such work and who are normally engaged in this type of work. Because of the complexity of the mechanical

work, unskilled labor is not permitted.

F. Gas piping work shall be performed by State licensed gas fitters.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials and equipment shall be new, conform to standards and carry labels in every case where standards have been established.

B. To the maximum extent possible, all mechanical equipment for any one system shall be the product of a single manufacturer, unless specifically dictated otherwise by the equipment schedules shown on the drawings. Owner/Engineer reserves the right to disapprove and reject equipment from various manufacturers when acceptable components can be secured from fewer manufacturers and to require that source of materials be unified to the maximum extent possible.

2.02 PAINTING

A. Finish painting will be provided by the Contractor. All pumps, motors, tanks, heat exchangers and all other factory manufactured and assembled apparatus shall be factory coated with manufacturer's standard shop coat, except where special finishes are specified. Contractor shall touch up all scratched or damaged equipment with paint supplied by the equipment manufacturer. Clean and paint to match original finish, all items scratched or otherwise damaged.

B. Contractor shall paint all steel brackets, supports, stands, hangers, etc., furnished and installed by this Division. Paint with one coat rust inhibitive paint, compatible with all other paints and matching adjacent colors.

1. Contractor shall paint supplemental steel that is attached to the building structural steel shall be painted to match the structural steel color. Hangers, guides and similar equipment that cannot be completely painted after installation shall be painted before installation.
    a. Refer to Division 01 and Architectural specifications for additional painting requirements.

C. Shop-painted structural steel that has been scratched, marred, or damaged by the installation of hangers and/or supplemental steel shall be touched-up to match the original shop paint.

PART 3 – EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Do not scale the drawings.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate and integrate the various elements of mechanical systems, materials and equipment. Comply with the following requirements:

B. Coordinate mechanical systems, equipment, and materials installation with other building components and building trades.

C. Verify all dimensions by actual field measurements.

1. Arrange for chases, slots, and opening in other building components during progress of construction, to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

F. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

G. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

H. Install systems, materials, and equipment to conform with accepted submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, Contractor shall review the conflict to the Contract Administrator.

I. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

J. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

K. Coordinate installation of access doors where units are concealed behind finished surface.

L. Install systems, materials, and equipment giving right-of way priority to systems required to be installed at a specified slope.

M. Provide assistance and coordination for the installation of firestopping systems.

3.03 ELECTRICAL INSTALLATIONS

A. Review all electrical drawings and specifications. Contractor shall confirm electrical characteristic requirements of all equipment prior to submittals with electrical contractor.

B. Unless specifically identified otherwise on the electrical drawings, provide equipment manufacturer installed or supplied motor starters, variable frequency drives, disconnect switches and fuses for all motor operated loads.

C. Provide all temperature control wiring and transformers, regardless of voltage, necessary for the complete operation of the system provided.

D. All work shall conform to the requirements of electrical drawings and Division 23.

3.04 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with the following requirements and as directed by the Owner's representative.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover work to provide for installation of ill-timed work.
   2. Remove and replace defective work.
   3. Remove and replace work not conforming to requirements of the contract documents.
   4. Remove samples of installed work as specified for testing.
   5. Upon written instructions from Contract Administrator or the Owner, uncover and restore work to provide for Engineer observation of concealed work.

3.05 INSTALLATION OF EQUIPMENT

A. All equipment shall be installed true, level and in the location shown on the Drawings. Precision gauges and levels shall be used in setting all equipment.

B. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Contract Administrator /Engineer during installation.

C. The equipment shall be brought to a proper level by wedges and shims. After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bond the machine firmly into place against the wedges or shims.

D. Furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of equipment. These shall be of ample size and strength for the purpose intended.

E. Anchor bolts shall be provided for equipment mounted on concrete pads.

F. All equipment shall be installed in such a manner as to provide access for routine maintenance, including lubrication.

G. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by this Contractor. See also under Painting (above).

H. All foundations, anchor pads, piers, thrust block, inertia blocks and structural steel supports shall be provided by the Contractor and shall be built to template and reinforced as required for loads imposed on them.

I. Contractor takes all responsibility and coordination with Contractors for sizes, locations, and design of all foundations, anchor pads, piers, thrust blocks, inertia blocks, curbs and structural steel supports, unless otherwise indicated on the Drawings.

3.06 CLEANING

A. Protect equipment against mortar, dust, weather, etc., during construction and leave all equipment clean. Remove from the premises, all debris and unused material and leave premises in a clean and neat condition.

B. Inspect all items of equipment thoroughly. Repair any items dented, scratched, or otherwise damaged in any manner and paint to match original finish (see above).
   1. All items so repaired and refinished shall be brought to the attention of the Contract Administrator for review and acceptance.

C. Provide a final cleaning all the work area at the conclusion of the project.
   1. Thoroughly clean all equipment prior to turn-over to the Owner
   2. Wipe down all equipment and insulation jacketing.
   3. Broom sweep and vacuum the work areas
   4. Remove all debris from the worksite; legally dispose.

3.07 GUARANTEE

A. Refer to Division 01. Guarantee all workmanship, materials, and equipment installed under these Specifications against any defects which may occur during one year period starting from point of acceptance as stated in Division 01. Guarantee all other work and damage as a result of such defects. Coordinate with the Prime Contractor for requirements of guarantee.

B. Replace any material and equipment prior to final acceptance, which is corroded or otherwise damaged through the failure to properly operate and maintain the installation during construction or testing.

C. Keep the work in repair and replace any defective materials, equipment or workmanship upon notice from the Owner's representative for a period of one year period starting from point of acceptance as stated in Division 01.

D. Materials or equipment requiring excessive service during the first year of operation shall be considered defective and costs associated with troubleshooting, correcting, testing, or replacing shall be at the Contractor’s expense.

E. List in the O&M Manuals, post on the equipment, and give to the Contract Administrator, a list of phone numbers to call for servicing during emergency and guarantee periods.

END OF SECTION 230500

SECTION 230505
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division 01 Sections apply to this Section.

1.02 SUMMARY

A. This section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete equipment base construction requirements.
   3. Equipment nameplate data requirements.
   4. Non-shrink grout for equipment installations.
   5. Field-fabricated metal and wood equipment supports.
   6. Installation requirements common to equipment specification sections.
   7. Cutting and patching.
   8. Selective demolition.

B. Pipe and pipe fitting materials are specified in piping system sections.

1.03 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms or pump pits.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. 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.

G. The word “Provide” is defined to mean both furnish and install the specified material and equipment, or service.

1.04 SUBMITTALS

A. Refer to Division 01 for submittals.

B. Product Data: submit product data on the following items:
   1. Escutcheons
   2. Dielectric Unions and Fittings
   3. Mechanical sleeve seals
   4. Joint sealers

C. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of work. Include coordination for shut-off valve of utility services and details for dust and noise control. Coordinate sequencing with construction phasing and occupancy specified in Division 01.

1.05 QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

1. Comply with provisions of ASME B31 Series Code for Pressure Piping.
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

B. Soldering and brazing procedures for refrigeration piping according to ANSI B9.1 “Standard Safety Code for Mechanical Refrigeration”.

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 prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight; support to prevent sagging and bending.

E. Deliver joint sealer and fire-stopping materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

F. Store and handle joint sealer and fire materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.07 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition: The following project conditions apply:
1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
2. Coordinate the shut-off and disconnection of utility services with the Contract Administrator.
3. Notify the Contract Administrator at least 14 days prior to commencing demolition operations. No work shall commence without direct permission of the Contract Administrator.
4. Perform demolition in phases as specified, indicated or required.

B. Environmental Conditions: Apply joint sealers and fire stopping under temperature and humidity conditions within the limits permitted by the manufacturer. Do not apply joint sealers and fire stopping to wet substrates. Provide ventilation per manufacturer’s requirements.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification sections for pipe and fitting materials and joining methods.

B. Elbows for all pipe sizes over 2” diameter shall be long radius type (1.5 the diameter to centerline of pipe).

C. Use reducers, increasers, or reducing tees for change of pipe size. Bushings are not allowed.

D. Utilize eccentric-style reducers (flat on top) in steam piping for connections to control valves and pressure reducing valves. Pitch pipe away from valve body or in-line device to prevent condensate build-up within valve body.

E. Forged steel branch connectors, per the limits set forth in Part 3 of this section, may be used to create branch connections in steel piping systems. All branch connectors shall be 3,000# fittings.
1. 'Weld-O-Lets”, “Three-O-Lets”, or “Sock-O-Lets”
2. “Trans-O-Con”

2.02 JOINING MATERIALS

A. Refer to individual piping system specification sections in Division 23 for special joining materials not listed below.

B. Pipe flange gasket materials: Suitable for the chemical and thermal conditions of the piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness, except where 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. ASME B16.20 for grooved, ring-joint, steel flanges.
   3. AWWA C110, rubber flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, GRADE 8 except where other material is indicated.

D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.

E. Solder Filler Metal: ASTM B 32.
   1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10-percent lead content.
   2. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20-percent maximum lead content.

F. Brazing materials: Comply with SFA-5.8, Section II, “ASME Boiler and Pressure Vessel Code” for brazing filler metal materials appropriate for the materials being joined. Copper-phosphorus alloy brazing filler metal; BcuP-5 (Staysilv), containing 15% silver (Ag), 5% phosphorus (P), remaining elements are copper (Cu).

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvents complying with the following:
   1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235.
   2. Chlorinated Poly-Vinyl Chloride (CPVC): ASTM F 493.
   3. Poly-Vinyl Chloride (PVC): ASTM D 2564.
   4. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel GRADE 8 bolts and nuts.

K. Couplings for buried piping: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.
   1. Sleeve: ASTM A 126, Class B, gray iron.
   2. Followers: ASTM A 47, Grade 32510 or ASTM A 536 ductile iron.
   3. Gaskets: Rubber.
   4. Bolts and Nuts: AWWA C111.
   5. Finish: Enamel paint.

2.03 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.
   1. Inside Diameter: Closely fit around pipe, tube, and insulation of insulated piping.
   2. Outside Diameter: Completely cover opening.
   3. Cast Brass: Split casting, with concealed hinge and set-screw, polished chrome finish.

B. Unions: Malleable-iron, Class 150 for steel piping systems and low pressure service; cast bronze, 125 wsp for copper piping systems and low-pressure service, hexagonal stock, with

ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

C. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
   1. Description: Combination of copper alloy and ferrous metal; threaded, solder, plain, and weld neck end types and matching piping system materials.
   2. Insulating Material: Suitable for system fluid, pressure and temperature.
   3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg. F. temperature.
   4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
   5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
      a. Provide separate companion flanges and steel bolts and nuts for 150 or 300-psig minimum working pressure to suit system pressures.
   6. Dielectric waterway fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

D. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened. Coordinate seals with prefabricated pipe manufacturer for application of mechanical seals with prefab pipe end seals and wall penetration requirements. Provide a water-tight seal at all pipe penetrations regardless of system used (mechanical seal and/or prefab pipe seal assembly).

E. Pipe Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 24 gage or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast-Iron: Cast or fabricated wall pipe equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
   4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
      a. Penetrating Pipe Deflection: 5 percent without leakage.
      b. Housing: Ductile-iron casting having water-stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
      c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
      d. Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

2.04 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000 psi, 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.05 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. See Section 23 0553.

2.06 MISCELLANEOUS METALS

A. Steel plates, shapes, bars and bar grating: ASTM A 500.

B. Cold-formed Steel Tubing: ASTM A 500.

C. Hot rolled steel tubing: ASTM A 501.

D. Non-shrink, nonmetallic grout: Premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.

E. Fasteners: Zinc-coated, type, grade, and class as required.

F. Provide necessary supplemental steel or strut-type framing systems for equipment, ductwork, and pipe support requirements.

G. Refer to Specifications for painting requirements for supplemental steel supports.

2.07 FIRE STOPPING

A. General: Refer to Division 01. Fire stopping caulk, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application. All products shall be installed by manufacturer trained and licensed installers in the manner determined by the manufacturer as tested by an independent testing laboratory.

B. Manufacturers: Subject to compliance with requirements, provide factory-engineered products by one of the following:
   1. 3M Fire Protection Products.
   2. Spec. Seal (Specified Technologies Inc.).
   3. Hilti.
   4. Accepted equal.

2.08 ELASTOMERIC JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. General Duty: One-part, neutral core silicone sealant of formulation indicated that is recommended for exposed applications on exterior and interior joints in vertical and horizontal surfaces of concrete, masonry, glass, aluminum, and steel.

C. Wet locations: Provide manufacturer's standard one part, mildew resistant, paintable silicone sealant that is recommended for exposed locations on interior ceramic tile, masonry, and metals in bathroom and shower room locations.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (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, except where deviations to layout are accepted on coordination drawings.

C. Install piping at indicated slope.

D. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, ¾” ball valve with hose connection, cap and chain. Install vents at high points. Pitch water piping upward in direction of flow and arrange fittings to permit air to be vented to system high points or to expansion tank, and to permit complete drainage to low points. Use eccentric fittings where necessary.

E. Install components having pressure rating equal to or greater than system operating pressure.

F. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

G. Install piping free of sags and bends.

H. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

I. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Locate group of pipes parallel to each other, spaced to permit valve servicing.

L. Install fittings for changes in direction and branch connections.

M. Install couplings according to manufacturers printed instructions.

N. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
   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 above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
   2. Build sleeves into new walls and slabs as work progresses.
   3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

P. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals; size sleeve installation of mechanical seals per manufacturer’s requirements.
   1. Install steel pipe for sleeves smaller than 6 inches.
   2. Install cast-iron wall pipes for sleeves 6 inches and larger.
   3. Assemble and install mechanical seals according to manufacturer's printed instructions.

Q. Below Grade, Exterior Wall, Pipe Penetrations: Install mechanical wall penetration system sleeves according to manufacturer's printed installation instructions. Coordinate with piping system requirements for mechanical seals.

R. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stopping sealant material.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other sections of these specifications for roughing-in requirements.

U. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS Soldering Manual, Chapter 22 The Soldering of Pipe and Tube.
   4. Brazed Joints: Construct joints according to AWS Brazing Manual, Chapter 28 Pipe and Tube.
   5. 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 inside diameter. Join pipe fittings and valves as follows:
      a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to AWS D10.12 Recommended Practices and Procedures for Welding Low Carbon Steel Pipe using qualified processes and welding operators according to Quality Assurance Article.
   a. All welders shall be certified by an independent AWS certifying agency for welding the piping material, system type, and system pressures for each pipe joint.
   b. Comply with ASME Boiler and Pressure Vessel Code, Section IX.
   c. Failure to utilize certified welders shall require the removal and replacement of the piping joint / joints / system at no additional cost to the Owner.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible.
   a. Use lubricants on bolt threads suitable and applicable for bolt threads.
   b. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
   a. Comply with ASTM F 402 for safe handling practice of solvent-cement and primers.
   b. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235 and ASTM D 2661.
   c. Chlorinated Poly-Vinyl Chloride (CPVC): ASTM D 2846 and ASTM F 493.
   d. Poly-Vinyl Chloride (PVC) Pressure Application: ASTM D 2672.
   e. Poly-Vinyl Chloride (PVC) Non-Pressure Application: ASTM D 2885.
   f. PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.

V. Piping Connections: Except as otherwise indicated make piping connections as specified below.
   1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
   3. Dissimilar Metal Piping System Connections: Install dielectric coupling and nipple fittings or flange assemblies to connect piping materials of dissimilar metals.

3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated.

B. Install equipment according to accepted submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to the Engineer of Record.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment, giving right-of-way to piping systems installed at a required slope.

3.03 CONCRETE BASES

A. Coordinate the construction of the concrete equipment bases of dimensions indicated, but not less than 4” high and 6 inches larger in both directions than supported unit. Follow supported equipment manufacturers setting templates for anchor bolt and tie locations.

B. See details on drawings.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 Structural Welding Code - Steel.

3.05 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.06 GROUTING

A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturers printed instructions.

3.07 SELECTIVE DEMOLITION

A. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.

B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage by the Contract Administrator.

C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials, equipment, and debris not indicated to be salvaged. Broom-sweep all floors and clean all windows within construction areas.

3.08 COORDINATION OF ACCESS DOORS PROVIDED BY THIS DIVISION

A. General: The mechanical design-build contractor must coordinate the installation of mechanical work with the installation of access doors. Mechanical equipment must be laid out so that the access panels as designed can serve their purpose.

B. Coordinate installation of access doors at all locations and with adequate door size to provide the required access to mechanical system components including but not limited to, fire dampers, smoke dampers, volume dampers, valves, steam traps, controls devices and components, and equipment filters.

C. Provide all access doors. Fire-rated access doors and frames shall be provided for all locations where the doors are to be installed in a rated assembly.

D. Responsibility for access to all mechanical items is with the design-build mechanical contractor. Obtain approval from the Contract Administrator before installation of access doors not shown on the drawings or doors that are to be relocated from locations shown on the drawings due to relocation of equipment to be serviced. Failure to obtain this approval may necessitate rework at the installing Contractors expense.

END OF SECTION 230505

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 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.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection 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.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 260583 for required electrical characteristics.

B. 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.

C. 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.

D. 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

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

C. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

D. Insulation System: NEMA Class B or better.

E. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

G. 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.

H. Sound Power Levels: To NEMA MG 1.

I. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

J. 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. Manufacturers:
   1. US Motors, a brand of NIDEC Motor Corporation: www.usmotors.com/#sle.

B. Applications:
   1. Commercial:
      a. Power Roof Ventilator (PRV):
         1) Operating Mode: Constant cfm.
         2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
      b. Hydronic Pump:
         1) Operating Mode: Constant speed.
         2) Input: Motor manufacturer to coordinate control requirements with the control board of the hydronic pump and/or specified sequence of operation.

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

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 230923 - Direct-Digital Control System for HVAC.

B. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2021).

B. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.

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.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Operation and Maintenance Data:.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
   3. Omega Engineering, Inc: www.omega.com.
   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. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Stainless Steel, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Stainless Steel, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

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 stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, two gauge adapters with 1/8 inch probes, two 1-1/2 inch dial thermometers.

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 thermometers and thermometer sockets, and adjacent to pressure gauges and pressure gauge taps.

3.02 SCHEDULE

END OF SECTION 230519

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 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. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

C. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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 methods for spring element load capacities.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and 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. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Equipment Isolation: As indicated on drawings.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Mason Industries; _____: www.mason-ind.com/#sle.
      b. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.
   2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

2.03 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics 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.
   2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
      e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
      f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Nonseismic Applications:
   1. Resilient Material Isolator Mounts, Nonseismic:
      a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
   2. Open (Unhoused) Spring Isolators:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
      b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
      c. Furnished with integral leveling device for positioning and securing supported equipment.
   3. Restrained Spring Isolators, Nonseismic:
      a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
      b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
      c. Furnished with integral leveling device for positioning and securing supported equipment.
      d. Provides constant free and operating height.
   4. Resilient Material Isolator Hangers, Nonseismic:
      a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
   5. Spring Isolator Hangers, Nonseismic:
      a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
      b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

PART 3 EXECUTION

3.01 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. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   3. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   6. Adjust isolators to be free of isolation short circuits during normal operation.
   7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 230548

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 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.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.

B. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

C. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Ductwork: Duct markers.

E. Instrumentation: Tags.

F. Major Control Components: Nameplates.

G. Piping: Pipe markers.

H. Pumps: Nameplates.

I. Relays: Tags.

J. Small-sized Equipment: Tags.

K. VRF outdoor condensing unit and indoor units: Nameplates

L. Valves: Tags.

2.03 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.

3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: Black.

C. Letter Height: 1/2 inch.

D. Background Color: White.

E. Plastic: Comply with ASTM D709.

2.04 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
2. Brady Corporation: www.bradycorp.com.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
4. Seton Identification Products, a Tricor Company: www.seton.com.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
3. MIFAB, Inc.; www.mifab.com
4. Seton Identification Products, a Tricor Company: www.seton.com.

B. Color: Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings identifying the fluid being conveyed and arrows indicating the direction of flow.

D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

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 tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. 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.

E. Install ductwork with 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.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

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 2008, with Errata (2019).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Progress Reports.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit to the the Construction Manager within two weeks after completion of testing, adjusting, and balancing.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
   3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in I-P (inch-pound) units only.
   7. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Project altitude.
      j. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 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 5 percent of design.

3.04 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

3.05 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. Effect system balance with automatic control valves fully open to heat transfer elements.

D. 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.

E. 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.

3.06 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Terminal Heat Transfer Units.
   3. Air Handling Units.
   4. Fans.
   5. Air Inlets and Outlets.

END OF SECTION 230593

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

B. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 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 three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 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: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. Conductivity: ASTM C177, 0.24 K Value at 75 degrees F.
   2. Minimum Service Temperature: 0 degrees F.
   3. Maximum Service Temperature: 850 degrees F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.
   5. Flame Spread and Smoke Developed Index: 25/50 rated in accordance with ASTM E84.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC: 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. Conductivity: 0.25 K Value at 75 degrees F when tested in accordance with ASTM C177.
   2. Minimum Service Temperature: Minus 297 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Maximum Moisture Absorption: 0.2 percent by volume, when tested in accordance with ASTM C209.
   5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
   6. Flame Spread and Smoke Developed Index: 25/50 rated in accordance with ASTM E84.
   7. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.04 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Speedline Corporation; www.speedline.com.
      c. Substitutions: See Section 016000 - Product Requirements.
   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: 10 mil, 0.010 inch.
e. Connections: Brush on welding adhesive.

3. Covering Adhesive Mastic: Compatible with insulation.

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.

END OF SECTION 230719

SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:
   1. Globe pattern.
   2. Butterfly pattern.
   3. Electronic operators.
   4. Radiation valves.

C. Dampers.

D. Damper Operators:
   1. Electric operators.

E. Input/Output Sensors:
   1. Temperature sensors.

F. Thermostats:
   1. Electric room thermostats.
   2. Outdoor reset thermostats.
   3. Electric low limit duct thermostats.

1.02 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. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats 2013.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

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. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out 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. Installer Qualifications: Company specializing in performing the work of this section with minimum three 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.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Globe Pattern:
   1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
   2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
   3. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Replaceable plugs and seats of stainless steel.
      c. Size for 3 psig maximum pressure drop at design flow rate.
      d. two-way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two-way valve operators to close valves against pump shut off head.

B. Butterfly Pattern:
   1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.
   2. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Size for 1 psig maximum pressure drop at design flow rate.

C. Electronic Operators:
   1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
   2. Select operator for full shut off at maximum pump differential pressure.

D. Radiation Valves:
   1. Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
   2. Rate for service pressure of 125 psig at 250 degrees F.
   3. Size for 3 psig maximum pressure drop at design flow rate.
   4. two-way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two-way valve operators to close valves against pump shut off head.
   5. Operators (Modulating): Self-contained, linear motorized actuator with approximately 3/4 inch stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC, 6 watt maximum input.

2.04 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gauge, 0.1046 inch.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gauge, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric, inflatable, mechanically attached, field replaceable.

E. Shaft Bearings: Oil impregnated sintered bronze.

F. Leakage: Less than one percent based on approach velocity of 2000 ft per min and 4 inches wg.

G. Maximum Pressure Differential: 6 inches wg.

H. Temperature Limits: Minus 40 to 200 degrees F.

2.05 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.06 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Use RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
   2. Temperature Sensing Device: Compatible with project DDC controllers.

2.07 THERMOSTATS

A. Electric Room Thermostats for VRF system:
   1. Thermostats shall be provided by the VRF vendor.

B. Electric Room Thermostats:
   1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
   2. Service: Heating only.
   3. Covers: Locking with set point adjustment, with thermometer.

C. Outdoor Reset Thermostats:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: Minus 10 to 70 degrees F.

D. Electric Low Limit Duct Thermostats:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
   2. Bulb length: Minimum 20 feet.
   3. Provide one thermostat for every 20 sq ft of coil surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. All new work shall integrate with the new DDC/BAS system

B. Verify existing conditions before starting work.

C. Verify that systems are ready to receive work.

D. Beginning of installation means installer accepts existing conditions.

E. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. See Section 262726.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

F. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

G. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

H. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 230913

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controller software.

1.02 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.02 OPERATOR INTERFACE

A. PC Based Work Station:

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

D. Hardware:
   1. Laptop:
      a. Laptop(s) to be provided by DDC controls manufacturer.
      b. Quantity: 1.
      c. Ports: _____.

2.03 CONTROLLERS

A. Building Controllers:
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
      b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      c. Share data between networked controllers.
      d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      e. Utilize real-time clock for scheduling.
      f. Continuously check processor status and memory circuits for abnormal operation.
      g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      h. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
      b. Perform routing when connected to a network of custom application and application specific controllers.
      c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
   3. Anticipated Environmental Ambient Conditions:
      a. Outdoors and/or in Wet Ambient Conditions:
         1) Mount within waterproof enclosures.
         2) Rated for operation at 40 to 150 degrees F.
      b. Conditioned Space:
         1) Mount within dustproof enclosures.
         2) Rated for operation at 32 to 120 degrees F.
   4. Provisions for Serviceability:
      a. Diagnostic LEDs for power, communication, and processor.
      b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
   5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
   6. Power and Noise Immunity:
      a. Maintain operation at 90 to 110 percent of nominal voltage rating.
      b. Perform orderly shutdown below 80 percent of nominal voltage.

c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Input/Output Interface:
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
a. Allow monitoring of On/Off signals from remote devices.
b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
b. Outputs provided with three position (On/Off/Auto) override switches.
c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.04 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.

3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
1. Weekly Schedules Based on Separate, Daily Schedules:
a. Include start, stop, optimal stop, and night economizer.
b. 10 events maximum per schedule.
c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
a. Operator determines action to be taken for alarm event.
b. Alarms to be routed to appropriate workstation.
c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 230993.

H. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION 230923

SECTION 230934
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

1.02 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).

D. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives 2020.

E. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems 2014.

F. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems 2021.

G. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems 2005.

H. NEMA MG 1 - Motors and Generators 2021.

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

J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

K. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide 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 internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
3. Efficiency: Minimum of 96 percent at full speed and load.
4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
5. Overload Rating:
   a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
   b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.

H. Control System:
1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
   a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
      1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
      2) Vector Control: Provide selectable autotuning function.
   b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
   c. Selectable braking control; DC injection or flux braking.
   d. Adjustable minimum/maximum speed limits.
   e. Adjustable pulse width modulation switching carrier frequency.
   f. Adjustable motor slip compensation.
   g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
4. Status Indications:
   a. Motor run/stop status.
   b. Motor forward/reverse status.
   c. Local/remote control status.
   d. Output voltage.
   e. Output current.
   f. Output frequency.
   g. DC bus voltage.
   h. Motor speed.
5. Protective Functions/Alarm Indications:
   a. Overcurrent.

b. Motor overload.
c. Undervoltage.
d. Overvoltage.
e. Controller overtemperature.
f. Input/output phase loss.
g. Output short circuit protection.
h. Output ground fault protection.

6. Inputs:
   a. Digital Input(s): Three.
   b. Analog Input(s): Two.
7. Outputs:
8. Features:
   a. Password-protected security access.
   b. Event log.

I. Power Conditioning/Filtering:
   1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
   2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
   1. Disconnects: Circuit breaker or disconnect switch type.
      a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
      b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   2. Provide door-mounted remote operator interface.

K. Service Conditions:
   1. Provide controllers and associated components suitable for operation under following service conditions without derating:
      a. Altitude: Less than 3,300 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Short Circuit Current Rating:
   1. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
   1. Comply with NEMA ICS 6.
   2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   3. Finish: Manufacturer's standard unless otherwise indicated.
   4. Cooling: Forced air or natural convection as determined by manufacturer.

2.02 OVERCURRENT PROTECTIVE DEVICES

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

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 230529.

F. Install controllers plumb and level.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

END OF SECTION 230934

SECTION 231126
FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators 2019.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

D. ASME B31.1 - Power Piping 2020.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

I. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.

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.

1.02 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 PRODUCTS

2.01 PROPANE GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
   2. Joints: ASME B31.1, welded.

2.02 PROPANE GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
   2. Joints: ASME B31.1, welded.

2.03 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.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

2.06 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, ductile iron, or _____ 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 _____ ends with union.

2.07 PLUG VALVES

A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.08 STRAINERS

A. Size 2 inch and Under:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2.09 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.

PART 3 EXECUTION

3.01 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. Pipe hangers and supports.

C. Unions, flanges, mechanical couplings, and dielectric connections.

D. General valve requirements

E. Valves:
   1. Gate valves.
   2. Ball valves.
   3. Plug valves.
   4. Butterfly valves.
   5. Check valves.

F. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 230516 - Expansion Fittings and Loops for HVAC Piping.

B. Section 230548 - Vibration and Seismic Controls for HVAC.

C. Section 230553 - Identification for HVAC Piping and Equipment.

D. Section 230719 - HVAC Piping Insulation.

E. Section 232114 - Hydronic Specialties.

F. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

B. ASME B31.9 - Building Services Piping 2020.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

D. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service 2019a.

E. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts 2014 (Reapproved 2020).

F. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

G. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications 2018.

H. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).

I. AWWA C606 - Grooved and Shouldered Joints 2015.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalog information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 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. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E. Coupling Manufacturer:
1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.
3. A distributor's representative is not considered qualified to perform the training.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 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 Engineer.
   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 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.

d. 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 ball valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
   3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.
   5. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 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. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   7. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
   8. Vertical Support: Steel riser clamp.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   11. 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.

2.03 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:
   1. Ferrous Piping: 150 psi malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.

2. Mechanical Couplings: Comply with ASTM F1476.
3. Housing Material: Ductile iron complying with ASTM A536.
4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
   a. Grinnell Products: www.grinnell.com/#sle.
   b. Victaulic Company: www.victaulic.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

D. Dielectric Connections:
1. Waterways:
   a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   b. Dry insulation barrier able to withstand 600-volt breakdown test.
   c. Construct of galvanized steel with threaded end connections to match connecting piping.
   d. Suitable for the required operating pressures and temperatures.
2. Flanges:
   a. Dielectric flanges with same pressure ratings as standard flanges.
   b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   c. Dry insulation barrier able to withstand 600-volt breakdown test.
   d. Construct of galvanized steel with threaded end connections to match connecting piping.
   e. Suitable for the required operating pressures and temperatures.

2.04 GENERAL VALVE REQUIREMENTS

A. Manufacturers:
1. Conbraco Industries; www.conbraco.com
2. Grinnell Products: www.grinnell.com/#sle.
3. Milwaukee Valve Company; www.milwaukeevalve.com
4. Nibco, Inc.; www.nibco.com
5. Tyco Flow Control; www.tycoflowcontrol.com
6. Victaulic Company: www.victaulic.com/#sle.
7. Viega LLC: www.viega.us/#sle.
8. Substitutions: See Section 016000 - Product Requirements

B. Valve Pressure and Temperature Ratings: No less than the rating indicated; as required for system pressures and temperatures.

C. Valve Sizes: Match upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
1. Gate Valves: Rising steam.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Obtain each valve type from a single manufacturer.

2.05 BALL VALVES

A. Up To and Including 2 Inches:
1. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

B. Over 2 Inches:
   1. Cast steel body, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle, flanged ends, rated to 800 psi.

2.06 FLOW CONTROLS

A. Manufacturers:
   1. Griswold Controls: www.griswoldcontrols.com/#sle.
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   3. Taco, Inc: www.taco-hvac.com/#sle.
   4. Tyco Flow Control; www.tycoflowcontrol.com
   5. Victaulic Company: www.victaulic.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 3.5 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
   2. Use flexible couplings in expansion loops.

J. 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.

K. Inserts:
   1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

L. Pipe Hangers and Supports:
1. Support horizontal piping as scheduled.
2. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

N. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100 .

O. Use eccentric reducers to maintain top of pipe level.

P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. See Section 099123.

R. 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.
4. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION 232113

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Pressure-temperature test plugs.

D. Balancing valves.

E. Relief valves.

F. Pressure reducing valves.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

B. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   2. Taco, Inc: www.taco-hvac.com/#sle.
   3. Spirotherm; www.spirotherm.com
   4. Substitutions: See Section 016000 - Product Requirements.

B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Air Vent:
   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.

D. Maximum Fluid Pressure: 150 psi.

E. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

A. Manufacturers:
   1. Flexicraft Industries: www.flexicraft.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. The Metraflex Company: www.metraflex.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Under:
   1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
   2. Body Material by Fluid Service:
      a. Cast Iron or Brass:
         1) Steam: Up to 250 psi at 450 degrees F.
         2) Liquids: Up to 400 psi at 150 degrees F.

C. Size 2-1/2 inch to 4 inch:
   1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
   2. Body Material by Fluid Service:
      a. Cast Iron:
         1) Steam: Up to 125 psi at 350 degrees F.
         2) Liquids: Up to 200 psi at 150 degrees F.

2.03 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.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and EPDM rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.04 BALANCING VALVES

A. Manufacturers:
   1. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
   2. Taco, Inc: www.taco-hvac.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Smaller:
   1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
   2. Metal construction materials consist of bronze.
   3. Non-metal construction materials consist of EPDM.
   4. Maximum Service Operation: 255 psi at 240 degrees F.

C. Size 2-1/2 inch and Larger:
   1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged or grooved connections.
   2. Valve body construction materials consist of cast iron.
   3. Internal components construction materials consist of EPDM.
   4. Maximum Service Operation: 255 psi at 240 degrees F.

2.05 RELIEF VALVES

A. Manufacturers:
   1. Conbraco Industries, Inc.; www.conbraco.com
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Tyco Flow Control; www.tycoflowcontrol.com
   4. Substitutions: See Section 016000 - Product Requirements.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.06 PRESSURE REDUCING VALVES

A. Manufacturers:

B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 232113.

C. Materials of Construction:
   1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
   2. Internal Components: Construct of stainless steel or brass and engineered plastics or composition material.

D. Connections:
   1. NPT threaded: 1/2 inch or 3/4inch.
   2. Soldered: 1/2 inch.

E. Provide integral check valve and strainer.

F. Maximum Inlet Pressure: 400 psi.

G. Maximum Fluid Temperature: 180 degrees F.

H. Adjustable Pressure Range: From 10 to 45 psi, set to 25 psi.

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. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blowdown connection.

F. Support pump fittings with floor-mounted pipe and flange supports.

G. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

H. 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.

I. Pipe relief valve outlet to nearest floor drain.

END OF SECTION 232114

SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line circulators.

1.02 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

B. Section 232113 - Hydronic Piping.

C. 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.

1.05 QUALITY ASSURANCE

A. Warranty: Minimum non-prorated 18 months from date of installation, not to exceed 30 months from date of manufacturer. Cover against defective material and/or faulty workmanship.

B. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com.

B. Grundfos Pumps Corporation: www.grundfos.com/#sle.

C. Taco Comfort Solutions; www.tacocomfort.com

D. Substitutions: See Section 016000 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

2.03 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 psi maximum working pressure and 230 degrees F maximum liquid temperature.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous.

D. Thrust Bearing: Aluminum oxide/carbon.

E. Neck Ring: Stainless Steel.

F. Shaft: Ceramic.

G. Secondary Seals: EPDM

H. Stator Housing: Aluminum

I. Rotor Can: PPS

J. Motor: 4-poly synchronous, permanent-magnet with integrated frequency converter.

K. Cataphoresis anti-corrosion surface treatment on all cast iron surface.

L. Insulation Shell: Tailor made, clip on.

M. Controls
   1. Integral differential pressure and temperature sensor.
   2. Optional modes which allow stepless adaption of performance to varying load requirements:
      a. Self-adapt for systems where duty point is unknown.
      b. Self-adapt combined with flow monitoring and electronic flow limitation.
      c. Constant differential pressure based on signal from integral or external sensor.
      d. Flow dependent variable pressure based on signal from internal sensor.
      e. Constant temperature based on signal from internal or external sensor.
      f. Constant differential temperature based on signal from internal or external sensor, or two seperate external sensors.
   3. Capability to handle signals from external sensors and controllers measuring flow, temperature, and/or pressure. Signal input configurable to eitehr 4-20mA or 0-10V.
   4. Electronic flow monitoring and limitation functionality which ensures that, by adapting pump performance, a given flow rate is not exceeded.
   5. Wireless communication without the use of external controllers between two single pups or between double pumps. Controlled in alternating, backup, or cascade modes.
   6. Open to access with dedicated hand held remote control device an with Android or iOS based smartphone. For commissioning, change of pump settings, change of control modes, and management of pump and system data.
   7. Ability to provide heat energy consumption in the system by continuously monitoring the system flow rate with the use of the built-in temperature sensor and by adding an external temperature sensor.
   8. Analog input for differential pressure sensor or constant/differential temperature control, monitoring of energy consumption or external set-point.
   9. Relay outputs configurable as alarm, ready, operation.
   10. Digital inputs for external start/stop, min/max curve.
   11. Capacity for optional Building Management System modules for communication with BACnet MS/TP, IP, Modbus RTU, TCP, LonWorks as well as cellular data transmission.
   12. Control panel with color display for pump setup and control with full access to all functions.
   13. Visual indication of pump status with options: pump running, ready, warning or alarm.

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.

END OF SECTION 232123

SECTION 232300
REFRIGERANT PIPING

PART 2 PRODUCTS

1.01 SYSTEM DESCRIPTION

A. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.02 REGULATORY REQUIREMENTS

1.03 PIPING

1.04 REFRIGERANT

1.05 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

1.06 VALVES

1.07 STRAINERS

1.08 FILTER-DRIERS

A. Performance:
   1. Flow Capacity - Liquid Line: ____ ton, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
   2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

END OF SECTION 232300

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 230130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

B. Section 230713 - Duct Insulation: External insulation and duct liner.

C. Section 233300 - Air Duct Accessories.

D. Section 233319 - Duct Silencers.

E. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

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 2021.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

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.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 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 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc of galvanized steel.
   2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.
   3. Flat Oval: Plus 2 in-wc of galvanized steel.
   4. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc; see Section 233700.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for supply, return, outside, and general exhaust air: 1/2 in-wc, galvanized steel.
   2. Low Pressure Service: Up to 2 in-wc:
      1) Seal: Class C, apply to seal off transverse joints.
      2) Leakage:
         (a) Rectangular: Class 24 or 24 cfm/100 sq ft.
         (b) Round: Class 12 or 12 cfm/100 sq ft.

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. 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.
   3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   4. Construct tee'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.
   5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
   8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

2.03 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type Where Concealed and/or Insulated: 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.
b. Type Where Exposed: Silicone caulking, paintable and permanently flexible and waterproof, clear. Wipe exposed areas clear of silicone.
c. VOC Content: Maximum 250 g/L, excluding water.
d. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
e. For Use with Flexible Ducts: UL labeled.

3. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
4. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:
   a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.04 FLEXIBLE DUCTS

A. Flexible Air Ducts:
   1. UL 181, Class 1, polyethylene film supported by helically wound spring steel wire.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: From 10 in-wc to 5 in-wc negative.
   4. Maximum Velocity: 5,500 fpm.
   5. Temperature Range: Minus 20 to 250 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C. Flexible Ducts: Connect to metal ducts with adhesive.

D. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.

E. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

3.02 CLEANING

A. Clean thoroughly each duct system as indicated within Section 230130.51.

B. Clean the duct system and force air at high velocity through the duct to remove accumulated dust. Clean half the system at a time to obtain sufficient air. 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. Backdraft dampers - metal.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connectors.

F. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

B. NFPA 92 - Standard for Smoke Control Systems 2021.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

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.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes. Include electrical characteristics and connection requirements.

C. Project Record Drawings: Record actual locations of access doors and test holes.

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. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING VANE & RAIL

A. Manufacturers:
   1. Dury-Dyne Corporation; www.durodyne.com
   2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   3. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Use of duct-mounted extractors is not acceptable.

C. Material: Galvanzied steel.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
   1. Greenheck Company; www.greenheck.com
   2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.

3. Nailor Industries, Inc: www.nailor.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
3. Nailor Industries, Inc: www.nailor.com/#sle.
4. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Hinges: Piano-type.

C. Fabrication: Rigid and close-fitting of minimum 24 gauge galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick, 0.75 lb density fiberglass insulation with sheet metal cover.

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 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
1. Carlisle HVAC Products: www.carlislehvac.com/#sle.
2. Duro-Dyne Corporation; www.durodyne.com
3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
a. Net Fabric Width: Approximately 3 inches wide.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.06 VOLUME CONTROL DAMPERS

A. Manufacturers:
1. Greenheck Inc.; www.greenheck.com
2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
3. Ruskin Company: www.ruskin.com/#sle.
4. 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.

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.

E. End Bearings: Except in round ducts 8 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
1. Manufacturers:

a. Carlisle HVAC Products: www.carlislehvac.com/#sle.
b. Duro-Dyne Corporation; www.durodyne.com
c. Substitutions: See Section 016000 - Product Requirements.

F. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.
4. Manufacturers:
a. Carlisle HVAC Products: www.carlislehvac.com/#sle.
b. Duro-Dyne Corporation; www.durodyne.com.
c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. 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.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers 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.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. 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.

K. 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. Cabinet exhaust fans.

C. Ceiling exhaust fans.

D. Inline centrifugal fans.

1.02 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook 2016.

1.03 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.

B. Loren Cook Company; _____: www.lorencook.com/#sle.

C. Twin City Fan & Blower; _____: www.tcf.com/#sle.

2.02 POWER VENTILATORS - GENERAL

A. Fabrication: Comply with AMCA 99.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

2.04 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Grille: Molded white plastic.

2.05 INLINE CENTRIFUGAL FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

C. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 230548.

D. Provide sheaves required for final air balance.

E. Install backdraft dampers on inlet to roof and wall exhausters.

END OF SECTION 233423

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust grilles.
   2. Wall-mounted, transfer grilles.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets 2006 (Reaffirmed 2021).

1.03 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.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. 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 MANUFACTURERS

A. Greenheck; www.greenheck.com

B. Metalaire, a brand of Metal Industries Inc: www.metalaire.come.

C. Price Industries: www.price-hvac.com.

D. Ruskin Company: www.ruskin.com.

E. Seiho International, Inc.; www.seiho.com

F. Substitutions: See Section 016000 - Product Requirements.

2.02 CEILING EGG CRATE EXHAUST AND TRANSFER GRILLES

A. Fabrication: Grid core consists of aluminum with mill aluminum finish.

B. Color: White.

2.03 WALL TRANSFER GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Color: As indicated on the drawings.

D. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

END OF SECTION 233700

SECTION 235216
CONDENSING BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230913 - Instrumentation and Control Devices for HVAC.

C. Section 232114 - Hydronic Specialties.

D. Section 232123 - Hydronic Pumps.

E. Section 232500 - HVAC Water Treatment.

F. Section 235100 - Breechings, Chimneys, and Stacks.

G. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.

B. AHRI 1500 - Performance Rating of Commercial Space Heating Boilers 2015.

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 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2022.

E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.

F. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI) Current Edition.

G. NFPA 54 - National Fuel Gas Code 2021.

H. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters 1990, with Amendment (2018).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a ten year pro-rated warranty for heat exchanger.

C. Provide a one year limited warranty for all other parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications, < 300 MBh Input Capacity:
   1. Ariston Thermo USA - HTP; www.htpproducts.com
   2. Lochinvar LLC: www.lochinvar.com.
   3. Weil-McLain: www.weil-mclain.com
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

C. Annual Fuel Utilization Efficiency (AFUE): Minimum 0.95 in accordance with ASHRAE Std 103.

D. Thermal Efficiency as defined by AHRI 1500: Minimum 95%.

2.03 BOILER CONSTRUCTION

A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp.

C. Required Directory Listings:
   1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
   2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensables.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gauge metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic or powder coated finish.

2.04 BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Supply and return water temperature sensors.

F. Flue gas temperature sensor.

G. Pressure Switches:
   1. High gas pressure.
   2. Low gas pressure.
   3. Air pressure.

H. Manual reset high limit.

I. Boiler Pump (where required by boiler design):
   1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
   2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
   3. Pump time delay.

2.05 FUEL BURNING SYSTEM

A. Provide integral pre-mix, metal mesh forced draft automatic burner, integral to boiler, designed to burn natural gas and propane, and maintain fuel-air ratios automatically.
   1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
   2. Forced Draft Design: Variable speed, mixes combustion air and gas.
   3. Modulation: Fully to minimum 5:1 turndown.
   4. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.

D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.06 FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:
   1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.
   2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
   3. Low-fire start time delay relay.
   4. Automatic water temperature reset based on outdoor air temperature.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

E. Cascade Control: To coordinate the operation of multiple boilers and pumps.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 033000.

D. Coordinate factory installed controls with Section 230913.

E. Coordinate provisions for water treatment in accordance with Section 232500.

F. Pipe relief valves to nearest floor drain.

G. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

H. Install primary boiler pump in accordance with Section 232123.

I. Provide piping connection and accessories in accordance with Section 232114.

J. Provide for connection to electrical service in accordance with Section 260583.

K. Vent combustion fumes in accordance with manufacturer's recommendations. Refer to Section 235100.

3.02 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. 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.

END OF SECTION 235216

SECTION 237313
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 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.

F. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

G. 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.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

1.03 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.

1.04 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.

1.05 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation; _____: www.carrier.com/#sle.

B. Daikin Applied; _____: www.daikinapplied.com/#sle.

C. Trane Inc; _____: www.trane.com/#sle.

D. York International Corporation / Johnson Controls Inc; _____: www.york.com/#sle.

2.02 CASING CONSTRUCTION

A. Full Perimeter Base Rail:
   1. Construct of galvanized steel.

B. Casing:
   1. Construct of one piece, insulated, double wall panels.
   2. Provide mid-span, no through metal, internal thermal break.
   3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
   4. Casing Air Pressure Performance Requirements:

C. Access Doors:
   1. Construction, thermal and air pressure performance same as casing.
   2. Provide surface mounted handles on hinged, swing doors.

D. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

E. Insulation:
   1. Provide minimum thermal thickness of 12 R throughout.
   2. Completely fill panel cavities in each direction to prevent voids and settling.
   3. Comply with NFPA 90A.

F. Finish:
   1. Indoor Units:
      a. Provide exterior, galvanized steel panels without paint.
      b. Color: Manufacturer's standard color.

2.03 FAN SECTION

A. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

B. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

C. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

D. Fan Accessories:

E. Drives:
   1. Comply with AMCA 99.
   2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9 L-10 life at 50,000 hours.
   3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
   4. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.04 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Eliminators: Three break of galvanized steel, mounted over drain pan.

C. Air Coils:
   1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

D. Fabrication:
   1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.

2. Fins: Aluminum.
3. Casing: Die formed channel frame of galvanized steel.

E. Water Heating Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

2.05 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Differential Pressure Gauge:
1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.06 DAMPER SECTION

A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor and return air.

B. Damper Blades:
1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on each blade.
2. Self-lubricating stainless steel or synthetic sleeve bearings.
3. Comply with ASHRAE Std 90.1 I-P for rated maximum leakage rate.
4. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.
5. Arrange in parallel or opposed-blade configuration.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Provide fixed sheaves required for final air balance.

D. Make connections to coils with unions or flanges.

E. Hydronic Coils:
1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

END OF SECTION 237313

SECTION 238129
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.

B. 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.

C. ITS (DIR) - Directory of Listed Products current edition.

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

E. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard data sheets showing capacities, airflows, electrical power, weights and dimensions, sound pressures, control options, etc.

C. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
   1. Detailed piping diagrams, with branch balancing devices.
   2. Condensate piping routing, size, and pump connections.
   3. Detailed power wiring diagrams.
   4. Detailed control wiring diagrams.
   5. Locations of required access through fixed construction.
   6. Drawings required by manufacturer.

D. Design Data:
   1. Provide design calculations showing that system will achieve performance specified.
   2. Provide design data required by ASHRAE Std 90.1 I-P.

E. Operating and Maintenance Data:
   1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
   2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
   3. Identification of replaceable parts and local source of supply.

F. Project Record Documents: Record the following:
   1. As-installed routing of refrigerant piping and condensate piping.
   2. Locations of access panels.
   3. Locations of control panels.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
   2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Compressors: Provide manufacturer's warranty for six (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of the manufacturer. according to manufacturers's terms and conditions. All warranty service work shall be preformed by a manufacturer factory trained service professional.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The system design indicated in Contract Documents is based on equipment and system designed by Mitsubishi-Trane.

B. Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
   1. Substitution requests will be considered only if received at least 10 days prior to the bid date.
   2. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   3. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   4. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.02 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.

B. Cooling Mode Interior Performance:
   1. Setpoint Range: 57 degrees F to 77 degrees F.

C. Heating Mode Interior Performance:
   1. Setpoint Range: 59 degrees F to 80 degrees F.

D. Operating Temperature Ranges:
   1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F to 60 degrees F dry bulb.
   2. Cooling Mode Operating Range: minus 4 degrees F to 110 degrees F dry bulb.
   3. Heating Mode Operating Range: 0 degrees F to 77 degrees F dry bulb; minus 4 degrees F to 60 degrees F wet bulb; without low ambient controls or auxiliary heat source.

E. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
   1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet, actual; 620 feet, equivalent.
   2. Total Combined Liquid Line Length: 3280 feet, minimum.
   3. Minimum Piping Length Between Indoor Units: 49 feet.

F. Control Wiring Lengths:

1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet, minimum.
2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet, minimum.
3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet.

G. Controls: Provide the following control interfaces:
1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.

H. Local Controllers: Wall-mounted, wired, containing temperature sensor.

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
1. Performance Certification: AHRI Certified; www.ahrinet.org.
2. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
3. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
4. Provide units capable of serving the zones indicated.
5. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
6. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:

C. Refrigerant Piping:
1. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
2. Refrigerant: Factory charged.
3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG, minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
   2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   4. Provide oil separators and intelligent oil management system.
   5. Provide spring mounted vibration isolators.

2.05 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.
   6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.06 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.

2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
   a. Provide thermistor on liquid and gas lines.
4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Wall Surface-Mounted Units: Finished white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.
   1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
   2. Sound Pressure Range: Measured at low speed at 3.3 feet below and away from unit.
   3. Condensate Drain Connection: Back, with piping concealed in wall.
   4. Fan: Direct-drive cross-flow type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.02 SYSTEM STARTUP

A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

B. Adjust equipment for proper operation within manufacturer's published tolerances.

END OF SECTION 238129

SECTION 26 0500
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section covers the general provisions that are applicable to all electrical work and the testing of the completed electrical systems. The requirements of other Sections shall take precedence over the requirements of this Section.

B. Equipment, pumps, plumbing items, HVAC equipment and other related work are specified in other Sections which are not a part of Division 26. The electrical connections to these devices, and the requirements for motors, motor starters, panelboards and other related work are specified in the appropriate Sections of Division 26. Certain electrical equipment is specified in other Divisions and is required to be furnished by equipment manufacturers. Drawings and general provisions of the Contract, including general conditions and supplemental conditions of other specification sections, apply to work in this section.

C. This division covers, in broad detail, the extent of the electrical work and the equipment to be provided and shall not be construed as a complete description of all of the details of design and construction required.

D. Drawings

1. Contract Drawings are, in part, diagrammatic and are intended to convey the scope of the work and indicate in general arrangement of the equipment and do not indicate every required offset, fitting, box, etc. Follow these Drawings in laying out the work. Consult all Drawings to become familiar with all conditions affecting the work and to verify spaces in which the work will be installed. Verify all dimensions with architectural plans.

2. Reasonable changes required by job conditions (including offsetting of conduit and light fixtures, etc.) shall be made at no additional cost to the owner.

3. Locations of equipment are to be as:
    a. Shown on Drawings;
    b. Directed in the field;
    c. Required for proper connection of equipment to be served;
    d. Required for proper symmetry in the space involved;
    e. With deviations made only with the specific written approval of the engineer and/or owner's representative.

E. Definitions - The term "provide" shall have the same meaning as "furnish and install". All material so implied either on the Drawings or in these specifications shall be furnished and installed unless specifically noted otherwise.

F. Provide all labor, materials, equipment, appliances and tools and perform all work necessary for the complete execution of the electrical work as shown on the Drawings, required by the Specifications and work not specifically shown or specified, yet required to insure proper and complete operation of all systems and to satisfy the design intent inherent in the Work and to comply with all applicable codes, regulations, and Electric Utility Co. requirements.

1.02 QUALITY ASSURANCE

A. All materials, equipment, sizes, capacities and installation of electrical work shall conform to the latest requirements of the National Electrical Code, National Electrical Safety Code, the National Electrical Manufacturers Association, the Board of Fire Underwriters, the Underwriter's Laboratories, Inc., the Institute of Electrical and Electronics Engineers, the prevailing State and Local Electrical Codes and to applicable requirements, rules and regulations of the Electric Utility Co. serving the Project.

B. Secure and pay for all permits and inspections required by any of the foregoing authorities. The electrical inspection shall be made and approved by the State of Maine Department of Public Safety and/or other State and/or local authority having jurisdiction. All certificates shall be in duplicate and shall be delivered to Engineer and become the property of Owner.

C. Before commencing work, review the Project with the local and State inspectors and the Electric Utility Co. Conform, in every respect, with their separate recommendations, unless the recommendations are inferior to, or in direct conflict with, the Contract Documents, then Engineer's acceptance will be required before proceeding with the Work.

D. Nothing in the Specifications, or shown on the Drawings, shall be construed as requiring a violation of any law, code or regulation. Any work or device which fails to receive the approval of any agency shall be promptly changed so as to fully comply.

E. All electrical work shall be performed by, or done under the direct supervision of, a duly licensed electrician who is qualified to do such work and who is normally engaged in this type of work.

F. Division 26 shall review the Drawings of other divisions, exchange shop Drawings with them, cooperate in the preparation or prepare space layouts as required, to avoid conflicts and interferences with the installation of other trades in the advanced stages of construction.

G. If, in the interpretation of contract documents, it appears that the Drawings and specifications are not in agreement, the one requiring the greater quantity or superior quality shall prevail, as decided by the Engineer.

1.03 SUBMITTALS

A. Submit one electronic copy of all submittal data and/or complete shop drawings as specified in each section for review.

B. See other Divisions for Administrative Provisions. Submit submittals as specified therein.

C. Submittals shall be complete by specification article. All items specified under the same article as the major item shall be included in the submittals. No partial or incomplete submittal will be accepted or reviewed. Submittals for equipment requiring electrical service shall include wiring diagrams.

D. Submittals and/or shop drawings are to be edited to show specific data for the equipment that the Contractor intends to provide.

E. Submittals and/or shop drawings are to be identified with numbers and letters identical to those listed on the Drawings and/or specifications.

F. Submit electronic copies of installation instructions and operation and maintenance manuals for all equipment.

G. Submit electronic copies of all required permits.

H. Submit electronic copies of electrical inspection certificates.

I. Submit complete listing of all tests performed and copies of the certified test results.

J. Submit as-built wiring diagrams and a copy of all circuit directories.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment in crates or cartons and do not uncrate until ready for installation. Protect equipment against weather, damage, and vandalism.

B. Properly store all materials and equipment in accordance with the manufacturers' recommendations and as required to protect them from damage and corrosion. Check and properly receipt material furnished by others, and assume full responsibility for all above materials while in receipt of Contractor and/or in storage with full visible identification and information.

C. Temporarily close all openings to prevent obstruction, damage or the intrusion of foreign materials.

1.05 POWER CHARACTERISTICS

A. Incoming Power - 120/208V, 3-phase, 60Hz., 4-wire

PART 2 PRODUCTS

2.01 GENERAL

A. All materials and equipment shall be new and shall conform to UL Standards and carry the UL Label in every case where UL Standards have been established for the materials or equipment.

B. To the maximum extent possible, all electrical equipment for any one system shall be the product of a single manufacturer. Engineer reserves the right to disapprove and reject equipment from various manufacturers when acceptable components can be secured from fewer manufacturers and to require that source of materials be unified to the maximum extent possible.

C. Permission to substitute equal or superior items may be requested. Completion date will not be extended because of any time lost due to consideration or installation of substitutions. All coordination of substituted equipment shall be the Contractor's responsibility.

2.02 NAMEPLATES

A. Provide nameplates for all items of equipment on all panelboards, controllers, selector switches, starters, safety switches, push button stations, and relay and equipment enclosures.

B. Nameplates shall be black laminated plastic or bakelite, with four edges neatly beveled. Lettering shall be engraved, white, with a height of approximately 3/16" to 1/4".

C. Provide two holes in nameplate and secure to equipment with non-ferrous screws. If adequate space is not available on item to which nameplate is to be affixed, nameplate may be installed adjacent to and as close to the item as possible, and in a position where it is readily visible.

D. Notations on nameplates shall be exactly the same as the corresponding notations that appear on the Drawings.

2.03 EQUIPMENT SUPPORTS

A. Provide all structural supports required for proper attachment of all equipment. Wall mounted equipment may be directly secured to walls with approved anchors.

B. Maintain air space between equipment and supporting walls. Groups or arrays of equipment may be mounted on adequately sized steel or aluminum channels, angles or bars. Prefabricated steel channels equal to those manufactured by Unistrut or Kindorf are acceptable.

C. Equipment suspended from ceilings shall be supported by adjustable threaded steel rods of adequate strength. No hangers may be secured to furred or suspended ceilings or attached to or carried through ductwork.

D. Provide all necessary anchoring devices and supports.

1. Use structural supports suitable for equipment.

2. Check electrical loads and dimensions of equipment with shop drawings.

3. Do not cut or weld to building structural members.

4. Unless otherwise noted herein or on Drawings, supports, anchors, anchoring devices and procedures shall conform to the requirements of Division 5.

2.04 MATERIAL AND CONSTRUCTION REQUIREMENTS

A. Unless otherwise shown on Drawings or specified, all enclosures, motors, wiring and other materials and all construction methods shall conform to the following:

1. Indoor, Above Ground, Dry Areas - NEMA 1, General Purpose, with gasketing for general purpose applications where atmospheric conditions are normal. Enclosures shall be sheet steel, treated to resist corrosion, prime painted and finished with a gray baked-on enamel. Control stations shall have NEMA 12, oil-tight and dust-tight enclosures.

2. Outdoors, Moist Areas and Indoor Below Grade Areas - NEMA 3R, rain-tight.

2.05 OTHER MATERIALS

A. All other materials, equipment, accessories, hardware, and appurtenant items, not specifically described but required for a complete and operable electrical installation, shall be new, of respective kinds, and as selected by Contractor subject to the acceptance of Engineer.

2.06 SPECIAL TOOLS/SPARE PARTS

A. Provide all special tools that are necessary for the proper operation and maintenance of the electrical systems.

B. Provide all spare parts that are necessary to insure the proper operation of the electrical systems for the first year of normal operations. Required spare parts are listed in other sections of this division.

C. Furnish two extra sets of fuses for each fuse type and rating incorporated in the Work.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to performing work required under Division 16, carefully inspect all existing conditions and the installed work of all other trades and verify that all conditions and all such work is complete to the point where the electrical work may properly commence.

B. Verify that electrical work may be done in complete accordance with all pertinent laws, codes, regulations and the design.

C. In the event of discrepancy, immediately notify Engineer.

D. Do not proceed with the work in areas of discrepancy until all such discrepancies have been fully resolved.

E. Notify proper authorities for inspections of Work required by applicable codes, rules or regulations.

3.02 PREPARATION

A. Layout all work at the site by consultation with other trades before installing work to eliminate any conflict between this work and work of other trades.

B. Coordinate electrical work, in advance, with other work. The installation of chases, openings, sleeves, etc., required for panels, boxes, outlets, receptacles, conduit, supports, wireways, etc., shall be done at such time as to minimize the need for subsequent cutting and patching. Prior to the ordering of any equipment, verify the location, type and characteristics of service to be furnished.

C. Contractor is cautioned that the power requirements and sizes of various equipment and machinery are subject to change and will be based on the accepted product or substitution actually provided. The actual equipment and machinery installed could result in the need to provide different sized wires, cables, conduits, boxes, starters, overload protection, fuses, and other electrical equipment, controls and materials. As such, the ordering and installation of work is not recommended nor encouraged until all shop drawings and other submissions have been made and have been accepted by Engineer, and all setting and power requirements determined, and then only after Contractor has coordinated all submissions and verified compatibility and determined the sizes required for each individual component. Any such work ordered or installed by Contractor shall be his responsibility and any modifications necessary shall be made to provide electrical

systems in complete compliance with the Contract Documents, and to accommodate final installed equipment requirements.

3.03 PERFORMANCE

A. Perform all work that is both requisite and essential in completing the intended installation in the proper manner.

B. The Drawings indicate the general arrangement of circuits and outlets, locations of switches, panelboards, conduits and other work. Field verification of all dimensions is required. Specifications and Drawings are for assistance and guidance, but exact locations, distances and levels shall be governed by actual field conditions. Conduit runs and grounding are shown diagrammatically only, and the layout does not necessarily show the total number of conduits for the circuit required, nor is the location of indicated runs intended to show the actual routing of conduits. Furnish, install and place in satisfactory condition, ready for operation, all conduits, cables and all other materials needed for the complete lighting, power and other electrical systems as shown or indicated on the Drawings. Install additional conduits and required wiring whenever needed to complete the installation of the specific equipment.

C. If any departures from the Drawings are deemed necessary by Contractor in order to furnish an efficient, complete and satisfactory installation, details of such departures and the reasons therefore shall be brought to the attention of Engineer. Layout all work at the site by consultation with the various trades before installing work to eliminate any conflict between this work and work of other trades.

D. Wherever obstructions are encountered in the path or course of the Work that are not shown nor anticipated in the Contract Documents, do not proceed with the installation of the Work before advising Engineer and receiving detailed information or Drawings or both. Failure to follow this precaution will obligate Contractor to the full extent of all necessary changes and adjustments to conform to the requirements of Engineer.

3.04 INSTALLATION

A. Install all work at the locations shown on the Drawings. Install all work plumb, level and square.

B. Where concealed work is designated, conceal the work within walls, floors, ceilings or underground. Panelboards, switches, receptacles, control stations and other control and wiring devices shall be "flush mounted", complete with cover plates or doors, as applicable. Unless otherwise shown or specified, all other work may be "surface mounted".

3.05 PENETRATIONS

A. Except where absolutely necessary, do not penetrate roofs and waterproofed surfaces. Where required, make penetrations prior to the application of roofing and waterproofing materials and provide all sleeves, pitch-pockets and other acceptable items. Advise Engineer in advance before making such penetrations, even where such penetrations are shown on the Drawings.

B. Seal all work and penetrations that enter or leave a room or structure that may contain a corrosive or potentially lethal atmosphere. Install seals in a manner to stop vapors and gases from escaping or from being communicated from such areas, through conduits and wireways, as well as around conduits or wireways.

C. Thoroughly seal all work and penetrations entering or leaving hazardous areas in accordance with NEC requirements.

D. Sleeves through fire rates walls, shafts, floors and partitions shall be packed full length with UL listed fill to maintain the rating of the separation.

3.06 BALANCING LOADS

A. Circuit numbering on the Drawings is indicated for clarification only. Because substitutions may produce different electrical loads, balance all light, power and heat loads so that a phase-to-phase difference of 5% is not exceeded.

3.07 FIELD QUALITY CONTROL

A. Check for proper phase sequence and test all parts of the electrical systems before placing them in service.

B. Provide all labor, materials, testing equipment, electricity, fuel, lights, lubricants, equipment, instruments and all other materials required for conducting all tests.

C. All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show insulation resistance between phase conductors and ground of not less than that required by NEC, or as specified herein.

D. All systems shall show proper neutral connections.

E. Insulation test of equipment, motors, cables, etc. shall pass the Standard Insulation Test established by the IEEE and shall be made before and after all required high potential tests. All insulation testers shall be of the motor driven, direct reading type, unless otherwise noted.

F. Check nameplate data on each piece of equipment and furnish copy of list to Engineer.

G. Check all motors for proper rotation and speed and all starters for proper overload protective elements. Correct all incorrect conditions.

H. Conduct a ground test on each and every circuit with conductors #2AWG and larger. The test results shall not be less than those required by the NEC or Underwriters Laboratories. Furnish a detailed record of these tests.

I. Test all electrical devices for proper control of motors and equipment.

J. Lamp all fixtures with lamps of designated rating, color and pattern and check operation.

K. Check amperage in all circuits and compare to nameplate data.

L. Conduct all other tests required to secure approval of the Work from all agencies having jurisdiction.

3.08 ADJUST AND CLEAN

A. Replace any portion of the Work that does not conform to established standards and requirements.

B. During tests, make all adjustments and changes until the equipment and systems are operating satisfactorily.

C. Should any defects be suspected or found after tests have been completed, make all required adjustments, repairs, and replacements, and retest to the satisfaction of Engineer.

D. Clean all exposed electrical work and remove all unnecessary labels, soil, markings, and foreign material. Do not remove labels required by the Specifications, laws, regulations and codes (e.g. UL Labels) or special labels warning of hazards, denoting special operating and maintenance procedures or labels with other important or meaningful messages, directions or warnings.

E. Thoroughly clean the interior of panelboards and the like and remove all dust, dirt, and other foreign materials which may adversely affect the operation of equipment, damage equipment, or which may create a potential hazard or unsafe condition.

F. Replace or thoroughly dry all electrical appliances or equipment that have been subjected to injury by water. Dielectric test, as directed, all appliances or equipment that is dried.

3.09 PROTECTION

A. Contractor shall be responsible for proper protective and safety measures when working overhead, under power lines, underground and in finished areas and shall provide all safety equipment and devices and make all repairs, replacements and touch-ups of all work and materials which may become damaged.

B. Where touch-ups do not unnoticeably blend in with adjacent surfaces, as determined by Engineer, replace or completely repaint the entire piece in question.

3.10 INSTRUCTION SERVICES

A. Provide a competent instructor, when requested by Engineer, to instruct Owner and his representatives in the proper operation and maintenance of the electrical systems.

B. Include in the Contract Price, the cost of the instructor on-site time, which may be broken down into several days during the period commencing near the date of final installations and extending through the one-year guarantee period. The instructor's time is totally independent of any time necessarily required of Contractor to return to the Project during the guarantee period for repairs, corrective work or for any other reasons.

END OF SECTION

SECTION 260501
ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide electrical demolition work required for removal / abandonment of systems, equipment and devices, etc. made obsolete by this Project, and as required for demolition and remodeling by other trades.

B. Related work specified elsewhere includes:
All drawings and General Provisions of this Contract.
Mechanical demolition — Division 230000
Other Electrical Work — Division 260000

1.2 EXISTING CONDITIONS

A. In general, all existing electrical systems, equipment, and devices are not shown on the Drawings unless pertinent to the remodeling work. Existing electrical conditions, where indicated, are based on casual field observations and must be field verified by the Contractor. Report any discrepancies to the Architect before disturbing the existing installation.

B. Before bidding, the Contractor shall thoroughly examine the site to determine all actual observable conditions. No additional compensation will be granted for extra work made necessary by the Contractor's failure to investigate such existing conditions.

C. Care should be taken to insure that all adjacent buildings have continuous power during the construction period. The project will have a phased construction period. Certain areas of the building will required power at all times, while other areas of the building are being renovated.

D. All existing panels and panel schedules shall be updated prior to the demolition work. All existing circuits, feeders, and panels shall be traced and labelled to aid in the demolition and removal of all unused and obsolete wiring.

1.3 COORDINATION

A. The Contactor shall bear in mind that adjoining areas and buildings must remain in operation, and electrical systems and services must remain in operation at all times, unless specifically approved otherwise.

B. Scheduling of all demolition Work shall be performed by the Contractor. Coordination and cooperation of all contractors shall be expected in all conditions at all times. Phasing of demolition shall be determined by the Owner / Architect with the input of the Contractor.

C. All utilities, services, equipment, alarms, etc. shall remain in service during the demolition process. Temporary provisions must be made to keep all services operable during the entire construction period.

D. Construction traffic and removal of debris will be limited to specific areas and routes. Confirm with the Owner / Architect.

E. The Contractor shall perform all electrical work that is necessary for the demolition and remodeling work performed by all other trades. Field verification of all demolition and remodeling of all trades shall be performed by contractor before bid date. Contractor shall coordinate all work made necessary by other trades remodeling/demolition.

1.4 ADJACENT MATERIALS

A. During execution of the demolition work, primary consideration shall be given to protecting from damage, the building structure, furnishings, finishes, and the like, which are not specifically indicated to be removed.

B. Existing items or surfaces to remain, which are damaged as a result of this work, shall be refinished, repaired or replaced to the satisfaction of the Architect / Owner, at no cost to the Owner.

C. Locate and identify (trace and label) all electrical conduit, wiring, and circuits passing through the project area and serving areas outside the work limits. Maintain electrical circuit continuity to all areas outside the work limits unless specifically authorized otherwise in writing by the Architect / Owner. When through-circuits must be interrupted, provide temporary wiring for affected areas outside the work limits to minimize or eliminate the outage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials used for patching shall be in conformance with the applicable sections of the Project Manual. Where materials are not specifically described, but required for proper completion of the Work, they shall be selected by the Contractor, subject to approval of the Architect / Engineer.

PART 3 - EXECUTION

3.01 INSPECTIONS VERIFICATIONS

A. Before commencing work of this section, carefully inspect the project areas and become familiar with existing systems and conditions.

B. Verify with the Owner, all systems, materials and equipment which are to be salvaged and those which must be removed. The Owner reserves the right to salvage any or all existing electrical materials and equipment at the project site. Items to salvage and turn over to UVM include but are not limited to: all fire alarm equipment, all VFDs, all exterior light fixtures, and the automatic transfer switch.

3.02 COORDINATION

A. Coordinate all demolition work through the Architect and with all other trades and utilities.

3.03 PERFORMANCE

A. Remove pertinent existing electrical equipment, devices, raceway, fixtures, wiring and related materials within the project work limits as indicated on the contract documents and as required for the completion of all work in other divisions.
   1. Remove all abandoned devices and all dead wiring back to source.
   2. Remove all low voltage wiring no longer in service back to the source.
   3. Remove all abandoned conduit, boxes, supports, etc. where exposed, including items above

suspended ceilings. Cut conduits flush with walls and ceilings and plug opening with like material.

4. All shutdowns of systems and electrical services shall be scheduled and approved in writing by the Architect / Owner.
5. All material removed, including light fixtures, ballasts, and tubes are to be disposed of by the electrical contractor in a legal manner that complies with all rules and regulations. This includes electrical material that may be considered hazardous.

B. Where existing walls and/or ceilings are to be removed, disconnect and remove all electrical, communication and alarm items. Install conduit, wire, etc. as necessary to maintain system continuity after removal of walls and/or ceilings. Refer to Demolition Drawings.

3.04 EXISTING WORK TO REMAIN

A. Existing lighting and power branch circuits and devices that are not removed shall be rewired and reconnected to new panels if the panel feeding the branch circuit and/or device is removed.

B. Where electrical systems in adjoining areas, or electrical systems indicated to remain become disconnected or affected by demolition work, the contractor shall reconnect circuits, etc. as required to restore original operation. Restoration work to comply with requirements of new Work.

3.05 CLEANING

A. Clean and repair all devices and light fixtures that are to be salvaged and reused. This includes re-lamping all re-located lighting fixtures unless otherwise noted. All lenses shall be cleaned prior to reinstallation. All electrical devices shall be cleaned and checked for flaws prior to re-installation.

B. Remove form the Project site, on a daily basis, all dirt, dust, debris, and equipment deemed unwanted by Owner, resulting from demolition operations. Refuse should not be allowed to block or otherwise impair access in corridors, stairs, sidewalks, or other traffic areas.

END OF SECTION

SECTION 26 0519
WIRES AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of wires and cables and connections to all equipment, motors, meters, lighting fixtures, motor control centers and electrical signal devices.

B. Related work specified elsewhere includes:

Excavating, Trenching and Backfilling
Other Electrical Work

C. Definitions: AWG - American Wire Gauge

1.02 QUALITY ASSURANCE

A. Acceptable manufacturers of wire and cable are Anaconda, General Electric, Senator or an approved equal.

B. Acceptable manufacturers of solderless pressure type terminals and lugs are O.Z. Manufacturing Co., Burndy Manufacturing Co., Thomas & Betts (T & B), or an approved equal.

1.03 SUBMITTALS

A. Cut-sheets of wires, cables and connectors proposed for use.

B. Description indicating where each type of wire and cable will be used.

C. Manufacturers' descriptive literature.

1.04 DELIVERY - HANDLING

A. Deliver all wires and cables in full coils or reels and protect against injury. UL "Approved Tags" giving grade of insulation, size and length of wire in each coil or reel and the manufacturer's name and date of manufacture shall be securely attached to each carton or reel.

PART 2 - PRODUCTS

2.01 WIRES AND CABLES

A. Conductors shall be hard drawn copper wire having a conductivity of 98% of that of pure copper (Matthiessen's Standard) throughout their lengths.

B. All wire and cable insulation and all outer covering shall be designed for the conditions under which the wire or cable is to be used.

C. Wire for lighting branch circuits shall be no smaller than No. 12 AWG. Wires of greater size, as indicated or required, shall be used to minimize voltage drops. Use no wire smaller than No. 10 AWG in runs exceeding 50' from the lighting panel to the first outlet or

lighting fixture and between fixtures. Conductors of No. 12 AWG may be solid, and conductors of sizes greater than No. 12 AWG shall be stranded.

D. Wire and cable for power circuits shall be insulated for not less than 600 volts with moisture and heat resistant insulation, Type XHHW or THWN.

E. Cable for lighting circuits shall be 600-volt moisture and heat resistant wire, Type THHN or THWN. Where wire is used for direct burial or in conduits that are installed underground, in damp locations and/or exposed to moisture, use Type RHW or XHHW.

F. Cable for 120-volt control circuits shall be No. 14 AWG, multi-conductor flame resistant, jacketed, cable. Each single wire shall consist of 7 strand bare copper, insulated with Type XHHW. Where control circuits are installed in conduits, single conductor cable maybe used in lieu of multi-conductor assembled cable.

G. All conductors for power control, alarm and indication shall be stranded or as specifically shown on the drawings and other specific areas of the Specification.

H. Cable without conduit may be provided for communication and sound systems, where protected. Cable must be UL listed for the application per NEC and be plenum rated.

I. Metal clad cable (Type MC) may be provided for concealed branch circuit wiring per NEC.

J. All cabling shall be PLENUM-RATED.

2.02 WIRE AND CABLE IDENTIFICATION

A. Conductors shall be color coded as follows:

Phase	120/240V
A	Black
B	Red
C	Blue
Neutral	White or Grey
Equipment Ground Wire	Green

B. Tag cables and wires in pull boxes, panelboards, motor control centers, at equipment, and at electrical devices. Tags shall be printed, stamped or engraved to indicate the circuit number, the voltage, the phase and a one-word description of its use or an equipment number designation. (e.g. - For Blower B-1, tag would read "B-1, 240V, 1□" --- For lighting, tag would read "LIGHT, CKT 18, 120 V., 1□"). Tags shall be wrap-around self-laminating, adhesive backed tags equal to Brady B-191, or phenolic cable marker tags equal to those manufactured by Seton Nameplate Corp.

2.03 SOLDERLESS PRESSURE CONNECTORS

A. No. 10AWG and smaller - T & B "Sta-Kon".

B. No. 8AWG and larger - T & B Series 54100.

2.04 UNDERGROUND MARKERS

A. All underground wires, cables and conduits, which are not encased in concrete, shall have a plastic ribbon marker installed in the backfill, located directly over the line and approximately 9" below finished grade, unless otherwise noted.

B. Markers shall be "Terra Tape" as manufactured by Griffolyn Co., Inc., or equivalent by Seton Nameplate Corp., or equal.

C. Tape shall be imprinted with appropriate warning words similar to, "CAUTION - BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.01 INSPECTION

A. Do not pull wires and cables until conduits have been installed and cleaned and cleared of obstructions.

B. Check all nameplate data of equipment actually furnished to determine wire sizes required.

3.02 INSTALLATION

A. All circuits shall be made up of single conductor wire or cables, unless otherwise noted.

B. Carefully install conductors to prevent damage to insulation and do not apply excessive strain on the wires.

C. If lubrication is necessary, install conductors using powdered soapstone or other UL labeled electrical lubricant. Oils, greases or other compounds are not permitted for use as lubricants.

D. Conductor splices in raceways or fittings are not permitted.

E. Where enclosure size of terminals at control devices make 7 strand No. 12 AWG wire termination impractical, termination of external circuits may be made in adjacent junction boxes with terminal strips, with No. 14 AWG stranded wires provided between terminal strips at control device and junction box.

F. Provide all wire connectors, terminal lugs and other items required and necessary to complete all wiring.

G. Connection of conductors to terminal posts or other conductors shall insure a thorough and tight connection without damaging the conductor. Make connections by means of solderless pressure type terminals or lugs. Connectors shall be for proper cable size and shall have a conductivity not less than that of the wire or cable to which they are attached. Carefully finish and fit to provide a low resistance connection without reducing cable copper.

H. Installations requiring special tools for proper application shall be installed only with those tools and in accordance with the established practice and the recommendations of the manufacturer.

I. Remove and replace any wire, cable, insulation, connector or other item of work, which has been pinched, scraped, broken, impaired or damaged.

J. All circuits shall have full size neutral conductors. All neutral conductors shall be the same size as the phase conductors. No circuits shall share neutral conductors.

3.03 PERFORMANCE

A. The number of wires indicated on the Drawings for all electrical, control, indication, metering, telephone and signal circuits have been determined for the general schemes based upon the requirements of the particular type and size of equipment shown or specified. The actual number of wires needed to complete each system shall in no case be fewer than the number indicated and additional wires shall be provided where necessary and required by the actual equipment finally installed.

B. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits. Correct all malfunctions when detected.

C. After wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION

SECTION 26 0526
GROUNDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of A/C System, Equipment, Appliance, and Motor, device and lighting grounds.

PART 2 - PRODUCTS

2.01 GROUND SYSTEMS

A. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (compression lug), grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with the industry standards for applications indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The A/C system shall be grounded in the main distribution panel.

B. All conduits entering metal enclosures shall have double locknuts or, if enclosure does not have provision for connecting by locknuts, provide a ground busing, wire jumper, and solderless lug to bond enclosure. All conduits leaving the main distribution panel and main switchboard shall be grounded to the ground bus by means of a grounding busing, wire jumper, and solderless lug.

C. A separate ground conductor (green wire) shall be installed in all raceways for feeders, lighting power, and receptacle branch circuits, all cables, and where called for on drawings.

D. A bonding jumper and ground bar shall be installed in the computer room.

E. All Distribution and branch circuit panels shall have a separate ground bar, "ILSCO" or approved equal.

F. All metallic conduits 1-1/4" or larger shall have grounding bushings.

G. All SO-type cords, or equivalent, shall have a separate ground wire (green) of equal size to circuit conductor.

H. Equipment ground conductor shall be copper with type THHN insulation, green only, up to and including #4 AWG; larger sizes may be black and identified with green tape.

I. Paint, grease or other contaminants shall be sanded clean before bonding ground conductor.

J. All exposed metal pipes such as gas lines, air lines, oil lines, etc. shall be bonded per NEC.

END OF SECTION

SECTION 26 0533
CONDUITS AND BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of conduits and boxes.

B. Related work specified elsewhere includes:
Excavating, Trenching and Backfilling
Other Electrical Work

1.02 QUALITY ASSURANCE

A. Set all conduits and boxes plumb and level.

B. All conduits and boxes shall be straight, free from blisters and defects, and shall bear the Underwriters' Label.

C. All conduits, boxes, raceways, etc. installed in finished areas shall be concealed from view.

1.03 SUBMITTALS

A. Submit manufacturer s catalog information sheets of all conduits, wall boxes and floor boxes proposed for use.

B. Description indicating where each type of conduit and box will be used.

C. Manufacturers' descriptive literature.

1.04 PENETRATIONS

A. Waterproofed Surfaces - Except where absolutely necessary, do not penetrate roofs and waterproofed surfaces. Where required, make penetrations prior to the application of roofing and waterproofing materials and furnish all sleeves, pitch pockets and other approved items.

PART 2 - PRODUCTS

2.01 RIGID CONDUITS

A. Except where otherwise noted, all conduits shall be rigid steel conduit or intermediate metal conduit, high grade, mild steel electrical pipe conforming to ANSI C80.1 and NEC Article 345 and Article 346.

B. Rigid conduit shall be galvanized and threaded and delivered with conduit couplings or tightly fitted plastic or fibre thread protectors.

2.02 THINWALL CONDUITS

A. Thinwall (EMT) conduit shall be used for all branch circuit and feeder work in dry locations inside buildings.

B. Fittings for thinwall conduits shall be compression type. Installation shall be in accordance with N.E.C. Article 348. Thinwall conduits shall be as manufactured by Republic, Triangle, Allied or approved equal. Steel set screw fittings may be installed where allowed by NEC and a grounding conductor is provided.

2.03 RIGID NON-METALLIC CONDUIT

A. Rigid non-metallic conduit schedule 40 PVC may be used for service entrance ductbank, - underground branch circuits and in concrete slabs. Rigid non-metallic conduit for service entrance shall be concrete encased under roads and driveways.

B. Installation and fittings shall be in accordance with N.E.C. Article 347. Rigid non-metallic conduits shall be as manufactured by Carlon or approved equal.

2.04 FLEXIBLE GALVANI□ED METAL CONDUIT

A. Flexible galvanized metal conduit shall be used between outlet boxes in hung or furred ceilings and flood type lighting fixtures.

B. Installation shall be in accordance with N.E.C. Article 350. Materials shall be as manufactured by Republic, Allied, Triangle, or approved equal.

2.05 LIQUID-TIGHT FLEXIBLE CONDUITS

A. Make terminal connections to motors and equipment with liquid-tight, flexible conduit of the same size as the conduit run.

B. Maximum length of liquid-tight flexible conduit - 18".

C. Conduit shall be single strip, continuous, flexible, interlocked, durable wrapped steel, galvanized inside and outside, and provided with a tough, inert and watertight plastic jacket, conforming to NEC Article 351.

D. Conduits shall be Seal-Tite, type V.A. (American Brass Co.), Flex-Seal, Type XI (Columbia Cable & Electric Corporation), or equal.

2.06 CONDUIT FITTINGS

A. Fittings shall be malleable or cast iron with threaded hubs and full body design conforming to NSI C80.4.

B. Covers shall be of stamped metal.heavy cast metal with composition gaskets (weatherproof type or vaportight type, as applicable).

C. Fittings and covers shall be galvanized or cadmium plated, inside and outside.

D. For liquid-tight flexible conduits, fittings shall have body and gland nut of cast malleable iron, cadmium plated, a one-piece brass grounding bushing which threads to interior of conduit spiral and a molded vinyl sealing ring between gland nut and bushing.

E. Couplings and elbows shall be threaded, same as conduit.

F. Fittings shall be the "Condulet" type.

2.07 SURFACE RACEWAY

A. Except as otherwise noted, all branch circuit wiring in finished areas shall be concealed. Surface raceway may be used only by permission of architect in existing areas deemed too difficult to conceal wiring.

B. Surface metal raceways shall be used where indicated on drawings.

C. Provide all surface metal raceways and all couplings, elbows, boxes, support clips and other appropriate fittings to provide a safe and complete installation.

D. Size to accommodate required number of conductors.

E. The surface metal raceway shall be Wiremold Co. 500 or 700 series, Walker or approved equal. Color shall be determined by architect. Multiple service raceway shall be Wiremold Co. G4000 series, Walker or approved equal.

2.08 GENERAL

A. Conduits shall be sized per ANSI C1 (National Electrical Code). Unless otherwise noted, minimum size shall be 1/2".

B. Each length of conduit shall bear the UL label and the manufacturer's name or trademark.

C. Provide No. 12 galvanized pulling wire in each empty conduit and duct, continuous.

D. Provide all unions, reducers, conduit caps and all other fittings and hardware required to complete all conduit runs.

E. Use lock nuts and proper insulating type bushings, as required.

F. Fasten all metallic conduits and armored cable to each adjacent section and to all boxes, fittings and equipment with firm, clean metallic contact to provide a well and continuous grounded system.

G. Provide conduit expansion fittings, complete with bonding jumpers, at all concrete expansion joints, between concrete structures and where conduits are firmly attached to two independent structures.

2.09 JUNCTION, PULL AND OUTLET BOXES

A. Size and gauge of boxes shall be in accordance with ANSI C1 and as required by the construction.

B. Boxes and covers shall be of sheet steel and shall be hot dipped galvanized after fabrication. Secure covers to boxes with brass or galvanized machine screws.

C. Provide cut or punched conduit holes. Torch cutting is not permitted.

D. All boxes exposed to the weather, moisture or vapor shall be cast aluminum with threaded hub. Covers shall be gasketed to make boxes vaportight and waterproof.

E. All boxes shall be provided with suitable ground lug.

F. Where more than two switches or other similar wiring devices are indicated at a single location and at the same elevation, they shall be installed in gang boxes with one cover plate.

2.10 UNDERGROUND CONDUIT

A. Unless otherwise specified or shown on the Drawings, all underground conduits shall be coated with an approved asphaltum paint and encased in sand.

B. Encasements, all around conduit, shall be a minimum of 6" of sand, unless otherwise specified or shown on the Drawings.

PART 3 - EXECUTION

3.01 INSPECTIONS - VERIFICATIONS

A. The Drawings indicate the general locations of outlets, fixtures, equipment, wiring and other electrical devices and the general details for the complete electrical and telephone installations.

B. Conduit locations are diagrammatic only and do not necessarily indicate the exact location or routing.

C. Prior to locating and installing conduits and boxes, check the Contract Drawings and the Work to be sure that the locations of all conduits and boxes will not interfere with or be covered by doors, casework, heating and process equipment, or the like, and that conduit stubs for motors and equipment will be placed in the proper locations.

3.02 INSTALLATION OF CONDUIT

A. Conform to NEC requirements.

B. Unless otherwise directed by Engineer or shown on the Drawings, all conduits shall be concealed in floors, walls, ceilings or underground.

C. For exposed work, support conduit every eight (8) feet with galvanized malleable iron one-hole straps and "clampbacks." Secure tightly with screws, bolts or other approved means. Size of bolts shall be commensurate with supported weight.

D. For parallel groups of exposed conduits, provide trapeze hangers or other approved method of installation.

E. All exposed conduits shall be neat and symmetrical and run parallel with adjacent walls, partitions and ceilings. Diagonal runs are not permitted.

F. Perforated straphangers are not permitted.

G. "Running thread" type conduit connections are not permitted.

H. In fill or slabs, run conduits as straight and direct as possible. Where required, use long radius bends. In structural slabs less than 4" thick, conduits having "D" over 1" are prohibited, where "D" is the maximum outside diameter or dimension of the conduit. In structural slabs 4" and thicker, "D" shall not exceed 1-□ inches. Where conduits are permitted in the slab, the center-to-center spacing shall not be closer than 3 "D" and in no case, less than 2 inches clear.

I. Conduit runs, through or below equipment foundations, are not permitted.

J. Unless otherwise specified or directed by Engineer, the minimum depth of cover over underground concrete encasements shall be 30", except under roads, parking lots and other traveled areas where it shall be 48".

K. Underground conduit runs shall be pitched for drainage, away from the level of entry to buildings or equipment.

L. In concrete walls below grade provide O. Z. Gedney type "FSK", or approved equal sleeves for all conduits.

M. The use of wooden plugs inserted into concrete or masonry as a base to fasten conduits is not permitted.

N. Avoid bends and offsets where possible. Where necessary, use a conduit-bending machine. No bends greater than 90□are permitted in any one run of conduit. Provide pull boxes where more bends are necessary.

O. Deformed or crushed conduit is not permitted.

P. Cut conduit with powered hacksaw. Cut ends square. Cut threads, clean and ream.

Q. Maintain six (6) inch minimum separation between all conduits and water lines.

R. All couplings shall be pulled up tight to provide electrical bond. Ends of conduits terminating in a pressed steel box shall be provided with a galvanized locknut and bushing inside and a locknut outside. Fiber or hardwood bushings are not permitted at termination of feeder conduits.

S. Plug and cap all conduits until ready to pull wires and make connections.

3.03 INSTALLATION OF BOXES

A. Locate special function outlets where shown on the Drawings.

B. Make dimension between door openings and wall switches uniform throughout the work.

C. Boxes shall be supported independently of all conduits and shall be rigidly secured in place.

D. Provide all adapters, jacks, terminals, terminations, trim rings, plates, covers, jacks and devices for complete and operable installations.

E. On concrete, brick or other masonry surfaces, secure surface mounted boxes with machine screws or bolts and expansive type shield.

F. On building steel, secure boxes by means of clamp type supports and provide rigid vibration-proof installation.

A. Surface mounted pull and junction boxes, one-foot square or more in area, shall be installed to provide a minimum air space between box and mounted surface of one (1) inch.

3.04 ADJUST AND CLEAN

A. Adjust all work to provide a rigid, neat, and clean conduit system.

B. Clear conduits of all obstructions and dirt prior to pulling wires or cables. Use ball mandrel, with a diameter equal to approximately 85% of the inside diameter of the conduit, followed by a close fitting wire brush and wad of felt or similar material. This assembly may be pulled together with, but ahead of, the cable being installed.

C. Clean empty conduits, as specified above.

END OF SECTION

SECTION 26 2800
CIRCUIT AND MOTOR DISCONNECTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes the furnishing and installation of Equipment, Appliance, and Motor Disconnect Switches and Safety Switches.

1.02 ACCEPTABLE MANUFACTURERS

A. Siemens, Eaton, Square D, General Electric, or approved equal.

1.03 SUBMITTALS

A. Manufacturer's catalog cuts and layout drawings, clearly indicating all voltage and ampere ratings, sizes, contactors, buswork and other features including indicator lights, lock-out devices, and other ancillary equipment.

PART 2 PRODUCTS

2.01 HEAVY DUTY SAFETY SWITCHES

A. Provide surface-mounted, heavy-duty type, sheet-steel enclosed, fusible, safety switches, of types, sizes and electrical characteristics indicated; rated 600 volts, 60 Hz; incorporating quick-make, quick-break type switches; so constructed that switch blades are visible in OFF position with door open. Each switch shall be equipped with an operating handle which is an integral part of the enclosure base and whose position is easily recognizable, and is pad-lockable in OFF position. Provide NEMA type 1A enclosure for dry locations indoors, NEMA 3R for wet locations, or as specified on Drawings.

B. Fusible switches shall have all of the above features. Fusible switches shall have positive pressure-type reinforced fuse clips and a short-circuit rating of 200,000 RMS amperes with class R rejection feature installed in the fuseholders.

C. All switches shall have neutral kits installed where required.

D. Sentinel motor starting switches shall be used at all equipment rated at 20A or less, 208v or 120v.

2.02 FUSES

A. Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time/current and peak let-through current characteristics indicated on Drawings, which comply with manufacturer□s instructions, applicable requirements of the NEC, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Provide UL Class RK5 time-delay fuses rated 600V, 60 Hz, 1 to 600 amperes, with 200,000 RMS symmetrical interrupting current rating for protecting motors and circuit breakers. Use Class J fuses where needed for series-protection of circuit beakers.

C. Provide UL Class KLU time-delay fuses rated 600 V, 60 Hz, 800 amperes, with 200,000 RMS symmetrical interrupting current rating for protecting the service entrance at the main disconnect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and install disconnects and safety switches at all the locations and at all the equipment shown on the Drawings, complying with manufacturer's instructions, applicable requirements of the NEC, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Install disconnect switches used with motor-driven appliances, motors, and controllers within sight of equipment served unless otherwise indicated.

C. Provide all coordination required with all other trades to insure the proper size of all equipment is supplied.

D. Mechanical equipment supplier shall provide all motor starters and VFD's. The electrical contractor shall install and wire all electrical items supplied by the MC.

E. Label all disconnects and other equipment devices with the Panel name and circuit number of the circuit feeding the device.

END OF SECTION