

Project Manual for

COFFIN ELEMENTARY

Brunswick, ME

VENTILATION IMPROVEMENTS AND ROOF REINFORCEMENTS

Issued for Bid

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- 1.1 Refer to the drawing package cover sheet for complete list of drawings for this Project and are part of the Contract Documents with the Project Manual.

END OF SECTION

**Brunswick School Department
Coffin Elementary Ventilation Improvements and Roof Reinforcement**

The Project consists of removing an existing ERV and associated ductwork from the ceiling structure at Robert P.T. Coffin Elementary School cafeteria, placing a new ERV and associated ductwork on the roof of the cafeteria, reinforcing the roof trusses below the ERV and associated cutting and patching. The work must be completed during summer vacation for the school district.

The cost of the work is approximately \$235,000. The work to be performed under this contract shall be completed on or before the Substantial Completion date of *19 August 2021*.

1. Bids shall be submitted in sealed envelopes plainly marked “Bid for **Coffin Elementary Ventilation Improvements and Roof Reinforcement**” and addressed to the Bid Administrator:

*Kelly Wentworth
Brunswick School Department
46 Brunswick Street
Brunswick, ME
04011*

The envelope shall contain a completed Contractor Bid Form, plus bid security when required, to be received no later than **2:00:00 p.m.** on **2 July 2021**. Bid submissions will be opened and read aloud at the address shown above at the time and date noted above.

Any bid submitted after the noted time will not be considered a valid bid and will remain unopened. Any bid submitted by another means will not be considered a valid bid.

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 not 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 Bond *are required* on this project.
If noted above as required, 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.
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.

00 11 13
Notice to Contractors

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. *The meeting will be held on 23 June 2021 at 10:00 a.m. at Robert P.T. Coffin Elementary School, 20 Barrows Street, Brunswick, Maine.*
8. Property Insurance for this construction contract, described in the Insurance Requirements section the General Conditions of the contract, shall be *Renovation or addition insured by Owner.*
9. Bid Documents are available electronically on the Brunswick School Department website. Bidders are encouraged to check website regularly for any issued addenda and to email Robin Tannenbaum at CHA Architecture (rtannenbaum@chacompanies.com) to be put on a list of bidders to be notified of updates to the bid documents.

00 21 13
Instructions to Bidders

1. Bidder Requirements

- 1.1 A bidder is a Contractor who is 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.

00 21 13
Instructions to Bidders

- 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 sum of an acceptable Base Bid plus any Alternate Bids the Owner elects to include. An acceptable bid is one from a responsive and responsible bidder.
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.
- 3.3 A bid that contains any escalation clause is considered invalid.
- 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 shall include the cost of Performance and Payment Bonds in the bid amount if the bid amount will result in a construction contract value over \$125,000, inclusive of alternate bids that may be awarded in the contract. Pursuant to 14 M.R.S.A., Section 871, Public Works Contractors' Surety Bond Law of 1971, subsection 3, the selected Contractor is required to provide these bonds before a contract can be executed. The form of bonds are 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 shall acknowledge on the bid form all Addenda issued in a timely manner. The Consultant shall not issue Addenda affecting the content of the bid less than 72 hours prior to the bid closing time. 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. After the bid closing time, such written withdrawal requests may be allowed in consideration of the bid bond or, without utilizing a bid bond, if the Contractor

00 21 13
Instructions to Bidders

provides documented evidence to the satisfaction of the Bureau that 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**

**Brunswick School Department
Coffin Elementary Ventilation Improvements and Roof Reinforcement**

Bid Form submitted by: *paper documents only to the address below.*

Bid Administrator:

*Kelly Wentworth
Brunswick School Department
46 Brunswick Street
Brunswick, ME 04011*

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 Schedules, 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 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 form of contract, general conditions, specifications, and drawings dated *15 June 2021*, prepared by *CHA Architecture* for *Coffin Elementary Ventilation Improvements and Roof Reinforcement*, as well as the premises and conditions relating to the work, proposes to furnish all labor, equipment, and materials necessary for and reasonable 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

insert brief name of Allowance

\$0.00

3. Alternate Bids *are not included* on this project.

No Alternate Bids

Any dollar amount line that is left blank by the 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. The Bidder acknowledges receipt of the following Addenda to the specifications and drawings:

Addendum No. ____ Dated: _____ Addendum No. ____ Dated: _____

Addendum No. ____ Dated: _____ Addendum No. ____ Dated: _____

Addendum No. ____ Dated: _____ Addendum No. ____ Dated: _____

Addendum No. ____ Dated: _____ Addendum No. ____ Dated: _____

5. Bid Security *is not required* on this project.

If noted above is required, 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.

6. 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).

**State of Maine
CONSTRUCTION CONTRACT**

Large Construction Project

(Contract value \$50,000 or greater. Contract includes Project Manual, Specifications and Drawings)

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 (not the PIP number)*

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	<u><i>\$0.00</i></u>
<u><i>Alternate Bid number and name or "no Alternates"</i></u>	<u><i>\$0.00</i></u>
<u><i>Alternate Bid number and name or "no Alternates"</i></u>	<u><i>\$0.00</i></u>
<u><i>Alternate Bid number and name or "no Alternates"</i></u>	<u><i>\$0.00</i></u>
<u><i>Alternate Bid number and name or "no Alternates"</i></u>	<u><i>\$0.00</i></u>
<u><i>Alternate Bid number and name or "no Alternates"</i></u>	<u><i>\$0.00</i></u>
Total Contract Amount	<u><i>\$0.00</i></u>

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 will be 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 TIME OF COMPLETION

2.1 The Work of this Contract shall be completed on or before the Final Completion date of *31 December 2021*.

The following abbreviated definitions are for reference only, see Section 00 71 00 *Definitions* for actual definitions.

Substantial Completion: date of first beneficial use by the Owner.

Final Completion: the Contractor's final completion deadline.

Contract Expiration: the Owner's deadline for management of contract accounts.

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 Owner has verified the appropriate coverage with the State of Maine Division of Risk Management, and selected the proper option as follows. Property Insurance for this construction contract, described in the Insurance Requirements section of the General Conditions of the contract, shall be *Non-standard project insured by Contractor.*

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

4.4 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.

4.5 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.

4.6 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 Consultant of any non-appropriation and the effective date of the non-appropriation.

ARTICLE 8 CONTRACT DOCUMENTS

8.1 The General Conditions of the contract, instructions to bidders, bid form, Special Provisions, the written specifications and the 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 Agreement is effective as of the date executed by the approval authority.

OWNER

CONTRACTOR

(Signature) (Date)
name and title

(Signature) (Date)
name and title

name of contracting entity
address

name of contractor company
address

telephone
email address

telephone
email address
Vendor Number

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

select proper approval authority			
Reviewed by:		Approved by:	
_____ <i>(Signature)</i>	_____ <i>(Date)</i>	_____ <i>(Signature)</i>	_____ <i>(Date)</i>
<i>insert name</i>		<i>Joseph H. Ostwald</i>	
<i>Project Manager/ Contract Administrator</i>		<i>Director, Planning, Design & Construction</i>	

SECTION 00 60 00 - PROJECT FORMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pre-Construction Forms.
2. Post-Award Certificates.
3. Clarification and Modification Forms.

1.2 FORMS

A. Pre-Construction Forms:

1. Performance Bond Form: Section 00 60 13.13 “Contractor Performance Bond” - Sample form.
2. Payment Bond Form: Section 00 60 13.16 “Contractor Payment Bond” - Sample form.

B. Post-Award Certificates: Available at [Forms | Bureau of General Services \(maine.gov\)](#).

1. Application for Payment Form.

C. Clarification and Modification Forms: Available at [Forms | Bureau of General Services \(maine.gov\)](#).

1. “Change Order Table A and Table B” - Change Order Form.
2. “Change Order Table C” - List of Items.
3. “Change Order Table D” - Details of Change Order.
4. “Construction Change Directive.”

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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 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 Real Estate Management (formerly known as 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.

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- 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*.

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- 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

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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 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, on a given project, with the following *responsive* standards, as required by the bid documents:
- provided specific qualifications to bid the project, if required;
 - attended mandatory pre-bid conferences, if required;
 - provided a bid prior to the close of the bid period;
 - submitted a complete bid form;
 - submitted 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;
 - employs adequate personnel and subcontractor resources;
 - maintains the equipment needed to perform the work;

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complies with the proposed implementation schedule;
complies with the insurance and bonding requirements;
can provide 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.

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- 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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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.

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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).

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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

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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

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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

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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.

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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

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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.

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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.

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- 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.

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- 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.

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- 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.

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- 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

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- 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.

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- 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.

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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.

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- 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.

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- 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.

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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.

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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.

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- 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.

SECTION 01 00 00 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Construction Schedule.
 - 4. Work restrictions.
 - 5. Health and Safety Procedures
 - 6. Contract Modifications
 - 7. Project Meetings
 - 8. Submittals
 - 9. Quality Control
 - 10. Temporary Facilities & Utilities
 - 11. Demolition and Construction Waste
 - 12. Cutting and Patching
 - 13. Cleaning
 - 14. Specification and Drawing conventions.

1.2 PROJECT INFORMATION

- A. Project Identification: Coffin Elementary Ventilation Improvements and Roof Reinforcements.
 - 1. Project Location: Coffin Elementary School, 20 Barrows Street, Brunswick, Maine
- B. Owner: Brunswick School Department.
 - 1. Project Owner Contact: Scott Smith, Director of Facilities, Ground and Food Service
 - 2. Contact: ssmith@brunswicksd.org.
- C. Architect: The Contract Documents were prepared for the Project by CHA Architects.
 - 1. Architect Contact: Robin Tannenbaum.
 - 2. Contact: rtannenbaum@chacompanies.com.
 - 3. Address: 49 Dartmouth Street, Portland, Maine 04101.
- D. Architect's Consultants: Architect has retained the following design professional who have prepared designated portions of the Contract Documents:
 - 1. Bennett Engineering, Inc.
 - 2. Thornton Tomasetti.
- E. Construction Administrator: The Construction documents will be administered by a firm to be determined.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

- B. Project consists of removing an existing ERV and associated ductwork from the ceiling structure at Robert P.T. Coffin Elementary School cafeteria, placing a new ERV and associated ductwork on the roof of the cafeteria, reinforcing the roof trusses below the ERV and associated cutting and patching, and other Work indicated in the Contract Documents.
- C. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.4 CONSTRUCTION SCHEDULE

- A. Submit draft Construction Schedule for review at the Preconstruction Conference. Finalize the Schedule with review comments and submit Construction Schedule within 10 working days after the Preconstruction Conference.
 - 1. Construction Start: 6 July 2021.
 - 2. Include as part of the Construction Schedule the start and completion of the following:
 - a. Substantial Completion.
 - 1) Allow for 10 working days for Construction Administrator's review.
 - b. Final Completion.
- B. Format: Provide bar chart, per Project Site, showing construction schedule. Revise as required during the construction period.
 - 1. Coordinate scheduling for the Work in communications with the Owner due to School activities and health cleaning procedures.

1.5 WORK RESTRICTIONS

- A. Coordinate with Owner for access to school.
- B. Use of Premises: Contractor shall have limited use of Project sites for construction operations as indicated on Construction Documents and as described within this Section.
 - 1. Use of Site: limit use of Project sites to areas within the Contract limits indicated. Do not disturb portions of Project sites beyond areas in which the Work is indicated.
 - 2. Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees and visitors, building occupants, and emergency vehicles. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. On-Site Work Hours: 7:00 am to 5:00 pm Monday to Friday.
 - 1. Hours for Utility Shutdowns: As approved by Construction Administrator and Owner.
 - 2. Hours for Core Drilling: As approved by Construction Administrator and Owner.
 - 3. Provide 24-hour notice to Construction Administrator when performing work other than normal working hours.

1.6 HEALTH AND SAFETY PROCEDURES

- A. Adhere to CDC/OSHA and Owner guidelines for precautions and actions to prevent the spread of COVID-19.
 - 1. Implement the NABTU and CPWR COVID-19 Standards for U.S. Construction Sites (current issue).
- B. Face coverings, masks, or respirators must be worn while on site.
- C. Practice social distancing measures insofar as practical for the execution of the construction work.
- D. Notify Owner and Construction Administrator immediately if a positive COVID-19 test result is received from anyone working on the site. Stop work immediately and confirm with CDC guidelines to verify if others working in close contact with the positive case have been infected and tested.
 - 1. The area which may have been contaminated with the positive case must be sanitized and cleaned.

1.7 CONTRACT MODIFICATIONS

- A. Owner-Initiated Proposal Requests: Construction Administrator will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the Construction Administrator.
- C. On Owner's approval of a Construction Change Directive, the Construction Administrator will issue a Change Order for signatures of Owner and Contractor per BGS forms.
 - 1. Change Orders will be processed once per month with Payment Request.

1.8 PAYMENT PROCEDURES

- A. Refer to Section 012900 "Payment Procedures."

1.9 PROJECT MEETINGS

- A. Preconstruction Conference: Schedule a preconstruction conference, before starting construction, at a time convenient to Owner and Construction Administrator, but no later than 15 days after execution of the Agreement. Conference will be held virtually, using platform agreed to by Contractor, Construction Administrator, and Owner. Meeting will be conducted to review responsibilities and personnel assignments.
 - 1. Minimum agenda: Distribute no later than 7 workdays prior to meeting, and discussed on the following:
 - a. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and the Construction Administrator;
 - b. Channels and procedures for communication;
 - c. Construction schedule, including sequence of critical work;
 - d. Contract Documents, including distribution of required copies of Drawings and revisions;
 - e. Processing of Shop Drawings and other data submitted to the Construction Administrator for review;
 - f. Applications for Payment schedule and procedures.

- g. Processing of field decisions and Change Orders;
 - h. Rules and regulations governing performance of the Work; and
 - i. Procedures for security, quality control, housekeeping, and related matters.
 - 1) Use of School facilities.
 - 2) Interactions with School Employees.
 - 3) Daily Cleaning.
 - j. Technical Specifications:
 - 1) Review selective demolition activities. Discrepancies found, if any.
2. Meeting Minutes: Forward to Construction Administrator for review and comment. Revise meeting minutes accordingly prior to distributing minutes to Owner and Construction personnel.
- B. Progress Meetings: Construction Administrator will conduct progress meetings once a month, scheduled two weeks following the Application for Payment.
1. Attendance: To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. Subcontractors, materials suppliers, and other may be invited to attend those project meetings in which their aspects of the Work are involved
 2. Conduct meetings virtually using agreed upon platform, and at project site at Contractor's option.
 3. Minimum agenda: Data will be distributed and discussed on the following:
 - a. Review progress of the Work since last meeting, including status of submittals for approval.
 - b. Identify problems which impede planned progress.
 - c. Develop corrective measures and procedures to regain planned schedule.
 - d. Complete other current business.
 4. Meeting Minutes: Record meeting minutes and forward to Construction Administrator for review and comment. Revise meeting minutes accordingly prior to distributing minutes to Owner and Construction personnel.

1.10 SUBMITTALS

- A. General: Prepare and submit Submittals required by individual Specification Sections.
1. Format: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
 2. Email: transmit to Construction Administrator by sending via email. Include information in email subject line as requested by Construction Administrator.
 - a. Include PDF transmittal form.
 - b. Construction Administrator will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 3. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Administrator's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - a. Initial Review: Allow 10 workdays for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Administrator will advise Contractor when a submittal being processed must be delayed for coordination.

- b. Sequential Review: Where sequential review of submittals by Construction Administrator's consultants, Owner, or other parties is indicated, allow 5 additional workdays for initial review of each submittal.
 - c. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
 - 4. Submittals that are "rejected" or noted as "revise and resubmit" two times, due to incompleteness and failure to revise per Construction Administrator's comments from previous submittals, will be now reviewed at the expense of the Contractor.
 - a. Compensation to the Owner: Provide credits, per Construction Administrator's tracked billable rate for extra Submittal reviews, at the end of the month when submitting Application for Payment.
- B. Contractor's Review:
 - 1. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Construction Administrator.
- C. Construction Administrator's Review:
 - 1. Do not order or install materials until the Construction Administrator has reviewed and returned the submittal.
 - 2. Action Submittals: Construction Administrator will review each submittal, provide a cover sheet with marks to indicate corrections or modifications required, and return it.
 - 3. Informational Submittals: Construction Administrator will review each submittal and will not return it or will return it if it does not comply with requirements. Construction Administrator will forward each submittal to appropriate party.
 - 4. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Construction Administrator.
 - 5. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmission without review.
 - 6. Submittals not required by the Contract Documents may be returned by the Construction Administrator without action.
- D. Submittals:
 - 1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 2. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 3. Samples: Prepare physical units of materials or products, including the following:
 - a. When indicated, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - b. When indicated, submit full-size units or samples of size indicated, prepared from the same material to be used for the Work, physically identical with the product proposed for use, and that show full range of color and texture variations expected.
- E. Substitutions:
 - 1. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Construction Administrator.

- F. "Or equal":
 - 1. Where the phrase "or equal," or "or equal as approved by the Construction Administrator," occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved for this Work by the Construction Administrator.
 - 2. The decision of the Construction Administrator will be final.
- G. Timing of Submittals:
 - 1. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
 - 2. In scheduling, allow at least ten working days for review by the Construction Administrator following his receipt of the submittal.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made by the Owner.
 - 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests: As specified in the Technical Specifications.
- C. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.12 TEMPORARY FACILITIES & UTILITIES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Construction Administrator and shall be included in the Contract Sum.
 - 1. Use of School facilities, including drinking fountains and restrooms, shall be confined to locations as directed by the Owner.
- B. Equipment, Tool and Materials Storage
 - 1. Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
 - 2. Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.
- C. Temporary Utilities:
 - 1. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 2. Hand Wash and Sanitizing Stations: Portable, touchless hand washing stations, including soap and towel dispensers. Provide hand sanitizer, on-demand water heater, freshwater tank, and wastewater tank contained within the mobile cabinet.

3. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. Electrical Outlets: Use of existing electrical system may be permitted within the School buildings for normal use loads. Coordinate with Owner, on an as-needed basis, for interior electrical service use.
 1. Do not use existing electric services for high electric service loads, provide own services for such work.
- E. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

1.13 DEMOLITION AND CONSTRUCTION WASTE

- A. Unless otherwise indicated, demolition and construction waste becomes the property of the Contractor.
- B. Provide own recycling and waste bins. Use of other Contractor's bins is prohibited.
- C. Recycling:
 1. General: Recycle paper and beverage containers used by on-site workers.
 2. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
 3. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - a. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 1) Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - c. Stockpile materials away from construction area. Do not store within drip line of trees.
 - d. Store components off the ground and protect from the weather.
 - e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.
- D. Disposal of Waste:
 1. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill acceptable to authorities having jurisdiction.
 - a. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 2. Burning: Do not burn waste materials.
 3. Disposal: Transport waste materials off Owner's property and legally dispose of them.

1.14 CLOSEOUT PROCEDURES

- A. Refer to Section 01 77 00 "Closeout Procedures."

1.15 CUTTING AND PATCHING

- A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the Work required to:
 - 1. Make the several parts fit properly.
 - 2. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
 - 3. Remove and replace work not conforming to requirements of the Contract Documents.
 - 4. Remove and replace defective work.
 - 5. Connect to existing construction.
- B. Prior to cutting which effects structural safety, submit written request to the Construction Administrator for permission to proceed with cutting.
- C. Materials: For replacement of items removed, use materials complying with pertinent Sections of these Specifications.
- D. Perform cutting, demolition and patching, by methods that will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work to Construction Administrator's approval.

1.16 CLEANING

- A. Progress Cleaning:
 - 1. Retained stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
 - 2. Completely remove scrap, debris, and waste material from the job site daily. Maintain school site clean, in areas of construction.
 - 3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material.
 - 4. At the end of each work shift, clean and sanitize contact surfaces in construction areas.
- B. Final Cleaning: Refer to Section 017700 "Closeout Procedures."

1.17 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.

4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Construction Administrator at earliest possible date, but no later than seven working days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide sub-schedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Name of Construction Administrator.
 - e. Contractor's name and address.
 - f. Date of submittal.
 - 2. Use Schedule of Values provided by BGS.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
 6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 7. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 8. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 9. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 10. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.
 11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- C. Draw-Down Schedule: Furnish to the Construction Administrator, at the beginning of the project, an expected monthly requisition estimate for the Owner's use in planning funding.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Construction Administrator and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 1. Submit draft Application for Payment 7 workdays prior to the Application for Payment, for Construction Administrator review. Make revisions as indicated by the Construction Administrator for the Application for Payment.
 2. Exact dates for submission will be reviewed at the Preconstruction Conference.
- C. Application for Payment Forms: Use forms posted on Bureau of General Services website as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Administrator will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Administrator by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. The list of subcontractors, principal suppliers and fabricators shall be used to designate which entities involved in the Work must submit waivers. The list will be approved by the Owner.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Record Drawing Updates: With each Application of Payment, record documents shall be maintained and current for trades, available for viewing at a central location.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.

5. Products list (preliminary if not final).
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits and other required permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
- J. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:
1. Contractor's Construction Schedule update.
 2. Submittals for Work being requisitioned for are complete and approved.
 3. Submit list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
 4. Minutes of previous month's progress meeting have been distributed.
 5. Record drawings and documents are current.
- K. Application for Payment at Substantial Completion: After Construction Administrator issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Final submittal of record documents and operation, maintenance data and demonstration and training.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
 6. Evidence that claims have been settled.
 7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 8. Final liquidated damages settlement statement, if applicable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Payment Procedures

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Complete and submit the following a minimum of ten days prior to requesting Construction Administrator's Review to determine the date of Substantial Completion. Items shall be complete.
 - 1. Prepare and submit a punch list of items to be completed or corrected. Include a value of the work and the reason why it is incomplete or needs correction.
 - 2. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - a. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 - b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - c. Include the following information at the top of each page:
 - 1) Project name.
 - 2) Date.
 - 3) Name of Architect.
 - 4) Name of Contractor.
 - 5) Page number.
 - 3. Advise Owner in writing of pending insurance change over requirements.
 - 4. Prepare and submit closeout submittals including but not limited to warranties, record documents, and manuals.
 - 5. Submit closeout submittals specified in individual Sections, including but not limited to, warranties, workmanship bonds, maintenance service agreements, certifications, and similar documents.

6. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities, including but not limited to Certificate of Occupancy, approvals of public and private entities having jurisdiction, operating certificates and completion of commissioning.
7. Prepare and submit a Schedule of Maintenance Materials specified in individual Sections. Maintenance Materials including but are not limited to extra materials, tools, and spare parts. Schedule shall identify Specification Section, item name, quantity and manufacturer's information including contact information, item identification, data sheets and special storage requirements.
8. Submit test/adjust/balance reports including a notarized letter from the Contractor indicating that all systems are complete.
9. Make final changeover of permanent locks and deliver keys to Owner with a list indicating which key opens which lock(s) utilizing final room numbering.
10. Instruct Owner's personnel in operation, adjustment and maintenance of products, equipment, and systems. Submit documentation that Owner training has been successfully completed.
11. Advise Owner in writing of utility changeovers.
12. Participate with Owner's personnel in conducting inspection and walkthrough with local emergency responders.
13. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
14. Complete final cleaning requirements, including touch-up paint.
15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.5 CONSTRUCTION ADMINISTRATOR'S REVIEW

- A. Submit a written request for the Construction Administrator's Review to determine the date of Substantial Completion. Contractor shall have completed the requirements of Substantial Completion a minimum of ten days prior to this request.
 1. Construction Administrator will either proceed with the Review or notify the Contractor of unfulfilled requirements.
 2. When the Construction Administrator proceeds, they will review the Project and submit a punch list of items that are incomplete and/or requiring correction. The punch list will be provided as a PDF electronic file.
 3. Along with the punch list the Construction Administrator shall issue the Certificate of Substantial Completion or indicate to the Contractor what items must be completed on the provided Punch List before it will be issued.
 4. The date that the Certificate of Substantial Completion is issued shall be the start date of the warranty periods specified.

1.6 FINAL COMPLETION PROCEDURES

- A. Before requesting final inspection for determining final completion, complete the following:
 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Submit certified copy of Construction Administrator's punch list, endorsed, and dated by Construction Administrator. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Provide documentation that all items on the Schedule of Maintenance Materials have been provided.

- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Construction Administrator will either proceed with inspection or notify Contractor of unfulfilled requirements. Construction Administrator will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

- C. Re-Inspection Fees:
 - 1. If the Construction Administrator performs re-inspections due to failure of the Work to comply with the Claims of Status of Completion made by the Contractor, or, should the Contractor fail to complete the work, or, should the Contractor fail to promptly correct warranty items or work later found to be deficient:
 - a. Owner will compensate Construction Administrator for such additional services.
 - b. Owner will deduct the amount of such compensation from the final payment to the Contractor.
 - 2. If the Work is not completed by the date set in the agreement, and the Construction Administrator needs to perform additional Contract Administrative and on-site observation duties:
 - a. Owner will compensate Construction Administrator for such additional services.
 - b. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Construction Administrator for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
 - 1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit by email to Construction Administrator.

- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper. Submit final warranties as a package for the entire project, assembled and identified as described below.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.
- G. Warranty Response Time: The Contract shall respond and begin to take necessary action within 7 days of receipt of written notification from the Owner. Response time for life safety items, and for building perimeter security shall be within 24 hours of receipt of written notification from the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - e. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - f. Resilient flooring shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner. No-wax floors shall be cleaned and buffed in accordance with flooring manufacturer's requirements.
 - g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces. Cleaning of windows shall be done just before Owner occupancy.
 - h. Remove labels that are not permanent.
 - i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - m. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - n. Leave Project clean and ready for occupancy.
- C. Construction Waste Recycling and Disposal: Comply with waste disposal requirements in Section 011000 "General Requirements."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Repair procedures for selective demolition operations.
 - 2. Patching and repairs.

1.2 FIELD CONDITIONS

- A. Owner's other Contractor will be working on portions of the building. Conduct selective demolition so other Contractor's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Construction Administrator of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Gypsum Board, Type X: ASTM C1396/C1396M; 5/8-inch thick, tapered.
- B. Joint Treatment Materials: Comply with ASTM C475/C475M.
 - 1. Joint tape: Paper.
 - 2. For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - c. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 - d. Finish Coat: For third coat, use drying-type, all-purpose compound.
- C. Paint:
 - 1. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - a. Benjamin Moore: Ultra Spec 500 Interior Latex Primer, No. N534.
 - b. PPG: Pure Performance Interior Latex Primer, 9-900 Series.
 - c. Sherwin Williams: ProMar 200 Zero VOC Interior Latex Primer B28W02600 Series.
 - 2. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

3. Topcoat: Latex, interior, high performance architectural, Gloss finish to match existing and adjacent surfaces, MPI #141.
 - a. Benjamin Moore: Ultra Spec 500 Interior.
 - b. PPG: 1500-0100 Series, Ultra-Hide Zero Interior Latex Paint.
 - c. Sherwin Williams: ProMar 200 Zero VOC Interior Latex.
 - d. Color: match adjacent existing gypsum board surfaces.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate, and measure the nature and extent of conflict. Promptly submit a written report to Construction Administrator.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Coordinate with other Contractor for shut-off and use of utilities and mechanical/electrical systems.
- B. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.3 PREPARATION

- A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 3. Flooring Protection:
 - a. At existing buildings where existing flooring is to remain, cover flooring with protection board that will prevent damage from construction activities, including moving of equipment and lifts, metal cuttings from steel cutting and threading operations, oils and fluids that could discolor flooring, water, construction worker traffic and activities.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch for a minimum of 1 hour after open flame or cutting activity and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly.

3.5 PATCHING AND REPAIRS

- A. Patch with gypsum wall board at locations where Laboratory Safety Device System has been installed.
 1. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
 2. Treat gypsum board joints, penetrations, fastener heads, and surface defects to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 - a. Prefill open joints and damaged surface areas.
 - b. Apply joint tape over gypsum board joints.
- B. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840, Level 4.
- C. Apply paint according to manufacturer's written instructions and to recommendations in "MPI Manual."
 1. Do not paint over shut-off valves, escutcheons, and fixtures. Protect from accidental paint spills and splatters.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 23 00 00

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the heating, ventilating and air conditioning systems indicated.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 “Common Work Results for HVAC” are hereby made a part of the work of this section.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 “Common Work Results for HVAC”, apply are as follows:
 - 1. Piping materials.
 - 2. Grooved joint couplings and fittings.
 - 3. Fittings for steel pipe.
 - 4. Hangers.
 - 5. Piping, valve and equipment identification.
 - 6. Valves.
 - 7. Hydronic specialties.
 - 8. Fans.
 - 9. Firestopping materials and methods.
 - 10. Packaged energy recovery equipment.
 - 11. Rooftop equipment supports.
 - 12. Grooved joint couplings and fittings.
 - 13. Propylene Glycol.

PART 2 PRODUCTS

2.1 PIPING MATERIALS AND ACCESSORIES

- A. Hot Water Heating Piping (HWS/R): Schedule 40 carbon steel pipe conforming with ASTM A53 or ASTM A106 with grooved or threaded joints and malleable iron fittings (2-1/2” pipe size and under). Mechanical press - connect (Viega MegaPress) may also be used up to 2” with the above mentioned standards. Pipe sizes 3” and over shall be grooved end or butt-welded with flanged connections. All 90 degree elbows shall be long radius type.
- B. Condensate Piping: Type L hard copper tubing and cast bronze or wrought copper solder or Victaulic Permalynx fittings or Schedule 40 PVC (solvent-welded). Mechanical press

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connections are also permitted provided they meet manufacturer's approval for specified application. (Viega ProPress or equivalent)

- C. Watertight Roof Penetrations: Piping penetrations thru the roof shall be made watertight with a curbed opening by Portals Plus or ConnFab.

2.2 FITTINGS FOR STEEL PIPE

- A. Fittings in sizes 1/2" through 2": Steel or malleable iron with requirements as follows:

1. Steel fittings socket welding or screwed type conforming to ANSI B16.11.
2. Malleable iron fittings screwed type conforming to ANSI B16.3.
3. Mechanical Press Fittings shall conform to ASTM A420 or ASME B16.3 and performance criteria of IAPMO PS117 or ICC LC1002.
4. Stainless steel fittings and pipe may be used in lieu of steel pipe with screwed fittings in applicable piping systems. Pipe shall conform with ASTM A312, Type 304/304L, Schedule 5S stainless steel with precision, cold drawn, austenitic stainless steel with elastomer O-ring seals. Victaulic Vic-Press 304™ or Viega ProPress 304 Stainless Steel Fittings w/ Viega Schedule 5 - ASTM A 312 tubing.

- B. Fittings in sizes 2-1/2" and larger:

1. Butt welding type conforming to ANSI B16.9.
2. Flanged type conforming to ANSI B16.5.
3. Grooved end type conforming to ASTM A536 ductile iron; ASTM A234 wrought steel; or factory-fabricated from carbon steel pipe conforming to ASTM A53.
 - a. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.

- C. Steel Flanges: Forged steel, welding type conforming to ANSI B16.5. Bolting and gaskets shall be as follows:

1. Bolting: Material used for bolts and studs shall conform to ASTM A 307, Grade B, and material for nuts shall conform to ASTM A 194, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI B18.2.1 and ANSI B18.2.2 with threads conforming to ANSI B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts.
2. Gaskets: Gaskets shall be of a material that resists attack by the fluid or gas in the pipeline and shall be suitable for the pressure and temperature ranges encountered. Gaskets shall be as thin as the finish of surfaces will permit. Raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Gaskets shall have an inside diameter equal to or larger than the port openings.
3. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 / W741 or Grinnell Style 71.

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- a. For Class 300 connections, Victaulic Style 743 or Grinnell Style 342.
- D. Butt Weld Joints: Shall conform to ANSI B31.1. The use of backing rings shall conform to ANSI B31.1. Ferrous rings shall be of weldable quality and shall not exceed 0.05 percent sulfur. Backing rings shall be of the continuous machined or split band type.
- E. Grooved Joints: Couplings shall consist of two ductile iron housings conforming to ASTM A536, elastomer gasket conforming to ASTM D2000, and zinc-electroplated steel bolts and nuts conforming to ASTM A449 and A183.
 1. Rigid Type: Housings shall provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
 - a. 2" through 8": Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F / 120 deg C. Victaulic Style 107.
 - b. Victaulic Zero-Flex Style 07.
 - c. Grinnell Style 772 rigid coupling with EPDM gasket, 2" and larger.
 2. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Installation-Ready Style 177 and Style 77 or Grinnell Style 707.
 3. 14" through 24": Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket, or Grinnell Style 772 with EPDM gasket.
 - a. Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07 or Grinnell Style 772 with standard groove.
 - b. Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77 or Grinnell Style 707 with standard groove.
- F. Mechanical Press Joints & Fittings - : ½-inch through 2-inch shall conform to IAPMO PS117 or ICC LC1002. Fittings shall have a rust resistance coating such as zinc/nickel and be listed for use with IPS schedule 5 thru schedule 40 carbon steel pipe conforming to ASTM A53, ASTM A106, ASTM A135, or ASTM A795. Fittings shall also have an EPDM sealing element, 420 stainless steel grip ring, 304 stainless steel separator ring, and leak detection feature which identifies un-pressed fittings during testing. Installation must be in accordance to manufacturer's instructions and specifications utilizing manufacturers recommended tooling.
 1. Viega MegaPress or equivalent.

2.3 HANGERS

- A. Adjustable Swivel Hanger: Pipe Sizes 2" and Less: Carpenter and Paterson Fig. 800 conforming to MSS-SP-58, oversize for insulated piping systems. Pipe Sizes Larger Than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 and Fig. 126 CT conforming to MSS-SP-58, provide copper plated clamps on copper pipes.

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- C. Spring Vibration Isolation Pipe Hangers: Mason Industries Model PC30N, or approved equal by Amber-Booth or Vibration Mountings and Controls, combination spring and double deflection bridge-bearing neoprene hangers, 1" static deflection.
- D. In grooved installations, use Victaulic Style 107 and 07 rigid couplings with offsetting angle-pattern bolt pads and AGS Series W07, which permit support and hanging in accordance with ANSI B31.1, B31.3, and B31.9.

2.4 VALVES

- A. Ball Valves: Victaulic PL-300 (push-to-connect) and Series 589/569 (Vic-Press), Apollo 77-100 (threaded) or 77-200 (solder), bronze, brass, or stainless steel body, full or standard port, Fed. Spec. WW-V-35, Type II, Class A (bronze), Style 3, blow-out proof stem, 300 pound W.O.G., screwed connection for steel pipe, Vic-Press connection for stainless steel pipe, sweat or push-to-connect connection for copper tube. Provide stem extension to allow operation without interfering with pipe insulation. Provide Tee handles for valves thru 2" pipe size.
- B. Gate Valves: Nibco Model S-113 or T-113, bronze body Fed. Spec. WW-V-54, wedge disc, rising stem, screwed connection for steel pipe, sweat connection for copper tube, 150-pound class.
- C. Outside Screw and Yoke (OS&Y) Gate Valves: Nibco Model F-617-0, iron body, Fed. Spec. WW-V-58 with bronze trim, 125 pound class.
- D. Check Valves: Victaulic Style 716 / W715, or Grinnell Model 590 grooved end spring actuated type, Nibco Model S-413 or T-413, bronze body Fed. Spec. WW-V-51, regrinding swing check type, 200 pound class.
- E. Butterfly Valves: Victaulic MasterSeal™ and AGS-Vic300, or Grinnell Model B-302, Centerline or Norris, valves shall conform with MSS-SP67, Type I; 300 psig - Tight shut off valve, ends shall be flangeless or grooved, ductile iron body, type 300 series corrosion resistant steel stems and corrosion resistant stainless steel, aluminum-bronze, or coated ductile discs with molded elastomer disc seals / pressure-responsive seats. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.) Valves shall have throttling handles with a minimum of 7 locking positions. Valves shall be suitable for water temperatures up to 250 degrees F for sizes through 12", and 230 degrees F for 14" and larger.

2.5 PIPING, VALVE AND EQUIPMENT IDENTIFICATION

- A. Pipe Identification: Provide plastic "wrap around" identification markers by Seton or Setmark indicating flow direction and fluid flowing for the following:

Hot Water Supply Piping
Hot Water Return Piping

1. Markers shall be placed 30-50 ft. apart for piping in accessible areas.
2. Markers shall be placed outside the pipe insulation and in the most obvious location for viewing. Markers shall not be installed in exposed areas except in the mechanical rooms.

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3. Piping identification shall be color-coded and in accordance with ANSI.

B. Equipment Identification:

1. Provide laminated plastic nameplates for boilers, pumps, and air handling units. Laminated plastic shall be 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.

C. Valve Tags:

1. Attach to each valve a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the valve numbers, each tag shall identify the system it controls. Service stop valves exposed in finished areas need not be tagged.
2. Tags shall be securely attached to stems of valves with copper or brass "S" hooks, or chains.
3. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing its function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung where directed. Two (2) additional unmounted copies shall be delivered to the Architect.
4. Tags and charts shall be coordinated with Section 22 00 00 Plumbing and when completed this work shall have been done sequentially.

2.6 HYDRONIC SPECIALTIES AND EXPANSION LOOPS

- A. Thermometers: Weiss Instruments Model DVU35, solar-operated, Tel-Tru, Terice or Ashcroft, adjustable angle, plastic or Type 304 stainless steel case. The digital display shall include 3/8" high (minimum) LCD digits. The thermometer display shall be in °F. Accuracy shall be +/- 1% of the displayed value or 1°, whichever is greater. Furnish with brass thermowells and provide with heat transfer fluid to fill the sealed interstitial space between bulb and well. Evidence of the transfer fluid leaking shall be cause for refilling and sealing the well.
- B. Pressure Gauges: Tel-Tru, or Ashcroft Type 1005, Grade B, ANSI B40.1, 3-1/2" diameter face installed with shut off petcock and restrictor. Pressure ranges: Gauges at base-mounted pumps shall have a 0-100 psig range with 5 psig graduations; all other gauges shall have a range of 0-60 psig with 5 psi graduations.
- C. Expansion Tanks (Captive Air Type) (ET): Taco Model as scheduled, Bell and Gossett or John Wood, tank shall be of capacity indicated and shall be welded steel, constructed and tested hydrostatically in accordance with Section VIII of the ASME Boiler Pressure Vessel Code. The tank bladder shall be butyl rubber and shall be removable for inspection. Tank shall have air charging and system connections, and shall be factory pressurized to 18 psig.
- D. Strainers: Victaulic Style 732/W732 or Grinnell Style S853 (grooved ends), Watts Model 77S, MIL-S-16293, 300 psig minimum rating wye strainers, ductile iron or bronze body,

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screen shall be stainless steel, monel or bronze with 20 mesh, 1/16-inch, or 1/8-inch perforations, as required. Provide with blowdown ball valve and 3/4" hose connection with brass cap and chain.

- E. Automatic Air Vents: Armstrong No. 1-AV, float type to vent air in hydronic systems. Vent constructed with cast iron body and stainless steel internals and with NPT male inlet and outlet for 1/4 inch overflow for safe water connection. 150 psi working pressure, 250°F maximum temperature. Provide manual ball shut-off valves at all air vents.
- F. Air Separator (AS-*): Caleffi Series NA5465M, "DirtMag", or equal, as scheduled, Magnetic Dirt Separator, epoxy-resin coated steel or brass construction, designed for not less than 150 psig and constructed and tested in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Tank shall have fabricated connections, screwed for sizes 2" and smaller, flanged for sizes 2-1/2 inches and larger. Separators shall be factory prime-painted. Each air separator shall have an internal design suitable for creating the required conditions for optimal air separation and microbubble removal. Provide fittings for connection of automatic air vent and for connection of manual blow-down valve.
- G. Manual Air Vents: Brass body, fiber discs, 125 psi working pressure, 240°F maximum temperature, adjustable for quick venting at system start-up. Provide manual ball shut-off valves at all air vents.
- H. Circulators (inline) (CP): Taco, Wilo, Grundfos, or approved equal, pumps shall be inline cartridge-type or close coupled pump of capacity and performance indicated with cast-iron body and bronze-fitted, 175 psig rated working pressure, 220°F maximum water temperature, carbon Ni-resist mechanical seal, flexible coupling, resilient-mounted drip-proof sleeve bearing motor. The pumps shall be factory tested, cleaned, and painted with machinery enamel. A set of installation instructions shall be included with the pump. Provide premium high efficiency motors. Following the completion of testing and balancing, provide pump impeller trim to match impeller size to the operating conditions.
Motors shall be premium high efficiency type, ECM, open drip-proof or TEFC by Baldor, Magnetek or Toshiba, as scheduled. Motor efficiencies shall comply with the Consortium for Energy Efficiency Standard. Air Separator (AS-*): Caleffi Series NA5465M, "DirtMag", or equal, as scheduled, Magnetic Dirt Separator, epoxy-resin coated steel or brass construction, designed for not less than 150 psig and constructed and tested in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Tank shall have fabricated connections, screwed for sizes 2" and smaller, flanged for sizes 2-1/2 inches and larger. Separators shall be factory prime-painted. Each air separator shall have an internal design suitable for creating the required conditions for optimal air separation and microbubble removal. Provide fittings for connection of automatic air vent and for connection of manual blow-down valve.

2.7 AIR-TO-AIR ENERGY RECOVERY UNIT

- A. Shall be Greenheck, Cook, AEX, Semco, Annexair, Renewaire, or approved equal, with arrangement, capacities and performance as scheduled (**Appendix A**). The heat recovery equipment shall be a factory assembled and tested package, constructed and rated in accordance with ARI, AMCA and UL. System components shall include fan(s), intake and exhaust hoods, air-to-air heat exchangers, airflow measuring stations, electric preheat coil, dampers, filter sections, vapor-tight lights, 120v. NEMA 3R service outlet, hot water heating coil, Variable Frequency Inverter Drives (VFD's), electric preheat defrost system, welded structural steel base, non-fused disconnect switches and double-wall, insulated airtight casing with interior sheetmetal liner. The casing shall have 1" thick (minimum) 3.0 pcf fiberglass thermal insulation.

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- B. The air-to-air heat recovery units shall be a rotating “enthalpy” wheel design or static plate core capable of sensible and latent energy transfer. Rotating wheel exchangers and drives shall include a purge section and a five (5) year replacement warranty for materials and labor. For outside units, the exterior casing shall be constructed of galvanized steel, weathertight, phosphatized and painted with a finish coat of epoxy paint inside and out (Greenheck “Permatector”, or approved equal).
- C. Fans shall be DWDI forward curved or airfoil blade or plenum fan with variable pitch belt drives selected at 1.5 times the maximum rated motor horsepower. Motors shall be mounted on an adjustable slide base. Motors shall be premium high efficiency, inverter-duty rated. Fan bearings shall be regreasable tapered roller pillow block bearings with an L10 life of 100,000 hours. Provide extended lubrication lines for each bearing. Fans shall have seismic rated 2" static deflection spring vibration isolators. All serviceable components shall be readily accessible via hinged (stainless steel) and latched fully gasketed quick release access doors.
- D. Supply prefilters shall be 2" thick, **MERV8** extended surface pleated media disposable type, Cam-Farr, American Air Filter, or approved equal. Exhaust prefilters shall be 2" thick, 30-35%, efficient, **MERV8**, extended surface pleated media disposable type by CamFarr, or approved equal. Furnish a total of three (3) complete sets of filters for each filter bank. Provide Dwyer “Magnehelic” differential air pressure gauges across each filter bank.
- E. Provisions shall be made for bypassing the heat exchanger, reducing the speed of the wheel or otherwise reducing the recovered heat on a call for cooling of the supply airstream (economizer cycle).
- F. Dampers shall be galvanized steel, airfoil blade, Ruskin Model CD60, or approved equal, "ultra low leak" type. Blade seals shall be neoprene and jamb seals shall be compressible aluminum or stainless steel. Motorized backdraft dampers and actuators with end switches shall be provided for the outside air intake and exhaust openings. Intake and exhaust duct connections shall be provided.
- G. Electrical work shall be in accordance with the National Electrical Code (NFPA 70) and shall include variable frequency drives for the wheel, supply and exhaust fans, junction boxes, disconnect switches, duplex weatherproof GFCI receptacles, and vapor-tight marine lights in each compartment. Provide switches with pilot lights. Wiring shall be in galvanized steel or liquidtight conduit. A single point electrical connection shall be provided. Motors shall be premium high efficiency inverter-duty type.
- H. Controls shall include the following: enthalpy controller, wheel rotation sensor, electric preheat frost control, variable frequency drives and Direct Digital controls with LonWorks®, Modbus or BacNet interface (coordinate with equipment furnished by the Controls Contractor), dirty filter sensor for outdoor and exhaust filters.
- I. The heat recovery units shall be started up and their operation verified by an authorized representative of the equipment.
- J. The heat recovery units shall be in compliance with ASHRAE/IESNA Standard 90.1-2010, “Energy Standard for Buildings Except Low-rise Residential Buildings” and all current addenda based on standard rating conditions per ARI Standard 340/36.

2.8 BRAZED PLATE HEAT EXCHANGER

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- A. The brazed plate heat exchanger shall be constructed of marine grade stainless steel with a 150 psi rated working pressure, suitable for service with propylene glycol and water, Taco, Bell and Gossett or equal.
- B. The heat exchanger shall have capacities and performance as scheduled (**Appendix B**).

2.9 PROPYLENE GLYCOL

- A. The system shall be filled with a 40% premix of propylene glycol and distilled water (Dowfrost HD, or equal).

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that the heating system may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 INSTALLATION OF PIPING

- A. In general, piping shall be run concealed above ceilings in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless written authorization is given by the Architect.
- B. Provide and erect in accordance with the best practice of the trade piping shown on the Drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.
- C. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- D. Piping shall be erected so as to provide for the easy and noiseless passage of heating fluid under working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size.
- E. Water mains shall be run level or pitch slightly upward so that no air pockets are formed in the piping. The mains shall be set at elevations such that the runouts feeding equipment shall have no pockets where air can collect except where vents are provided. Provide drains at low points in the piping systems.
- F. High points in water piping shall be provided with manual vents.
- G. In the erection of water piping, make proper allowances for expansion and contraction. Piping shall be anchored as necessary to control expansion. Hot water runouts to units shall

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be the size as indicated on the Drawings and shall come off the main downward or off the side with a minimum of two 90° elbows provided on runout from main.

1. For water systems, use adequate numbers of Victaulic flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer.) Where expansion loops are required, use Victaulic flexible couplings on the loops.
- H. Install stop valves and unions to facilitate isolation and removal of equipment. Provide final connections for hydronic specialties furnished under other sections of the Specifications.
- I. Steel piping shall have screwed, grooved end, welded or mechanical press connections. Threads on piping shall be full length and clean cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used. Pipe threads: standard pipe threads, machine cut and full length. Pipe: reamed to remove burrs and up ended and rapped to dislodge dirt and scale. Joint compound shall be applied to male thread only. If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied. Caulked threads will not be permitted. Mechanical connections ½” – 2” must be made to manufacturer’s specifications and instructions. Installers shall be trained on proper installation by manufacturer.
- J. Steel Piping 2-1/2" and larger shall have welded or grooved end connections.
1. Welded Joints:
 - a. Welding Procedure Specifications: Before any welding is performed, submit copies of welding procedure specification for metals included in the work together with proof of qualification as outlined in ANSI B31.1.
 - b. Performance Qualification Record: Before any welder or operator shall perform any welding, submit 2 copies of the Welder's Performance Qualification Record in conformance with ANSI B31.1 showing that the welder was tested under the approved procedure specification submitted. In addition also submit each welder's assigned number, letter, or symbol which shall be used to identify the work of the welder, affixed to the joint immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be given a requalification test and upon failing to pass the test shall not be permitted to work this contract.
 - c. Previous Qualification: Welding procedures, welders and welding operators previously qualified by test may be accepted for this contract without requalification subject to approval and provided that the conditions specified in ANSI B31.1 are met before a procedure can be used.
 - d. Surface Conditions: Welding shall not be done when the atmospheric temperature is less than 0 degrees F, when the surfaces are wet, when rain or snow is falling or moisture is condensing on the surfaces to be welded, nor during periods of high wind, unless the welder and the work are protected properly. At temperatures between 32 degrees and 0 degrees F, the surfaces for an area within 3 inches of the joint to be welded shall be heated with a torch to a temperature warm to the hand before welding. Surfaces to be welded shall be free from loose scale, slag, rust, paint, oil and foreign material. Joint surfaces

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shall be smooth, uniform, and free from fins, tears and other defects which might affect proper welding. Slag shall be removed from flame cut edges to be welded by grinding, temper colors need not be removed. Each layer of weld metal shall be cleaned thoroughly by wire brushing prior to inspection and deposition of additional weld metal.

- e. Base Metal Preparation: Preparation of pipe ends shall be done by machining and/or grinding, except that oxygen or arc cutting will be permitted on carbon steel pipe only if the cut is reasonably smooth, true and heavy oxide is thoroughly cleaned from the flame cut surfaces by grinding.

The ends of pipe-to-pipe, and pipe-to-fitting, joints shall be aligned accurately within a tolerance of twenty percent of the pipe thickness. Alignment shall be maintained during welding by suitable clamps, jigs, tack welds, or other devices. If tack welds are used to maintain alignment, they shall be kept below the outside surfaces of the pipe and shall not exceed twice the pipe thickness in length or two thirds the pipe thickness in depth, shall be the same quality as the final welds, and shall be fused thoroughly in the final weld. Defective tack welds shall be removed before the final weld is made.

- f. Quality of Welds: The quality of welds shall be in accordance with ANSI B31.1. The surface of the finished welds shall have a bright metallic luster after cleaning, shall be fairly smooth with regular, even ripples, and shall be uniform in contour. Except as necessary to correct defects, the surfaces shall not be dressed, smoothed, or finished for improving their appearance. Welds shall be sound throughout and fused thoroughly, and shall be free from gas pockets, oxides, slag inclusions, and surface porosity, except that very small pores or specs of oxides or slag will be allowed if dispersed widely and if not larger or more numerous than those produced in passing qualification tests. Welds shall be free from overlaps, undercuts and excessive convexity. The inside of the pipe shall be free from blobules of weld metal which would restrict the pipe area or might become loose.

- g. Correction of Defects: Defective or unsound welds shall be corrected by removing and replacing the welds with new welds, or as follows:

- 1) Excessive convexity - chip or grind weld to required size.
- 2) Undercutting, shrinkage cracks, craters, blowholes, and excessive porosity - chip or grind weld to sound weld and base metal and deposit additional weld metal.
- 3) Undersize and excessive concavity - clean weld and deposit additional weld metal.
- 4) Overlapping and lack of fusion - remove weld by chipping or grinding and reweld.
- 5) Slag inclusions - chip or grind weld to remove slag and fill with weld metal.
- 6) Removal of adjacent base metal during welding - chip or grind weld to sound base and weld metal and form full size by depositing additional

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weld metal. Pipe or fittings which cannot be rewelded satisfactorily shall be replaced with new pipe or fittings at the Contractor's expense. Caulking of welds shall not be done. Before adding weld metal or rewelding, the surfaces shall be cleaned thoroughly. The removal of weld metal from a defective weld shall not extend into the base metal beyond the weld penetration. Where incomplete fusion is disclosed by chipping or grinding to correct defects, the part of the weld shall be removed and rewelded. In chipping or grinding welds, the weld or base metal shall not be nicked or undercut.

2. Grooved Joints (Victaulic or Grinnell):
 - a. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
 - b. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
 - c. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.
 - d. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s)).
- K. Connections between copper and steel piping shall be made with brass fittings.
- L. Install Vic-Press 304™ in accordance with Victaulic recommendations. Pipe shall be certified for use with the Vic-Press 304™ system, square cut (+/-0.030"), properly deburred, and cleaned. Pipe ends shall be marked with a gauge supplied by Victaulic. Use a Victaulic 'PFT' series tool with the proper sized jaw for pressing.
- M. Install thermometer wells for temperature gauges and sensors, projecting a minimum of 2" into the pipe with extension to face of insulation. Piping 1½" and smaller shall be enlarged to 2" where wells are installed. Wells shall be installed in active sections of piping. Fill wells with heat transfer fluid.
- M. Viega, ProPress copper, bronze and stainless steel fittings ½" – 4": Sealing element shall be verified for the intended use. Tube ends shall be cut on a right angle (square) to the tube. Tube ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the tube end with a clean rag. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting. Utilizing a Viega Insertion Depth Inspection Gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the tube fully into the fitting and mark the tube wall at the face of the fitting. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint. Installation must be in accordance to the most current edition of the manufacturers installation guidelines

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- O. Solder joints shall be made with non-lead solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Hot wipe solder at each fitting.
- P. PVC and CPVC piping shall have solvent welded joints except at connections to equipment and valves which shall be screwed for sizes 2" and smaller and flanged for sizes 2-1/2" and larger. Solvent welded joints: Pipe ends deburred, and beveled. Pipe end and fitting: Cleaned and dried, primed to soften bonding surfaces. Pipe end: Apply even full layer of solvent cement after priming. Before cement starts to set, insert pipe end into fitting and turn 1/4 turn to evenly distribute cement. Hold joint together until cement sets-up, wipe excess cement off joint.
- Q. Pipe penetrations through walls, floors and ceilings shall have pipe sleeves of the same material as the pipe and in accordance with Section 23 05 00 "Common Work Results for HVAC" and the IBC. Pipe sleeves shall be suitable for firestopping in accordance with the firestopping manufacturers recommendations. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Pipe sleeves thru floors above grade shall be watertight, Link Seal Model "L" modular seal by Thunderline, with Century-Line pipe sleeve.
- R. Automatic Air Vents: Shall be installed with a manual isolation ball valve. The vent discharge shall be piped to a local floor drain.

3.3 PIPE HANGERS

- A. Impact driven studs are not acceptable.
- B. Pipes (copper or steel) shall be supported at intervals and rod sizes as follows, double nuts on hangers and on beam clips. PVC and CPVC shall have hanger spacing reduced by 50%.

Pipe Size	Hanger Spacing	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	7'	3/8"
1-1/4"	8'	3/8"
1-1/2"	9'	3/8"
2"	10'	3/8"
2-1/2"	10'	1/2"
3"-6"	8'	1/2"

- C. Verticals: Supported at the base and at intervals as follows by use of clamp hangers:

Steel Pipe: Not more than 16 ft.

Copper Pipe and Tubing:

1-1/2" and larger - Not more than 12 ft.

1-1/4" and smaller - Not more than 6 ft.

- D. Provide welded insulated steel saddles at each hanger on steel piping systems 4" and larger.
- E. PVC and CPVC Piping: Supported at 5' maximum intervals.

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- F. In grooved installations, use Victaulic Style 107 and 07 rigid couplings with offsetting angle-pattern bolt pads and AGS Series W07, or Grinnell, which permit support and hanging in accordance with ANSI B31.1, B31.3, and B31.9.

3.4 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

3.5 TEST AND ADJUST

- A. Piping Systems: Test with water to a pressure of 75 psi and hold for a period of two hours. Repair any leaks and retest the piping system; repeat process until systems are leak-free. Test piping before it is insulated.
- B. Before operating any system, flush the piping to remove oil and foreign materials.
- C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- D. Demonstrate that the HVAC systems have free and noiseless circulation of water, that all air has been purged and that systems are watertight.
- E. Correct defects which develop in operational testing, conduct additional testing until defect free operation is achieved.

3.6 CLEANUP AND CORROSION PREVENTION

- A. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

3.7 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not be less than eight (8) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.8 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by

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mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

APPENDIX A
ENERGY RECOVERY VENTILATOR

ERCH-55-15H-HW-01

Unit Performance

Design Conditions						
Elevation (ft)	Summer		Winter DB (F)	Supply (CFM)	Outdoor Air (CFM)	Exhaust Air (CFM)
	DB (F)	WB (F)				
62	86.8	73.9	-5.0	6,000	6,000	5,500

Unit Specifications					
Qty	Weight (lb)	Cooling Type	Heating Type	Unit Installation	Unit ETL Listing
1	2,446 (+/- 5%)	None	Hot Water Coil	Outdoor	ULcUL 1995

Configuration			
Outdoor Air		Exhaust Air	
Intake	Discharge	Intake	Discharge
End	End	End	Side

Energy Recovery Performance									
Design Condition	Temperature (F)								Capacity Reduction (BTU/h)
	Outdoor Air		Supply Air		Return Air		Exhaust Air		
	DB	WB	DB	WB	DB	WB/RH	DB	WB	
Summer	86.8	73.9	78.9	67.3	75.0	62.5/50	83.4	70.4	155,520.0
Winter	-5.0	-6.2	42.6	36.3	70.0	54.3/35	17.2	17.1	308,448.0

Heating Specifications									
Type	Fluid Type		Flow Rate (GPM)	Fluid PD (ft wg)	Capacity (MBH)	Fluid Conditions		Performance	
	Type	%				EWT (F)	LWT (F)	EAT (F)	LAT (F)
Hot Water	Propylene	40	25	3.1	348.5	180.0	150.0	43.0	96.3

Air Performance							
Type	Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	FRPM	Fan		
					Qty	Type	Drive-Type
Supply	6,000	0.5	1.477	1185	1	Forward Curve	Belt
Exhaust	5,500	0.5	0.787	995	1	Forward Curve	Belt

Motor Specifications						
Motor	Qty	Operating Power (hp)	Size (hp)	Enclosure	Efficiency	RPM
Supply	1	5.51	7-1/2	ODP	PE	1725
Exhaust	1	4.12	5	ODP	PE	1725

Electrical Specifications				
Power Supply	Rating (V/C/P)	MCA (A)	MOP (A)	Fan Power (W/CFM)*
Unit	208/60/3	96.7	100.0	1.197

*Fan Power (W/CFM) = (Supply BHP + Exhaust BHP) / Supply CFM

Construction Features And Accessories

Unit		Accessories	
Unit Installation - Outdoor	Std	Frost Control - 12.3 kW Electric Preheater	X
Energy Recovery Device - Polymer Wheel w/ Silica Gel Desiccant	Std	Roof Curb - GKD - 70.82/93.14-G12	X
Unit Construction - Double Wall	Std	Outdoor Air Filters - 2" MERV 8, 6-16x20	Std
Insulation - 1 inch 1# R4.2 fiberglass	Std	Exhaust Air Filters - 2" MERV 8, 6-16x20	Std
Corrosion Resistant Fasteners	Std	Outdoor Air Damper - Insulated Low Leakage	X
Hinged Access	Std	Return Air Damper - Insulated Low Leakage	X
Factory Wired Non-Fused Disconnect Switch	Std	Fan Isolation - Neoprene	X
Belt Drive Supply and Exhaust Blower	Std	Service Outlet	X
Unit Finish - Permatector, Concrete Gray (RAL 7023)	X	Unoccupied Recirc Damper	
Short Circuit Current - 5 kA	Std	Piping Vestibule	X
Controls		Vapor Tight Lights	
Unit Controls - Microprocessor	X	Condensate Overflow Switch	
Internally Mounted Control Center with motor starters, 24 VAC control transformer(s) and control circuiting fusing	Std	Spare Filters - Both, Qty: 2 set(s)	X
Network Protocol - BACNetIP	X	Spare Energy Wheel Belt	
BMS Monitoring Points		Spare Energy Wheel Segments	X
Supply Fan Control - CO2 Sensor - Room/Space Mounted	X	Spare Fan Belts	
Exhaust Fan Control - Supply Tracking	X	ElectroFin Coil Coating	
Energy Wheel Economizer Control - Modulating Wheel, OA Temp Setpoint w/VFD Wheel	X	Warranty Options	
Factory Mounted Sensors		Unit Warranty - 1 Yr (Standard)	Std
Exhaust Fan Only Power		Energy Wheel Warranty - 5 Yrs Less Motor	Std
Rotation Sensor	X		
Control Accessories			
Remote Display			
Dirty Filter Sensor(s)			
Airflow Monitor - Outdoor Air	X		
Room Thermostat - Temperature	X		
Room Sensing			

Standard Option	Std
Not Included	
Included	X

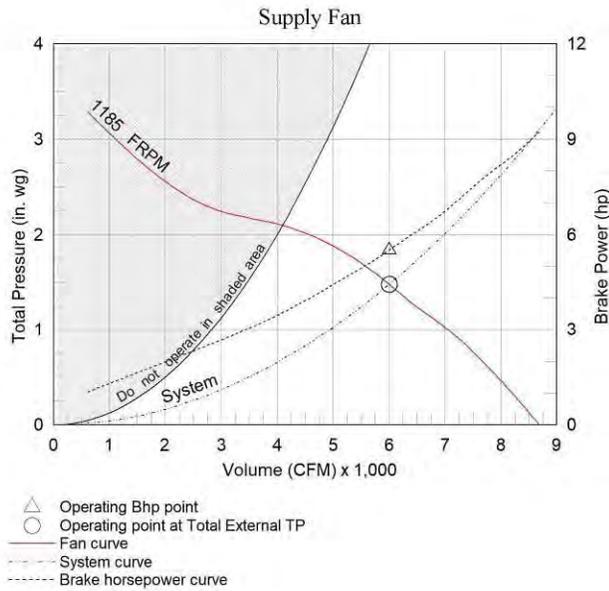
Notes	
Outdoor Air Damper supplied is insulated, low leakage, motorized VCD-34 (leakage rate of 3 CFM / ft ² @ 1 in. wg), Class1A	
Return Air Damper supplied is insulated, low leakage, motorized VCD-34 (leakage rate of 3 CFM / ft ² @ 1 in. wg), Class1A	

Supply Fan Charts And Performance

Supply Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
6,000	0.5	1.477	1185	5.51	1	7-1/2	1	Forward Curve	Belt

Pressure Drop (in. wg)						
Weatherhood	Filter	Damper	Cooling	Heating	External	Total
0.376	0.314	0.011	-	0.276	0.5	1.477

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
97.6	92.6	87.4	85.6	84.8	84.1	82.3	76.9	90.8	79.3	33.9

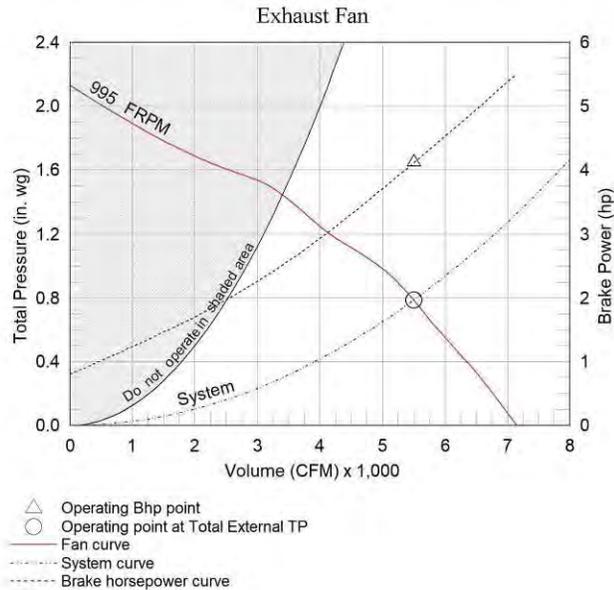


Exhaust Fan Charts And Performance

Exhaust Fan Performance									
Total Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Operating Power (hp)	Motor		Fan		
					Qty	Size (hp)	Qty	Type	Drive-Type
5,500	0.5	0.787	995	4.12	1	5	1	Forward Curve	Belt

Pressure Drop (in. wg)						
Weatherhood	Filter	Damper	Cooling	Heating	External	Total
-	0.26	0.024	-	-	0.5	0.787

Sound Performance in Accordance with AMCA										
Sound Power by Octave Band								Lwa	dBA	Sones
62.5	125	250	500	1000	2000	4000	8000			
79.3	77.5	71.7	70.2	71.5	71.5	67.8	60.2	77	65.5	14



Heating Performance

Heating Specifications									
Type	Fluid Type		Flow Rate (GPM)	Fluid PD (ft wg)	Capacity (MBH)	Fluid Conditions		Performance	
	Type	%				EWT (F)	LWT (F)	EAT (F)	LAT (F)
Hot Water	Propylene	40	25	3.1	348.5	180.0	150.0	43.0	96.3

Coil Information						
HW Coil Model	Fins Per Inch	Rows Deep	Face Velocity (ft/min)	Coil Pressure Drop (in. wg)	Connection Size (in.)	
HW58S02Q10-57x26-RH	10	2	583	0.276	2.5	

Unit Details
Copper tube, aluminum fin coil construction
Coil control valves must be field provided by others
Coil freeze protection is to be provided by others

Energy Recovery Summer Performance

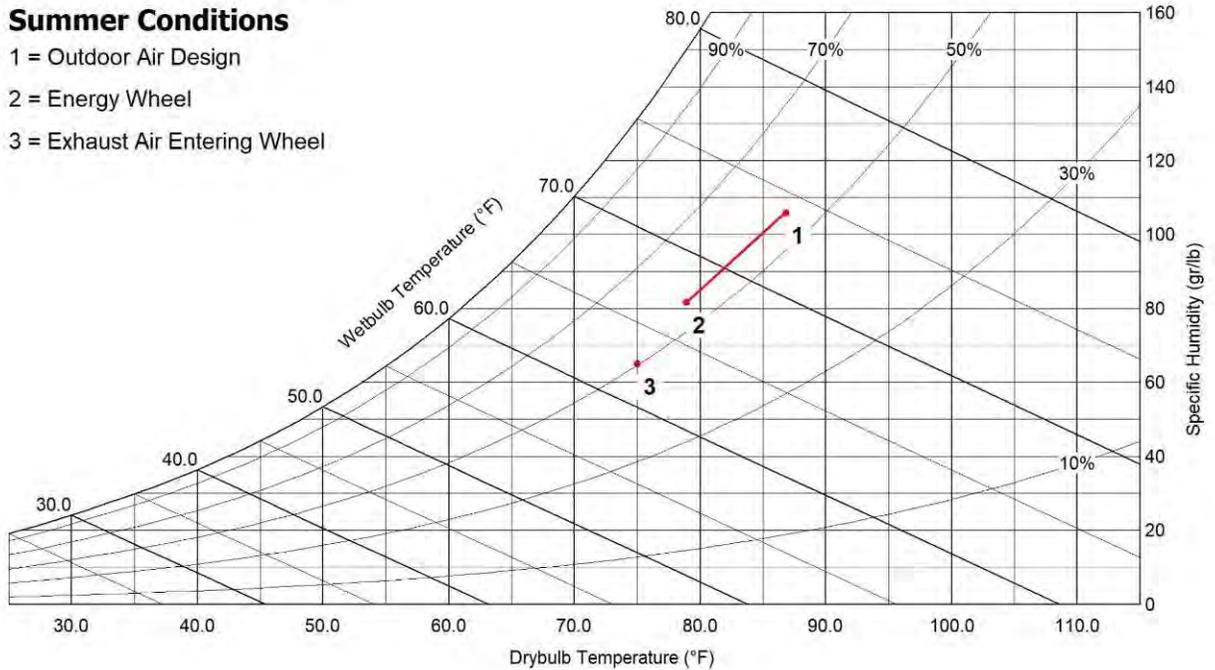
Outdoor Air		Supply Air	
Dry Bulb (F)	86.8	Dry Bulb (F)	78.9
Wet Bulb (F)	73.9	Wet Bulb (F)	67.3
Specific Humidity (gr/lb)	106	Specific Humidity (gr/lb)	82
Enthalpy (BTU/lb)	37.5	Enthalpy (BTU/lb)	31.7
Exhaust Air		Return Air	
Dry Bulb (F)	83.4	Dry Bulb (F)	75.0
Wet Bulb (F)	70.4	Rel. Humidity (%)	50
Specific Humidity (gr/lb)	90	Specific Humidity (gr/lb)	65
Enthalpy (BTU/lb)	34.2	Enthalpy (BTU/lb)	28.2

Design Air Flow Conditions			
OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
6,000	61.6	5,500	64.9

Outdoor Air Cooling Reduction				Equipment Reduction (tons)
OA Load w/o Energy Recovery		OA Load with Energy Recovery		
(BTU/h)	(tons)	(BTU/h)	(tons)	
251,100.0	20.93	95,580.0	7.97	12.96

Summer Conditions

- 1 = Outdoor Air Design
- 2 = Energy Wheel
- 3 = Exhaust Air Entering Wheel



Energy Recovery Winter Performance w/Preheater

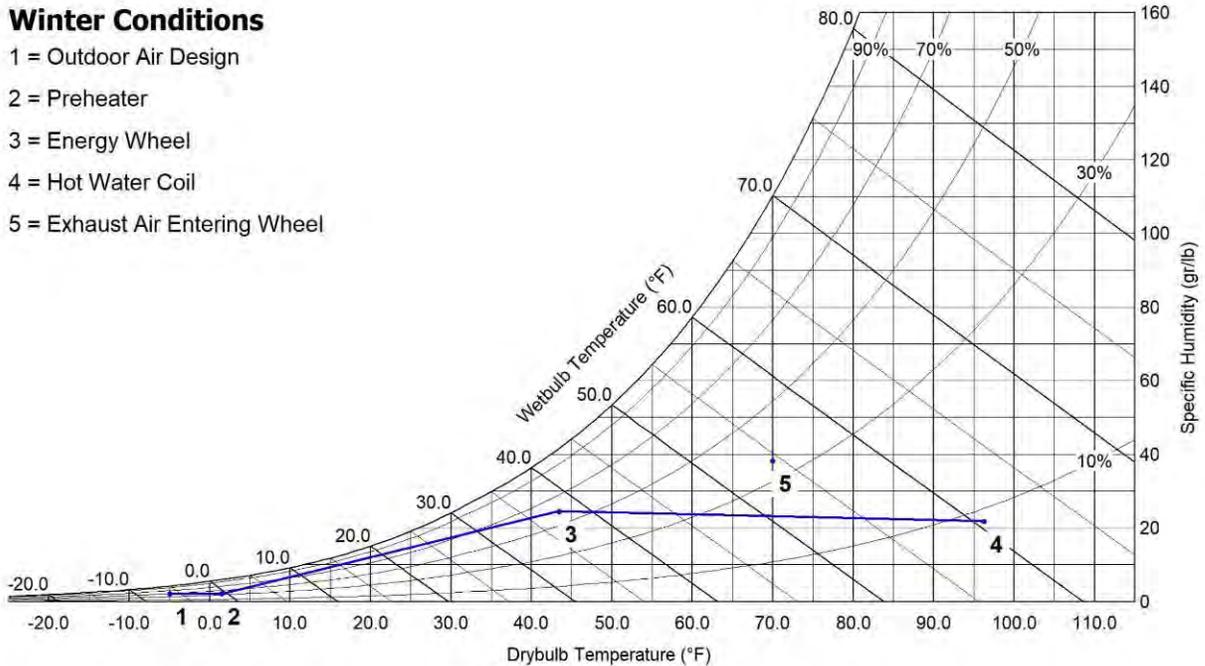
Entering Air		Leaving Air	
Dry Bulb (F)	1.5	Dry Bulb (F)	43.4
Wet Bulb (F)	-0.6	Wet Bulb (F)	???
Specific Humidity (gr/lb)	2	Specific Humidity (gr/lb)	25
Enthalpy (BTU/lb)	0.7	Enthalpy (BTU/lb)	14.2
Leaving Air		Entering Air	
Dry Bulb (F)	22.4	Dry Bulb (F)	70.0
Wet Bulb (F)	20.9	Rel. Humidity (%)	35
Specific Humidity (gr/lb)	13	Specific Humidity (gr/lb)	38
Enthalpy (BTU/lb)	7	Enthalpy (BTU/lb)	22.8

Design Air Flow Conditions			
OA Volume (CFM)	ASHRAE 90.1 OA Enthalpy Recovery Ratio	EA Volume (CFM)	EA Wheel Effectiveness
6,000	61.2	5,500	69.4

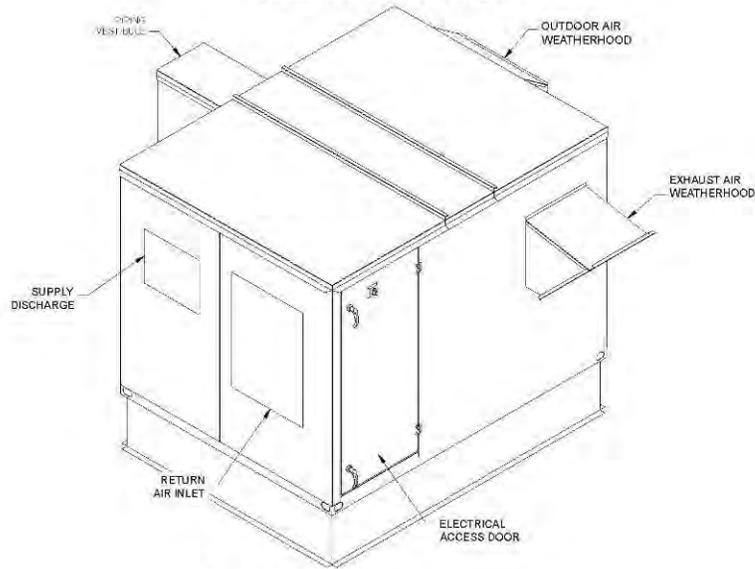
Outdoor Air Heating Reduction			
OA Load w/o Energy Recovery (BTU/h)	OA Load with Energy Recovery (BTU/h)	Equipment Reduction (BTU/h)	Sensible Effectiveness (%)
486,000.0	177,552.0	308,448.0	72.3

Winter Conditions

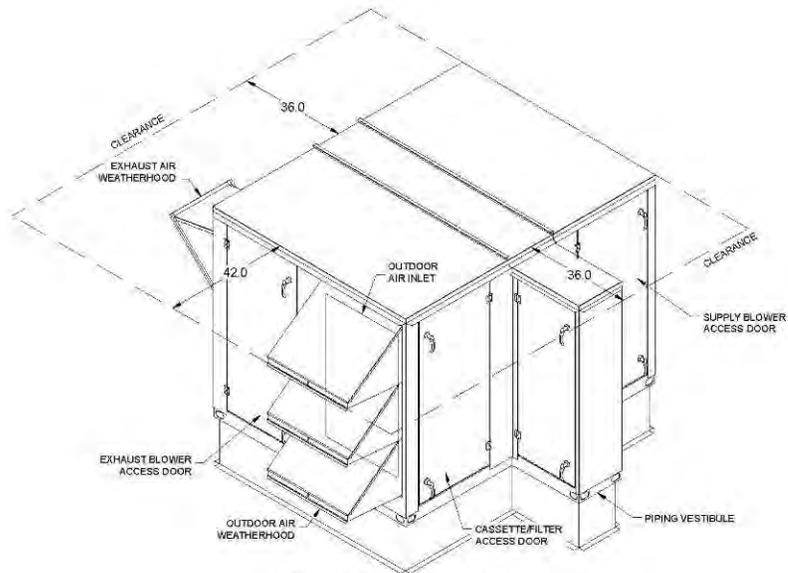
- 1 = Outdoor Air Design
- 2 = Preheater
- 3 = Energy Wheel
- 4 = Hot Water Coil
- 5 = Exhaust Air Entering Wheel



Isometric Drawings

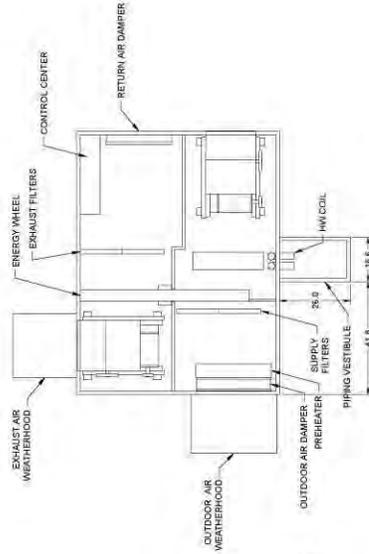


Back Right Isometric

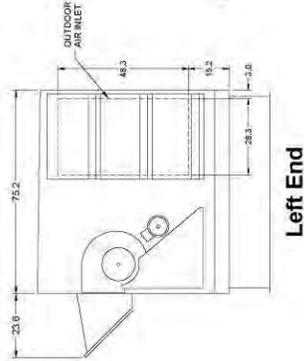


Front Left Isometric

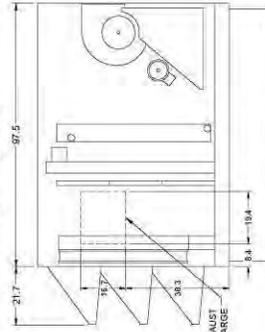
Overview Drawings
Plan



*Reference unit (RM) for the correct dust bin size. Dust bin size larger than shown will work.

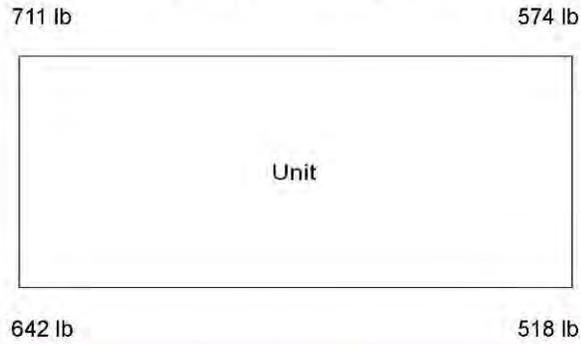


Left End



Right End

Unit Corner Weights



Note

Estimated corner weights are shown looking down on unit and the outside air intake will be on the left. Weights are applied at the base of the unit. Images not drawn to scale.

Greenheck Network Interface v2.6 Modbus/BACnet Points List

Type	BACnet Device Instance: 77000 (default) Analog = AV, Integer = AV, Digital = BV			Modbus-RTU/TCP/IP Network Address: 1	Read (R) Write (W)	Description	Included	
	Instance	Name	Units	Register				
Analog	1	Outside_Air_Temp	degree F	40002	R/W	Outdoor Air Temp (### # F)	X	
Analog	2	Supply_Air_Temp	degree F	40003	R	Supply Air Temp (### # F)	X	
Analog	3	Cold_Coil_Leaving_Temp	degree F	40004	R	Cold Coil Temp (### # F)		
Analog	4	Room_Air_Temp	degree F	40005	R/W	Room AirTemp (if installed) (### # F)		
Analog	5	Outside_Humidity	percent	40008	R/W	Outdoor Relative Humidity (### #%)		
Analog	6	Room_Humidity	percent	40007	R/W	Room Relative Humidity (### #%)		
Analog	11	Temp_Set_Point	degree F	40012	R/W	Temperature SetPt (read/write) (### # F) (See Controller IOM)	X	
Analog	12	Active_Temp_Set_Point	degree F	40013	R	Active Temperature Set Point (### # F)	X	
Analog	13	Dehumid_Set_Point	percent	40014	R/W	Dehumidification SetPt (read/write) (## # F, ## #%) (See Controller IOM)		
Integer	1001	Unit_Status_Index	no-units	45003	R	Note 1 (See below)	X	
Integer	1002	Heating_Control_Loop	percent	45004	R	Heater output (0-100%)	X	
Integer	1003	Cooling_Control_Loop	percent	45005	R	Coolingr output (0-100%)		
Integer	1004	Energy_Wheel_Speed	percent	45006	R	Energy recovery wheel speed (0-100%)	X	
Integer	1005	Reheat_Control_Loop	percent	45007	R	Hot gas reheat output (0-100%)		
Integer	1006	CO2_Level	ppm	45008	R	CO2 Levels (ppm)	X	
Integer	1007	CO2_Set_Point	ppm	45009	R/W	CO2 Set Point (ppm)	X	
Integer	1008	Supply_VFD_Speed	percent	45010	R	Supply Fan VFD Speed (0-100%)	X	
Integer	1009	Supply_VFD_SetPt	percent	45011	R/W	Supply Fan VFD Set Point (0-100%)		
Integer	1010	Exhaust_VFD_Speed	percent	45012	R	Exhaust Fan VFD Speed (0-100%)	X	
Integer	1011	Exhaust_VFD_SetPt	percent	45013	R/W	Exhaust Fan VFD Set Point (0-100%)		
Integer	1012	OA_Damper_Position	percent	45014	R	Outdoor Damper Position (0-100%)		
Integer	1013	OA_Damper_SetPt	percent	45015	R/W	Minimum OA Damper Position (0-100%)		
Integer	1014	Duct_Pressure	no-units	45016	R	Supply Duct Pressure (# ##"WC)		
Integer	1015	Duct_Pressure_SetPt	no-units	45017	R/W	Supply Duct Pressure Set Point (value/100=# ##"WC)		
Integer	1016	Building_Pressure	no-units	45018	R	Building Pressure (value/1000 = 0.##"WC)		
Integer	1017	Building_Pressure_SetPt	no-units	45019	R/W	Building Pressure Set Point (value/1000 = 0.##"WC)		
Integer	1018	Occupied_Unoccupied	no-units	45020	R/W	Occupied/unoccupied command (0=occupied, 1=unoccupied, 2=MWU)	X	
Integer	1019	IG_Alarm	no-units	45021	R	IG Alarm - For alarm detail		
Integer	1021	Airflow_CFM1	cfm	45023	R	Airflow 1 (cfm)	X	
Integer	1022	Airflow_CFM2	cfm	45024	R	Airflow 2 (cfm)		
			Inactive_Text	Active_Text				
Digital	1	On_Off_Stat	Off	On	10002	R	Unit ON/OFF Status	X
Digital	2	Supply_Fan_Status	Off	On	10003	R	Supply fan status	X
Digital	3	Exhaust_Fan_Status	Off	On	10004	R	Exhaust fan status	X
Digital	4	Occupancy_Status	Unoccupied	Occupied	10005	R	Occupancy Status (0=Unoccupied 1=Occupied)	X
Digital	5	Stage_Compressor1_Status	Off	On	10006	R	Stage Compressor #1 status	
Digital	6	Stage_Compressor2_Status	Off	On	10007	R	Stage Compressor #2 status	
Digital	7	Defrost_Mode	Off	On	10008	R	Defrost mode status	X
Digital	8	Digital_Scroll_Status	Off	On	10009	R	Digital Scroll status	
Digital	10	Unit_Start_Stop	Stop	Start	10011	R/W	Unit start/stop command	X
Digital	11	Reset_Alarm	Don't Reset	Reset Alarms	10012	R/W	Reset alarms command	X
Digital	13	Stage_Compressor3_Status	Off	On	10014	R	Stage Compressor #3 status	
Digital	14	Stage_Compressor4_Status	Off	On	10015	R	Stage Compressor #4 status	
Digital	20	Global_Alarm	Off	Alarm	10021	R	Global alarm indication (active when there is at least one alarm)	X
Digital	21	Supply_air_proving	Off	Alarm	10022	R	Supply airflow proving alarm	X
Digital	22	High_Wheel_Pressure	Off	Alarm	10023	R	High wheel pressure (high airflow or dirty wheel)	X
Digital	23	Wheel_Rotation	Off	Alarm	10024	R	Wheel rotation alarm	X
Digital	24	Exhaust_air_proving	Off	Alarm	10025	R	Exhaust airflow proving alarm	X
Digital	25	Dirty_filter	Off	Alarm	10026	R	Dirty filter alarm	
Digital	26	Compressor_trip	Off	Alarm	10027	R	Compressor trip alarm	
Digital	27	Supply_air_low_limit	Off	Alarm	10028	R	Supply air temperature low limit alarm	X
Digital	28	Sensor1_out_of_range	Off	Alarm	10029	R	Sensor#1 out of range (outside air temperature)	X
Digital	29	Sensor2_out_of_range	Off	Alarm	10030	R	Sensor#2 out of range (supply air temperature)	X
Digital	30	Sensor3_out_of_range	Off	Alarm	10031	R	Sensor#3 out of range (cold coil leaving air temperature)	
Digital	31	Sensor4_out_of_range	Off	Alarm	10032	R	Sensor#4 out of range (room temperature)	
Digital	32	Sensor5_out_of_range	Off	Alarm	10033	R	Sensor#5 out of range (room humidity)	
Digital	33	Sensor6_out_of_range	Off	Alarm	10034	R	Sensor#6 out of range (outdoor humidity)	
Digital	34	Sensor7_out_of_range	Off	Alarm	10035	R	Sensor#7 out of range (building pressure sensor)	
Digital	35	Sensor8_out_of_range	Off	Alarm	10036	R	Sensor#8 out of range (duct pressure sensor)	
Digital	36	Sensor#9_out_of_range	Off	Alarm	10037	R	Sensor#9 out of range (CO2 sensor)	X
Digital	37	Sensor10_out_of_range	Off	Alarm	10038	R	Sensor#10 out of range (auxiliary temp)	

Note: Unit status index: 0=system off; 1=initial delay; 2=opening dampers; 3=exhaust fan starting; 4=supply fan starting; 5=system on; 6=defrost mode active; 7=sys on-economizer; 8=sys on-heating; 9=sys on-cooling; 10=sys on-econ & cooling; 11=sys on-dehumidifying; 12=sys on-dehumidifying & reheat; 13=unocc-unit off; 14=unocc-unit on; 15=unocc-heating; 16=unocc-cooling; 17=unocc-dehumid; 18=unocc-dehumid & reheat; 19=Manual override; 20=remote off; 21=Alarm

Microprocessor Controller Sequence of Operation

MICROPROCESSOR CONTROLLER: Controller shall be provided with required sensors and programming for rooftop unit. Controller shall be factory programmed, mounted and tested. Controller shall have a LCD readout for changing set points and monitoring unit operation.

UNIT START COMMAND (Unit will be enabled to start once a jumper is placed between R to G):

- Factory mounted and wired outdoor air damper actuator is powered
- Exhaust fan starts after a (adj.) delay.
- Supply fan starts after a (adj.) delay.
- Tempering options and energy wheel option to function as described below.

UNIT STOP COMMAND (OR DE-ENERGIZED):

- Supply fan, exhaust fan, energy wheel and tempering options de-energized.
- Outdoor air damper actuator is spring return close.

OCCUPIED/UNOCCUPIED MODES: Shall be based on a 7-day time clock internal to the controller. The schedule shall be set by the end user. When a user initiates an override input, the controller will switch from unoccupied to occupied mode. The controller will return to the scheduled occupied/unoccupied mode after the override time has expired. If internal time clock is disabled, a remote contact or a BMS can control the occupied/unoccupied mode.

Occupied Mode:

- Damper control per below.
- Supply fan ON.
- Heating per below.

Unoccupied Mode (Unit Off): Unit remains off when in unoccupied mode.

- Supply fan OFF
- Exhaust fan OFF
- Tempering OFF
- Outdoor air damper closed
- Return damper closed

MORNING WARMUP: Prior to occupancy, the controller will reference the temperature differential between the current room temperature and the occupied temperature set point. The controller will then look at the amount of time required from the previous days morning warm up sequence and determine how far in advance the unit has to be started to meet the desired occupied set point by the time of occupancy.

SUPPLY BLOWER SEQUENCE: The supply blower is provided with a factory mounted variable frequency drive. The supply blower speed will be controlled with the following sequence.

CO2 Sensor: The supply blower speed is modulated based upon the signal from a CO2 Sensor (factory provided, field mounted and wired). The controller will modulate the supply fan based upon a comparison of the CO2 set point (adj.) to the actual CO2 levels reported from the sensor. **(Mechanical high static protection cutoffs must be installed by others to protect the system and equipment from over-pressurization. The manufacturer does not assume responsibility for this.)**

BMS Control: The supply blower is modulated based upon a command from the Building Management System. (This Sequence must be field configured.)

EXHAUST BLOWER SEQUENCE: The exhaust blower is provided with a factory mounted variable frequency drive. The exhaust blower speed will be controlled with the following sequence.

Supply Tracking: The exhaust fan will modulate to track the speed of the supply fan.

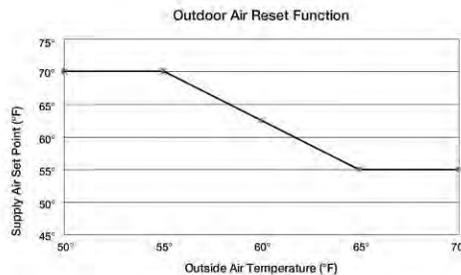
BMS Control: The exhaust blower is modulated based upon a command from the Building Management System. (This sequence must be field configured.)

HEATING SEQUENCE: The heating is controlled to maintain the supply temperature set point. The heating will be locked out when the outside air is > 80 F (adj.).

Hot Water Coil: The controller will modulate a hot water valve (field provided) to maintain the supply temperature set point (adj.). **Coil Freeze protection must be provided by others in the field!**

SUPPLY SET POINT RESET FUNCTION: The controller will modulate the heating and cooling to maintain an active set point.

Outside (OA) Reset: The controller will monitor the outdoor air temperature and adjusts the desired supply temperature set point accordingly. For example, when the outdoor air is below 55 F, the controller will change the supply temperature set point to 70 F. If the outdoor air is above 65 F, the controller will change the supply set point to 55 F. If the outdoor air temperature is between 55 F and 65 F, the supply set point changes according to the outdoor air reset function. A visual representation of this is shown below.



Room Reset: The controller will reset the supply air temperature set point to maintain the room temperature set point (adj.).

Local (Supply Temp Control): The supply set point will be a constant temperature set from the controller (adj.).

BMS Control: The controller will adjust the desired supply temp set point to satisfy the desired BMS set point.

BUILDING FREEZE PROTECTION: If the supply air temperature drops below 35 F (adj.) for 300s (adj.), the controller will de-energize the unit and activate the alarm output.

FROST CONTROL: Frost control for the energy wheel is enabled when frost is present on the wheel; based on the outside air temperature and the pressure drop across the wheel. If the outdoor air temperature is below 5 F adj. and the differential pressure across the wheel is about 1.5", adj. frost control will enable.

Preheat: When frosting is occurring, the preheater is energized to defrost the wheel. Once either the pressure drop decreases below the pressure switch set point, or the outdoor air temperature increases above the temperature set point the unit will resume normal operation.

ECONOMIZER SEQUENCE: When the application requires cooling, and the outdoor air conditions are suitable for free cooling, the controller will modulate the energy wheel speed to maintain the discharge temperature set point. If the energy wheel modulates to the economizer set point and the discharge temperature is not met, the controller will increase the call for cooling to meet the discharge temperature and could engage mechanical cooling.

Temperature: The economizer will be locked out when: the outside air is < 40 F DB (adj.) or > 65 F DB (adj.); the unit is operating in dehumidification mode; or there is a call for heating.

ALARMS INDICATION: The controller will display alarms and have one digital output for remote indication of an alarm condition. Possible alarms include:

Building Management System: The controller will send all alarms to the BMS.

Dirty Wheel Alarm: The controller monitors pressure across the wheel and sends an alarm in the case of an increased pressure drop.

Wheel Rotation Alarm: The controller monitors wheel rotation, if the wheel does not rotate for a set period of time (adj.) an alarm will generate.

Supply and Exhaust Air Alarm: The controller monitors the proving switch on each blower and sends an alarm in the case of either blower proving switch not engaging.

Temperature Sensor Alarm: The controller sends an alarm in the case of a failed air temperature sensor.

ACCESSORIES: The following accessories will be included with the unit to expand the functionality or usability of the controller.

BMS Interfacing: A BMS port or serial card is provided with the controller for field interfacing with a building management system. Each card is sent out with the default parameters, and the controls contractor must change the appropriate addresses to match the BMS settings.

Airflow Monitoring: The outdoor airflow monitoring device is installed as a stand alone option in the control center. It includes a heated thermistor that is used to measure feet per minute in the housing. This feet per minute is converted to CFM in the factory supplied airflow readout device. This device is not connected to the controller.

Damper End Switch: Damper end switched will be provided to ensure the supply and exhaust fans do not enable until the dampers are proven open.



Printed Date: 06/06/2021
Job: 4690 Coffin Gym ERV
Mark: ERV1
Model: ERCH-55-15H-HW-01

Warranty Statement for Dedicated Outdoor Air Systems (DOAS)

Unit Warranty

Greenheck warrants the equipment to be free from defects in material and workmanship for a period of 1 year (standard) from the shipment date.

Energy Wheel Warranty

The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of 5 years from the shipment date.

Warranty Notes

Any component which proves defective during the warranty period will be repaired or replaced at Greenheck's sole option when returned to our factory, transportation prepaid. All warranties do not include labor costs associated with troubleshooting, removal, or installation. Greenheck will not be liable for any consequential, punitive, or incidental damages resulting from use, repair, or operation of any Greenheck product. These warranties are exclusive and are in lieu of all other warranties, whether written, oral, or implied, including the warranty of merchantability and the warranty of fitness for a particular purpose. No person (including any agent or salesperson) has authority to expand Seller's obligation beyond the terms of this warranty, or to state that the performance of the product is other than that published by Seller.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

GKD Roof Curb

Model: GKD-70.82/93.14-G12

Curb Height (in.)	Curb Length (in.)	Curb Width (in.)	Material	Finish Type	Duct Adapter	Curb Weight (lb)
12	93.14	70.82	Galvanized	Galvanized	Yes	207

Standard Construction Features:

All dimensions shown are actual and in units of in.'s

If unit is selected with side or end discharge/return, there will not be bottom connections supplied with the curb.

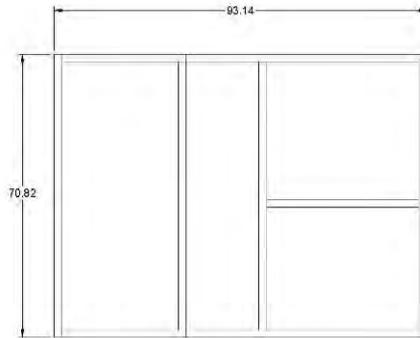
14 gauge galvanized steel (perimeter channels).

14 gauge galvanized steel (interior channels).

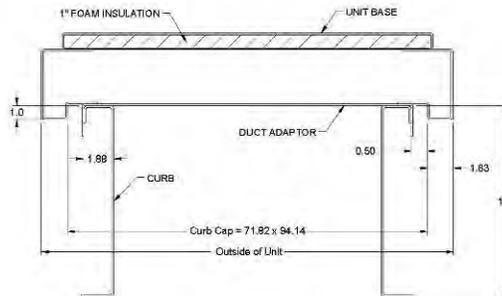
Ships knocked down for field assembly.

Curb insulation to be provided by others.

**Top View
of Curb**



**Cross-Section
View of Unit
on Curb**



APPENDIX B

HEAT EXCHANGER



Taco, Inc.
 1160 Cranston Street
 Cranston, RI 02920 USA
 (401) 942-8000 FAX: (401) 942-2360

Selection: 32
Customer: Coffin Elementary School
Contact:

Date: 06/10/2021
Version: Taco 2002
User: USER

Liquid To Liquid

Design Conditions	Side A (HOT)	Side B (COLD)
Fluid Type:	Water	Propylene Glycol 40.0 % conc.
Mass Flow Rate	196.3 lbs/min	214.6 lbs/min
Entering Fluid Temp	190.0 °F	150.0 °F
Leaving Fluid Temp	160.0 °F	180.0 °F
Flow Rate	24.2 GPM	25.8 GPM
Fouling Factor	0.0001 °F-SqFt-H/BTU	0.0001 °F-SqFt-H/BTU
Pressure Drop	2.0 PSI	2.1 PSI
Fluid Properties		
Specific Heat	1.001 BTU/lb-°F	0.926 BTU/lb-°F
Conductivity (k)	0.386 BTU/ft-hr °F	0.252 BTU/ft-hr °F
Viscosity	0.864 lb/ft-hr	0.963 lb/ft-hr
Density (rho)	60.690 lb/cu.ft.	62.222 lb/cu.ft.
Model Parameters:		
Number of Channels	17	18
Velocity	0.65 ft/sec	0.66 ft/sec
Heat Transfer Coefficient	2431	1534
Internal Volume	0.175 cu.ft.	0.185 cu.ft.
Heat Transfer Rate	354000 BTUH	Nominal Surface 44.6 sq.ft.
LMTD	9.9 °F	Over-Surface 0.3 %
Overall Uo	791	Net Weight 50.3 lbs
Model	TFP10X20-36(1-1/2"TMPT)	Dimensions 9.8W × 20.3L × 3.7D in

Model Selection:
 Standard

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.
- B. Section 02 41 20 - SELECTIVE STRUCTURE DEMOLITION

1.2 WORK SHOWN ON DRAWINGS

- A. The drawings accompanying this specification, as a part thereof, are working drawings indicating the location and arrangement of the increments of the systems of this section of work. Material deviation from this arrangement, process or means of application, shall bear the Engineer's review stamp before the change is made on the job or materials are ordered. Changes made without such review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings are not intended to show in minute detail minor items of installation or materials such as specific fittings or findings.

1.3 MATERIALS AND LABOR

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Provide, when required, labeled samples of material or equipment specified herein or proposed to be used in this work.
- D. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the specifications.

Coffin Elementary Ventilation Improvements and Roof Reinforcement

1.4 EQUIPMENT INSTALLATION IN HEATING SEASON

- A. The system shall be installed provided that the construction area will have sufficient heat to maintain temperature above 40°F throughout the construction period.

1.5 COOPERATION BETWEEN TRADES

- A. Provide information sufficiently in advance of this work, so that work by the other trades may be coordinated and installed without delays. Furnish and locate sleeves, supports, anchors and necessary access panels.
- B. Where work is concealed, assure it does not project beyond finished lines of floors, ceilings, or walls.
- C. Equipment or piping requiring access found to be located above sheetrock ceilings shall be brought immediately to the attention of the Architect for resolution.

1.6 VISITING THE PREMISES

- A. Visit the premises and review the existing conditions, as applicable.

1.7 ORDINANCES, AUTHORITIES, PERMITS, AND FEES

- A. Obtain necessary permits and licenses, give notices and comply with laws, ordinances, rules, regulations or orders affecting the work, and pay fees and charges in connection therewith.
- B. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

1.8 PROTECTION OF WORK AND MATERIALS

- A. Protect and care for materials delivered and work performed until the completion of the work. Defective equipment or equipment damaged in the course of storage, installation or test shall be replaced or repaired to the satisfaction of the Engineer at no additional cost to the Owner.

1.9 INSURANCE

- A. Purchase and maintain Public Liability and Property Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the General Conditions.

1.10 APPLICABLE CODES

- A. Work and materials shall conform to the latest rules and regulations listed below and these rules and regulations hereby are made part of this specification. They include, but are not necessarily limited to the following:

2009 International Energy Conservation Code
American Society for Testing and Materials (ASTM)
Underwriters' Laboratories, Inc. (UL)
Air Moving and Conditioning Assoc. (AMCA)

Coffin Elementary Ventilation Improvements and Roof Reinforcement

American Society of Heating, Refrigerating, and Air
Conditioning Engineers (ASHRAE)
American Society of Mechanical Engineers (ASME)
National Electrical Manufacturers Association (NEMA)
Institute of Electrical and Electronics Engineers (IEEE)
American National Standards Institute (ANSI)
National Fire Protection Association (NFPA)
American Water Works Association (AWWA)
Local Fire Code
Local Plumbing Codes
American Welding Society

1.11 SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, eight (8) copies, to be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", "Submit Specified Item", or "Rejected" less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).
- B. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes. Typical similar items would be "Diffusers and Registers", "Valves and Controls". Rejection of individual items shall not be cause for rejection of the entire document.
- C. Clearly indicate item(s) to be reviewed on each submission by highlighting or underlining intended item(s). Submissions not clearly marked shall be returned "Amend and Resubmit".
- D. Shop drawings must bear the Engineer's review stamp. In the event that the Engineer returns shop drawings "Amend and Resubmit" or "Rejected", the shop drawing must be revised and resubmitted for review.
- E. Furnishing of the specified item must still produce the results and performance, dependability and quality reasonably to be expected within the spirit of the specifications, drawings, and the standard of good mechanical performance normal to the trade.

1.12 SUBSTITUTIONS

- A. Refer to Specification Section 01 60 00 / 22. Where the specifications allow the substitution of a product, still this product is subject to review by the Engineer in accordance with the paragraph entitled "Shop Drawings". Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the Engineer is first obtained. The (ONLY) notation in the specification is an exception to this and leaves no option.

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- C. For materials or equipment which are supplied with integral or factory applied finish, the colors will be considered in evaluating substitutions.
- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The cost of any changes because of substituted item shall be borne by the Contractor requesting such change.

1.13 COMMISSIONING

- A. Mechanical systems in this project will be commissioned by an independent commissioning agent, hired by the Owner. All division 23 contractors and subcontractors will be responsible for carrying out the commissioning requirements specified in Section 019133 - General Commissioning Requirements, and other sections referenced in 019133, at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 GRADES AND ELEVATIONS

- A. Establish and maintain grades and elevations in connection with this work.

3.2 EQUIPMENT SUPPORTS

- A. Furnish and install equipment supports for mechanical equipment as required. Supports shall be subject to review by the Engineer. All equipment shall be installed level and per the manufacturers recommendations.

3.3 SLEEVES AND PREPARED OPENINGS

- A. Coordinate core-drilling, cutting, patching and setting of sleeves, frames, framing and lintels for openings with other trades. Sleeves shall be furnished by the Contractor. Pipe sleeves shall be provided at all floor and wall penetrations. Sleeves shall be Schedule 40 steel pipe for iron pipe, Type "L" copper for copper pipe and Schedule 40 PVC for plastic pipe. Sleeves shall be firestopped, as specified. Piping penetrations thru floors above grade shall have watertight pipe sleeves (LinkSeal, or approved equal).
- B. Failure to give timely notice of and to locate openings and furnish sleeves shall cause no additional expense to the Owner.

3.4 CONNECTION TO EQUIPMENT

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

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3.5 ACCESS TO EQUIPMENT

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

3.6 ACCESS PANELS

- A. Access panels shall be provided where indicated on the drawings and as required for access to valves and other serviceable components. Access doors shall be Milcor, Zurn or approved equal hinged with primed finish and with allen wrench operated latch.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.

3.7 PAINTING OF EQUIPMENT

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, e.g. boiler rooms, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.

3.8 GUARDS

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings.

3.9 LUBRICATION

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.

3.10 ELECTRIC MOTORS AND MOTOR CONTROLS

- A. Unless otherwise noted, motors, motor starters and other electrical accessories which are specified under Mechanical specifications shall be selected with characteristics as follows:
 - 1/2 Horsepower and less - 120 volt, 1 phase, 60 Hz.
 - 3/4 Horsepower and larger – 460 or 208 volt, 3 phase, 60 Hz., as indicated.
- B. Motors shall be built in accordance with the latest applicable NEMA, IEEE and ANSI Standards. Motors shall be manufactured by Baldor, Magnetek or Toshiba, of the latest type and quality specified under individual items of equipment. Motor efficiencies shall be premium high efficiency type per the Consortium for Energy Efficiency Standard and/or be “Energy Star” compliant.
- C. Magnetic motor starters for mechanical items of equipment shall be furnished under Division 26 unless the starter is an integral part of a factory packaged item of equipment.

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Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters shall be combination type with "Hand-Off-Auto" switches and shall have single phase protection or shall have relays installed to provide this feature. Starters shall be equipped with suitable step-down transformers to provide required control voltage.

- D. Motors shall have a minimum continuous duty service factor of 1.15. Minimum motor efficiency shall be:

MOTOR HORSEPOWER	PERCENTAGE EFFICIENCY		
	(1200RPM)	(1800 RPM)	(3600 RPM)
1-3	----	86.5	85.5
5	89.5	89.5	86.5
7.5	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2

3.11 CLEANING OF SYSTEMS

- A. Piping and duct systems shall be thoroughly cleaned and flushed prior to initial operation.
- B. Thoroughly clean exposed portions of the mechanical installation, removing labels and foreign substance.
- C. Furnish detergents, solvents, cleaning compounds, and tools required for cleaning operations.
- D. Keep the premises free from accumulation of waste material or rubbish and at the completion of the work, remove from the job site tools, scaffolding, surplus materials, and rubbish, leaving the work areas "broom" clean.

3.12 STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.
- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

3.13 OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Engineer. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

3.14 RECORD DRAWINGS

- A. During construction, keep an accurate record of deviations to the installation of the work as indicated on the drawings. Upon completion of the work, furnish a copy of this record to the Engineer. **Submit record drawings before requesting final payment.**

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3.15 MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this specification or as directed by the Engineer, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

3.16 MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.
- E. Material shall first be submitted in preliminary form for review by the Engineer. After review, submit two (2) copies in bound volumes to the Engineer for distribution.

3.17 GUARANTEES

- A. An item becomes "defective" when it ceases to conform to the Contract Documents. Guarantees begin on the date of issuance of a certificate authorizing final payment or certificate of substantial completion with the Owner taking occupancy or beneficial use thereafter.
- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for not less than one (1) year. Guarantee shall further state that the Contractor will, at his own expense, repair or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects.
- C. Where special guarantees, covering installation, operation or performance of any systems, or equipment furnished under are indicated, the full responsibility for the fulfillment of such guarantees must be assumed by the Contractor who shall obtain written guarantees in triplicate, two (2) copies of which shall be filed with the Engineer before final acceptance.
- D. Repeated malfunctioning or failure in service of any item or work of the system is sufficient cause for the Engineer to order the removal of the item, and its replacement with new item at the expense of the Contractor.

3.18 EXISTING UTILITIES AND EQUIPMENT

- A. The Contractor shall be responsible for correcting any damage to existing systems, components or utilities that are to remain in service.

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- B. The Contractor shall visit the premises to become familiar with the existing conditions prior to submitting a bid. No additional compensation will be allowed for existing conditions that are readily apparent during a site visit.

3.19 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified. Coordinate size, location and type of pipe and duct sleeves as required by firestopping systems.

3.20 HAZARDOUS MATERIALS

- A. Recognized hazardous materials such as lead, mercury or asbestos shall be prohibited from the project. Submit MSDS sheets to the Owner for review.

* END OF SECTION *

SECTION 23 05 01

MECHANICAL DEMOLITION, RELOCATION AND ALTERATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide removal, relocation, rerouting and reconnecting of existing mechanical facilities, as shown and as required by Contract Documents, to accomplish alteration, restoration and to accommodate new construction.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 “Common Work Results for HVAC” are hereby made a part of the work of this section.
- B. Section 02 41 19 - SELECTIVE STRUCTURE DEMOLITION

1.3 QUALITY ASSURANCE

- A. Regulatory Agencies and Codes – Comply with the following:
 - 1. International Energy Conservation Code 2009
 - 2. Plumbing Code – Maine Plumbing Code
- B. Reference Standards – Comply with the following:
 - 1. American National Standards Institute (ANSI): Safety Requirements for Demolition – ANSI A10.6.
 - 2. National Fire Protection Association (NFPA): Safeguarding Building Construction and Demolition Operations – NFPA 241.
 - 3. US Environmental Protection Agency (EPA)

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. For materials required for this work, comply with the applicable specification sections in Divisions 22 and 23.

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PART 3 - EXECUTION

3.1 GENERAL

- A. The demolition and removal of all mechanical components is part of the work of the Filed Sub Bid Contractor.
 - 1. The Mechanical Subcontractor shall perform the mechanical removals and relocations and coordinate the work with the General Contractor as to the extent and timing of the removals. The Mechanical Subcontractor shall provide any necessary caps, valves, plugs, rerouting of piping and temporary services that are to be maintained during the demolition and removals process or as part of any Phasing.
- B. Provide alteration and demolition of mechanical facilities as required by the drawings and specifications.
- C. Do not begin work until time schedules and manner of operations have been approved by the Architect.
- D. Verify the location of all related existing equipment, piping and other mechanical facilities. Provide for the removal, relocation, rerouting and reconnecting of this work as required because of demolition methods or sequences employed. Obtain the Owner's permission prior to commencing any work.
- E. Comply with the installation procedures specified in the applicable specifications sections in Divisions 22 and 23.
- F. Where existing equipment must remain in service during construction, provide rerouting and reconnecting of mechanical services as required to maintain continuous service.
- G. Maintain system continuity and operation of piping or ductwork circuits, whether spliced, extended, relocated or newly constructed.
- H. If requested, store, on the site, materials and equipment to be salvaged for future use by the Owner.
- I. Ductwork, piping, hangers, supports, anchors, etc. shall be removed along with ductwork and piping shown to be removed.
- J. Where equipment, ductwork and piping is removed or disconnected under Divisions 22 and 23, perform the work in such a manner that no damage is done to the structure or remaining portions of the existing systems. Do not under any circumstances place a stress on existing ductwork or pipe and fittings which are to be reused. Be fully responsible for and repair, at no additional expense to the Owner, any leaks developing in existing piping or ductwork due to failure to take proper precautions when making alterations.

3.2 PIPING

- A. Welded piping shall be cut off square at the locations indicated on the demolition drawings. Openings of any remaining valves, piping or fittings shall be closed off with weld caps or blind flanges to prevent debris from entering the existing systems.

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- B. Threaded piping shall be disconnected at the location indicated on the demolition drawings. Openings of remaining valves, piping, fittings and equipment shall be closed off with pipe plugs or pipe caps as required to prevent debris from entering the existing systems.
- C. Pipe hangers, supports, and/or anchors shall be removed along with all piping shown to be removed.
- D. Provide shutoff valves to isolate new work from existing and temporary or permanent connections to new work as required for proper testing and cleaning of new work.

3.3 INSULATION

- A. Insulation shall be removed from all piping, fittings, valves and equipment designated for demolition.
- B. Comply with all safety precautions relocated to insulation removal.

* END OF SECTION *

SECTION 23 0 593

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION: The work covered by this section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required for testing and balancing the air and water systems.

1.2 RELATED DOCUMENTS

A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.

1.3 DEFINITIONS

A. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment, (e.g., reduce fan speed, throttling).

B. Balance: To proportion flows within the distribution system (submains, branches and terminals) in accordance with specified design quantities.

C. Procedure: Standardize approach and execution of sequence of work operations to yield reproducible results.

D. Report Forms: Test data sheets arranged for collection of test data in logical order to submission and review. This data should also form the permanent record which shall be used as the basis for any future testing, adjusting, and balancing required.

E. Test: To determine quantitative performance of equipment.

1.4 SUBMITTALS: Submit the following:

A. Standards Compliance:

Testing Agency
Testing Agency Personnel
Professional Engineers
Instrument Calibration

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1.5 TESTING AND BALANCING AGENCY

- A. Air and Water Systems Testing and Balancing: Upon completion of the installation and field testing, performance test and adjust the supply, return, make-up, and exhaust air systems, and heating water systems to provide the air volume and water flow quantities indicated. Accomplish work in accordance with the agenda and procedures specified and AABC 71679 and standards of the NEBB. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.
- B. Agency Qualifications: Obtain the services of a qualified testing organization to perform the testing and balancing work as herein specified. Prior to commencing work under this section of the specifications, the testing organization shall have been reviewed by the Architect. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB, or the testing organization shall have submitted proof to satisfy the Architect that the organization meets or exceeds the technical standards for membership of the AABC as published in the AABC 71679. The testing organization shall be independent of both the installing contractors and equipment suppliers for this project.

1.6 AGENDA

- A. Preliminary Report: Review drawings and specifications prior to installation of any of the affected system. Submit a written report to the Architect indicating any deficiencies in the system that would preclude the proper adjusting, balancing, and testing of the systems.

1.7 PROCEDURES, GENERAL

- A. Requirements: Adjust systems and components thereof that perform as required by drawings and specifications.
- B. Test Duration: Operating tests of heating and cooling coils, fans and other equipment shall be of not less than 4 hours duration, after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.
- C. Instrumentation: Method of application of instrumentation shall be in accordance with the manufacturer's instructions. Furnish personnel, instruments, and equipment for tests specified herein.
- D. Accuracy of Instruments: Instruments used for measurements shall be accurate. Provide calibration histories for each instrument for examination. Calibrate each test instrument by an reviewed laboratory or by the manufacturer. The Architect has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.
- E. Accuracy of Thermometers: Plus or minus one graduation at the temperatures to be measured. Graduations shall conform with the following schedule:

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Medium	Design Temperature Differential (°F)	Maximum Graduation (°F)
Air	10 or less	1/2
Air	over 10	1
Water	10 or less	1/10
Water	10-20	1/2
Water	over 20	1

F. Flow Rate Tolerance: Values are based on discussion in ASHRAE "HVAC Applications", Chapter 34. Air filter resistance during tests, artificially imposed if necessary, shall be 80 percent of final values.

1. Air Handling Unit CFM: Minus 0 percent to plus 10 percent.
2. Other Fans: Minus 0 percent to plus 10 percent.
3. Air Terminal Units (VAV Boxes): Minus 5 percent to plus 10 percent.
4. Minimum Outside Air (for manually set dampers): Minus 0 percent to plus 10 percent.
5. Individual Room Air Outlets and Inlets, and Air Flow Rates Not mentioned Above: Minus 10 percent to plus 10 percent.
6. Heating System Pumps GPM: Minus 0 percent to plus 10 percent.
7. Other Pumps GPM: Minus 10 percent to plus 10 percent.
8. Air Handling Unit Coils GPM: Minus 5 percent to plus 10 percent.
9. Terminal Unit Coils/Elements GPM: Minus 10 percent to plus 10 percent.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 AIR SYSTEM PROCEDURES

- A. Adjustments: Adjust air handling systems to provide the required design air quantity to, or through, each component. Conduct adjusting and balancing of systems during periods of the year approximating maximum seasonal operation.
- B. Balance: Use flow adjusting (volume control) devices to balance air quantities only; i.e., proportion flow between various terminals comprising system, and only to the extent that their adjustments do not create objectionable air motion or sound, i.e., in excess of specified limits.
- C. Balancing Between Runs (submains, branch mains, and branches): Use flow regulating devices at, or in, the divided - flow fitting. Minimize restriction imposed by flow regulating devices in or at terminals.
- D. Final Measurements of Air Quantity: Make final measurements of air quantity, after the air terminal has been adjusted to provide the optimum air patterns of diffusion.
- E. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds, or axial-flow fan wheel blade pitch. For systems with direct-connected fans (without adjustable pitch blades), damper restrictions of a system's total flow or variable speed rheostats shall be adjusted as appropriate.
- F. Air Measurement:
 - 1. Pitot Tube: Except as specifically indicated herein, make pitot tube traverses of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform with the ASHRAE Handbook Fundamentals.
 - 2. Pitot Tube Traverse: Pitot-tube traverse may be omitted if the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of Pitot-tube traverse, determine air flow in the duct by totalling volume of individual terminals served, measured as described herein.
 - 3. Measurements of Air Quantity: Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.
- G. Air Terminal Balancing: Measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing.

3.2 WATER SYSTEM PROCEDURES

- A. Adjustment: Adjust heating, water systems to provide required quantity to, or through each component.
- B. Metering: Measure water quantities and pressures with calibrated meters.

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- C. Water Measurements and Balancing: Use venturi tubes, orifices, or other metering fittings and pressure gages. Adjust systems to provide the design flow rates through the heat transfer equipment prior to the capacity testing. Perform measurement of temperature differential with the air system, adjusted as described herein, in operation.
- D. Automatic Controls: Position automatic control valves for full flow through the heat transfer equipment of the system during tests.
- E. Flow: Flow through by-pass circuits at three-way valves shall be adjusted to balance that through the supply circuit.
- F. Distribution: Adjust distribution by means of balancing devices (cocks, valves, and fittings) and automatic flow control valves. Do not use service valves for adjustment. Where automatic flow control valves are utilized in lieu of venturi tubes, record only the pressure drop across the valve if within the pressure drop rating on the valve tag.
- G. Special Procedures: Where available, pump capacity (as designed) is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the system.

3.3 CERTIFIED REPORTS

- A. Submittal: Submit three copies of the reports described herein, covering air and water system performance, air motion (fpm), to the Architect prior to final tests and inspection.
- B. Instrument Records: Include types, serial numbers, and dates calibration of instruments.
- C. Reports: Reports shall identify conspicuously items not conforming to contract requirements, or obvious maloperation and deficiencies.
- D. Certification: The reports shall be certified by an independent Registered Professional Engineer who is versed in the field of air and water balancing and who is not affiliated with any firm involved in the design or construction phases of the project.

3.4 AIR SYSTEM DATA

- A. Report: The certified report shall include for each air-handling system the data listed below:
 - 1. Equipment (fan or factory fabricated station unit):
 - a. Installation Data:
 - 1) Manufacturer and Model
 - 2) Size
 - 3) Arrangement, Discharge, and Class
 - 4) Motor H.P., Voltage, Phase, Cycles, and Full Load Amps.
 - 5) Location and Local Identification Data
 - b. Design Data: Data listed in schedules on drawings and specifications.
 - c. Fan Recorded (Test) Data

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- 1) C.F.M.
 - 2) Static Pressure
 - 3) R.P.M.
 - 4) Motor Operating Amps.
 - 5) Motor Operating B.H.P.
2. Duct Systems:
- a. Duct Air Quantities (Maximum and Minimum) - Main, Submains, Branches, Outdoor (Outside) Air, Total-Air, and Exhaust
 - 1) Duct size(s)
 - 2) Number of Pitot-tube (Pressure) Measurements
 - 3) Sum of Velocity Measurement, excluding pressure measurements
 - 4) Average Velocity
 - 5) Recorded (Test) C.F.M.
 - 6) Design C.F.M.
 - b. Individual Air Terminals:
 - 1) Terminal Identification (Supply or Exhaust, Location and Number Designation)
 - 2) Type Size, Manufacturer, and Catalog Identification
 - 3) Design and Recorded Quantities - C.F.M.
 - 4) Deflector Vane or Diffusion Cone Settings
 - 5) Applicable Factor for Application, Velocity, Area
 - 6) Design and Recorded Velocities - F.P.M. (State "core" "inlet," as applicable)

3.5 WATER SYSTEM DATA

A. Report: Include data listed below:

1. Pumps:
 - a. Installation Data:
 - 1) Manufacturer and Model
 - 2) Size
 - 3) Type Drive
 - 4) Motor H.P., Voltage, Phase, and Full Load Amps.
 - b. Design Data:
 - 1) G.P.M.
 - 2) Head
 - 3) R.P.M.
 - 4) B.H.P. and Amps.

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- c. Recorded Data:
 - 1) Discharge Pressures (Full-Flow and No-Flow)
 - 2) Suction Pressures (Full-Flow and No-Flow)
 - 3) Operating Head
 - 4) Operating G.P.M. (from pump curves if metering is not provided)
 - 5) No-Load Amps. (where possible)
 - 6) Full-Flow Amps
 - 7) No-Flow Amps

- 2. Air Heating and Cooling Equipment:
 - a. Design Data:
 - 1) Load in Btu per hr
 - 2) G.P.M.
 - 3) Entering and Leaving Water Temperature
 - 4) Entering and Leaving Air Conditions (D.B. and W.B.)
 - 5) C.F.M.
 - 6) Water Pressure Drop

 - b. Recorded Data:
 - 1) Type of Equipment and Identification (location or number designation)
 - 2) Entering and Leaving Air Conditions (D.B. and W.B.)
 - 3) Entering and Leaving Water Temperatures
 - 4) G.P.M. (if metered)
 - 5) Temperature Rise or Drop

- 3. Converters and Heat Exchangers:
 - a. Installation Data:
 - 1) Manufacturer, Model, and Type
 - 2) G.P.M.
 - 3) Inlet (entering) and Outlet (leaving) Temperatures
 - 4) Water Pressure Drop

 - b. Recorded Data:
 - 1) G.P.M. (if metered)
 - 2) Entering and Leaving Water Temperature - System
 - 3) Water pressure drop
 - 4) Heating (or Cooling) Media Steam Pressure and Temperature and Condensate Temperature, or Entering and Leaving Water Temperature
 - 5) Heating (or Cooling) Media - Flow (G.P.M. or lbs. per hour)

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3.6 FINAL TESTS, REVIEW, AND ACCEPTANCE

- A. Capacity and Performance Tests: Make tests to demonstrate that capacities and general performance of air and water systems comply with contract requirements.
- B. Final Inspection: At the time of final review, recheck, in the presence of the Engineer, random selections of data water and air quantities and air motion recorded in the certified report.
- C. Points and Areas for Recheck: As selected by the Architect.
- D. Measurement and Test Procedures: As reviewed for work forming basis of certified report.
- E. Selections for Recheck (specific plus random): In general, selections for recheck will not exceed 25 percent of the total number tabulated in the report.
- F. Retests: If random tests elicit a measured flow deviation of ten percent or more from, at ten percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made.
- G. Marking of Settings: Following final acceptance of certified reports by the Architect, the settings of valves, dampers, and other adjustment devices shall be permanently marked, so that adjustment can be restored if disturbed at any time. Do not mark devices until after final review.

* END OF SECTION *

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including the project manual are hereby made a part of the work of this section.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the heating, ventilating, air conditioning, and plumbing systems.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
 - 1. Piping insulation.
 - 2. Duct insulation.
 - 3. Equipment and component insulation.
 - 4. Insulation application schedule.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Mechanical rooms and Elevator machine rooms.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures, such as unheated attic spaces or non-air conditioned areas.
- D. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- E. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- F. Exposed: Visible from a finished or unfinished space.

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1.5 MANUFACTURER'S STAMP OR LABEL

- A. Packages or standard containers of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation shall be asbestos-free.

1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS

- A. Materials shall have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with NFPA 255, ASTM E84, or UL 723.
- B. Provide materials with flame resistant treatments not subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, or heat.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors for securing insulation to ducts or equipment.

PART 2 PRODUCTS

2.1 PIPING INSULATION

- A. Fiberglass: Heavy density preformed fiberglass with thermal conductivity of 0.29 Btu-in/hr-ft²-°F at 150°F mean temperature, Johns Manville Micro-Lok HP, or approved equal. Insulation shall conform to ASTM C547 Class I and shall be suitable for 850°F service. Fitting insulation shall be of same material used for pipe. The flame spread / smoke developed rating shall be 25 / 50.
 - 1. Insulation Jacket: All service (ASJ) type conforming to Fed. Spec. HH-B-100B Type I. Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be factory premolded, one-piece, PVC covers with pressure sensitive taped joints. Jackets in exposed locations shall have a white surface suitable for field painting. Provide vapor barrier as required by service.
 - 2. Aluminum Jackets: ASTM B 209M (ASTM B 209), Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide 1/2" wide stainless steel bands. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.
 - 3. PVC Jacket: Glossy white finish, ASTM 1784, minimum thickness 0.030", over insulation and vapor barrier with solvent-welded joints. Jacket shall be overlapped 2" minimum on down side.
Provide jacketing over insulation in finished areas such as Kitchens, Gymnasiums and in classrooms and other spaces where exposed to view. See the Reflected Ceiling Plans for additional information. Provide jacketing on insulated exterior piping.
- B. Flexible Unicellular: Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft²-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type I, Tubular and shall be suitable for 200°F service. Fitting insulation shall be of same material used for pipe.

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Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

- C. Fittings, Flanges, Hydronic Components and Accessories, Pump Casings and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, 1.02 Btu-in/hr-F²-°F thermal conductivity, white color.

2.2 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), 0.29 Btu-in/hr-ft²-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.
- B. Fiberglass (Ductboard): Fiberglass insulation board with foil-scrim-kraft facing/vapor barrier, 3.0 lb./CF density, 0.25 Btu-in/hr-ft²-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A and B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

2.3 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft²-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment and Piping): Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft²-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 GENERAL

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- A. Insulate after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and are dry.
- B. Install insulation with jackets drawn tight and cement down longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems and pipe penetrations through fire rated assemblies. Extend surface finishes to protect ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Keep insulation and piping dry during the application of the finish. Bevel and seal the edges of exposed insulation.
- C. Unless otherwise indicated, do not insulate the following:
 - 1. Factory preinsulated flexible ductwork.
 - 2. Factory pre-insulated ductwork, plenums, casings, mixing boxes, and filter boxes.
 - 3. Chrome plated pipes and fire protection pipes.
 - 4. Vibration isolating connections.
 - 5. Adjacent insulation.
 - 6. ASME stamps, nameplates, access plates.
 - 7. Ductwork exposed to view in a normally occupied space.
 - 8. Hydronic specialties: Low water cutoff, relief valves, relief valve discharge piping, pressure reducing valves, and expansion tanks.

3.3 PIPING INSULATION

- A. Pipe Insulation (Fiberglass): Place sections of insulation around the pipe and joints, tightly butt into place. Draw jacket laps tight and smooth. Secure jacket with fire resistant adhesive, or factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps.
- B. Flanges, Flexible Connectors, Pump Connectors, Unions, Valves and Fittings Insulation (Fiberglass): Factory fabricated removable and reusable insulation covers. Place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling or with metal or plastic tacks made for securing PVC fitting covers and secure with PVC vapor barrier tape.
- C. Pipe Insulation (Flexible Unicellular): Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, flexible connectors, pump connectors, unions, valves, pump casings, hydronic accessories and components and fittings.
- D. Where penetrating roofs and exterior walls, insulate piping to a point flush with the underside of the deck or wall and seal with a vapor barrier coating.
- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields (16 gage minimum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of

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molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 12" long and shall not compress the insulation. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. **For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.**

- F. PVC or Metal Jackets: Provide over exterior insulation exposed to the weather. Machine cut jacket to smooth edge of circumferential joints. Overlap metal jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9 inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing. Solvent weld PVC jacket system to provide continuous watertight seal.

Provide 30 mil glossy PVC jacketing over insulation in finished areas such as Kitchens, Main Street, Gymnasiums and in classrooms and other spaces where exposed to view. Provide PVC jacketing over insulation in unfinished spaces such as Mechanical and Boiler Rooms within 10' of the finished floor. See the Reflected Ceiling Plans and Room Finish Schedules for additional information.

3.4 DUCT INSULATION

- A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins. After installing washers, provide foil-scrim-kraft (FSK) tape to seal break in vapor barrier, tape shall extend 1" minimum around pin. Apply insulation with joints tightly butted. Bevel insulation around name plates and access plates and doors. Seal joints with FSK tape. Provide additional adhesive or staples to assist tape adhesion in difficult applications.
- B. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.

3.5 EQUIPMENT INSULATION

- A. General Procedures: Apply equipment insulation suitable for temperature and service to fit as closely as possible to equipment. Join sections of insulation with adhesive. Bevel insulation around nameplates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Provide vapor barrier seal at joints and seams for "cold" equipment.

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- B. Heating Equipment: Provide semi-rigid mineral fiberboard insulation. Seal longitudinal and lateral seams with FSK tape. Bond cuts, ends, and mitered sections with adhesive. Provide a vinyl-acrylic mastic coating on exposed fiberglass ends.
- C. Cold Equipment, Valves, Pump Casings, Flexible Connections and Accessories: Provide flexible unicellular sheet insulation, bond cuts, butt joints, longitudinal joints and ends with vapor barrier adhesive. Vapor seal exposed edges to equipment.

3.6 INSULATION APPLICATION SCHEDULE

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
PIPING:		
Domestic Cold Water Piping 1" and smaller	1/2"	Fiberglass w/ASJ or Flexible
Hot Water Heating Supply and Return Piping (HWS/R, LTHWS/R) 2" and larger	2"	Fiberglass w/ ASJ
1½" and smaller	1½"	Fiberglass w/ ASJ
Hot Water Heating Supply and Return Branch Piping Less than 10 ft in Stud Walls	1"	Fiberglass w/ ASJ
Hot Water Heating Supply and Return Branch Piping Less than 10 ft in Block Wall	1"	Flexible Unicellular
Hot Water Heating Supply and Return Piping 2" and larger	2"	Fiberglass w/ ASJ
1½" and smaller	1½"	Fiberglass w/ ASJ

DUCTWORK:

Acoustically Lined Ductwork: Unless indicated otherwise, acoustical duct liner shall be 1" thick. Acoustically lined ductwork in unconditioned spaces (such as mechanical rooms) shall have 1½" thick fiberglass ductwrap. Exposed ductwork in finished spaces shall be double-wall insulated construction.

Concealed Supply Ductwork from the AC Unit(s) / ERV's to Spaces Served	1½"	Ductwrap, FSK
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<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
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DUCTWORK:

Plenums at Intake and Exhaust louvers	2"	Ductboard, FSK
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Exhaust Ductwork from a point three (3) feet interior of the motorized control damper or backdraft damper to the exterior wall, roof, or louver. 2" Ductboard, FSK

3.7 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

* END OF SECTION *

SECTION 23 09 00

INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the automatic temperature control system indicated. The system shall be a direct digital control (DDC) system with dynamic color graphics software to provide the sequences as described in these specifications. The ATC system shall be complete with required components including, low voltage and line voltage wiring and conduit. Control wiring shall include all control-related components and devices and associated interlock wiring, including that furnished or required by the HVAC equipment manufacturers, including sensors, controllers, valves, etc. Coordinate with the respective equipment manufacturers. Wiring shall be in accordance with Division 26, "Electrical" of the specifications and NFPA 70, National Electrical Code.
- B. Recognized hazardous materials such as lead, mercury or asbestos shall be prohibited from the project. Submit MSDS sheets to the Owner for review.
- C. The control system shall be fully compatible with the existing Brunswick Schools BAS.

1.2 ACCEPTABLE MANUFACTURERS

- A. Siemens Industry, Mussey Road, Scarborough, ME. ONLY.

1.3 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 23 00 00 – HVAC.

1.4 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00 relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the shop drawings paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
 - 1. Temperature control system schematic including variables, flow diagrams, ladder diagrams, and point to point wiring diagrams, indicating set points, reset ranges, throttling ranges, controller gains, differentials, operating ranges, normal positions, controller action, dial ranges, voltages, currents, mounting locations, indicators, and terminal strip points.

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2. Sequence of operation for each system and function.
3. Generic, functional description of each control component indicated.
4. Equipment interlocks required by sequence of operation.
5. Automatic valve schedule showing flow, Cv, and pressure drop.
6. Manufacturer's Data:
 - a. Dampers, valves and operators.
 - b. Controllers, including wiring and connection diagrams.
 - c. Thermostats, temperature sensors, including wiring and connection diagrams.
 - d. Temperature and pressure indicators.
 - e. Pressure sensors, including wiring and connection diagrams.
 - f. Switches, relays, transmitters, transformers, including wiring and connection diagrams.
7. Dynamic color graphics software data.

1.5 WARRANTY

- A. The automatic temperature control system shall have a **two (2) year parts and labor** warranty.

PART 2 – PRODUCTS AND FEATURES

2.1 CONTROL PANELS

- A. In general, relays, transformers, or other control devices (not including room thermostats or duct-mounted instruments) shall be grouped and mounted in a factory-built cabinet enclosure.

2.2 AUTOMATIC CONTROL DAMPERS

- A. Automatic dampers not furnished with equipment shall be furnished under this paragraph. Automatic dampers shall be constructed and installed in accordance with the following specifications:
 1. Damper Blades: All automatic dampers, including dampers for static pressure control, shall be of the balanced type, factory-fabricated, with fully gasketed galvanized steel airfoil blades, mounted in welded frames. Damper blades shall be not more than 8 inches wide, shall have interlocking edges, edge and jamb seals and be capable of operation against 4" static pressure differential. Dampers shall be Arrow "Arrow-Foil" Model PBDAF-206, OBDAF-207, Ruskin Model CD-60 or Tamco Series 1000.
 2. Modulating Dampers: All modulating dampers shall be of the opposed blade type.

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3. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48 inches in length between bearings.
 4. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to prevent rusting.
 5. Dampers shall be guaranteed to close tightly, and shall provide substantially the full area of the opening when open. All outdoor air intakes and all exhaust ducts to outside and all fresh air, return air and exhaust air dampers in systems shall have damper blades with inflatable seals or other devices to guarantee low leakage, not to exceed 6 CFM/SF at 1 in. WG pressure differential.
 6. Damper Linkages: Damper-operating links shall be cadmium plated steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand, without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor. Linkages shall be concealed in the frame.
- B. Damper Actuators: For each automatically controlled damper, a suitable damper actuator or actuators shall be provided in accordance with the following specifications:
1. Actuator: Damper actuators shall be electronic, direct-coupled, spring-return type and have a rating of not less than twice the torque needed for actual operation of the damper.
 2. Adjustments: Provide adjustable stops for the open and closed positions.
 3. Mounting: Damper actuators shall be direct-coupled over the shaft. The damper actuators and mounting base shall not be mounted directly on cold or insulated ducts and casings, but shall be mounted outside the insulated covering in such a manner as to prevent sweating and interference with the insulation.
 4. Where indicated, damper actuators shall be provided with an auxiliary switch rated at 120 V AC, and accept a 0 to 20 ma input.

2.3 AUTOMATIC CONTROL VALVES (HOT WATER, 250°F MAX.)

- A. Valves shall have removable composition discs with monel stem, globe pattern, Belimo, or equal. Bodies two inches or smaller shall be bronze with screwed ends. Bodies 2-1/2 inches and larger shall be cast-iron with flanged ends. Valve bodies, trim and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated teflon packing suitable for hot water service, as required.
- B. See the Control Valve Schedule on the Drawings. Modulating valves shall be sized for maximum pressure drop of 1.5 to 4.0 psi. Two position valves shall be line size or have a maximum pressure drop of 1.0 psig.
- C. Automatic control valve differential shut-off pressure shall be a minimum of 35 psig.

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- D. Heating valves shall fail to the "normally-open" position.
- E. Valves shall have a clearly marked position indicator as part of the operating linkage.
- F. Actuator: Shall be electronic, direct-coupled, pulse width modulation (PWM) or spring return type and have a rating of not less than twice the torque needed for actual operation of the valve.

2.4 TEMPERATURE SENSORS

- A. Temperature Sensors: RTD Elements, accuracy of $\pm 0.1\%$ at 70°F, sensors shall be securely attached to a single gang electrical box or other suitable base, securely mounted on the wall or other building surface. Each sensor shall be located where shown or, if not shown, where it will respond to the average temperature in the room. Sensors, generally, shall be mounted 48 inches above the floor, and shall not be mounted on outside walls if other locations are possible. If located on an outside wall, it shall have an insulated base. Sensors shall have locked or concealed adjustment devices, by means of which the operating points can be adjusted through a range of not less than 10 degrees above and below the operating points specified.
- B. Room temperature sensors shall be equal to Vaisala, Kele or Honeywell, with blank covers. Provide an override button with LED indicator light. Provide tamperproof cast aluminum guards, where indicated. Temperature sensors / thermostats with guards shall have a blank, lockable cover (tamperproof).

2.5 CO₂ and IAQ SENSORS

- A. Duct mounted: CO₂ sensors shall be Vaisala Carbocap Series, Model GMD20, Kele, Telaire or TSI and utilize Non-Dispersive Infrared Detection (NDIR) or Photo-Acoustic Sensing and be capable of daily self-calibration during "unoccupied" periods.
- B. Wall-mounted room sensors: CO₂ sensors shall be equal to Vaisala Carbocap Series, Model GMW20, Kele, Telaire or TSI combination temperature and CO₂ without CO₂ display. IAQ sensors shall be BAPI "AQS", or equal. Sensors shall be mounted at 48" A.F.F.

2.6 REMOTE NOTIFICATION

- A. The workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), and email accounts based on a point's alarm condition. All "critical" alarms shall be configured for Remote Notification. See "Input-Output Summary" sheets.
- B. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
- C. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.

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- D. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
- E. The system shall be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
- F. The message detail shall be configurable on a per user basis.
- G. The workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- H. The workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

2.7 SEQUENCE OF CONTROL

- A. Provide and install electronic/electric DDC components to enable the mechanical system to operate in the following sequences:
 - 1. Heat Exchanger, (**HEX, CP1**):
 - a. The control valve shall proportion to satisfy the ERV discharge temperature setpoint.
 - b. Pump CP1 shall operate continuously when the outside air temperature is below 50F.
 - 2. Energy Recovery Ventilator (**ERV1**):
 - a. "Occupied" Mode:
 - 1. Fans: The supply and exhaust fans shall operate continuously. The motorized supply and exhaust dampers shall open. Unit **ERV1** shall have the fan speed controlled directly from room CO₂ with a minimum fan speed of 50%.
 - 2. Discharge air temperature control: The discharge air temperature shall be reset from 55⁰F. at a 75⁰F. return air temperature to 95⁰F. at a 60⁰F. return air temperature. The discharge air temperature shall be maintained by modulating the wheel and sending a signal to the 2-way modulating control valve. The discharge temperature sensor shall be located in the supply fan cabinet. Provide an energy recovery wheel "enable-disable" signal based on outside air temperature (economizer operation).
 - 3. Freeze protection: If the energy recovery wheel stops (where applicable) as sensed by the wheel rotation sensor, the unit shall shut down, open the hot water control valve and generate an alarm at the BAS. A manual reset freezestat shall shut down the fans and close the outside air damper if the discharge temperature falls below 45⁰F.

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4. Smoke detectors in the discharge and return air shall de-energize the unit and close the outside air dampers if smoke is detected. The smoke detectors shall be wired to interface with the building fire alarm system (by Electrical Contractor).
 5. A high static pressure switch shall shut down the unit if the discharge static pressure reaches the setpoint. Motorized dampers in the intake and exhaust ducts shall be interlocked to open when the units are operating.
 6. A BacNet or Lonworks interface shall be provided (coordinate with the unit manufacturer). Provide a programmable terminal unit controller to provide the control sequence described herein. Coordinate with miscellaneous controls and sensors provided by the equipment manufacturer.
 7. The electric preheat coil shall be enabled whenever the outside air temperature is below 5F.
- b. "Unoccupied" Mode:
1. The unit shall remain off.
- c. Coordinate with the packaged controls furnished with the unit. See Section 230000.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 2. Verify that the automatic temperature control system may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

3.2 INSTALLATION

- A. Provide wiring, and conduit to connect the ATC components for an operational ATC system. Wiring and installation shall conform to NFPA 70.
- B. Identification: Label or code each field wire at each end. Permanently label or code each point of field terminal strips to show the instrument or item served. Color-coded cable with annotated cable diagrams may be used to accomplish cable identification.
- C. Temperature Sensors: Stabilize sensors to permit on-the-job installation that will require minimum field adjustment or calibration. Temperature sensor assemblies shall be readily accessible and adaptable to each type of application to allow quick, easy replacement and servicing without special tools or skills. Strap-on sensor mountings, using helical screw stainless steel clamps, shall be permitted on new piping for unit heater or other on-off

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operation only, after pipe is cleaned to bright metal. Strap-on bulb and pipe shall be insulated after installation. Strap-on sensor mountings are also permitted for hot water piping sizes up to 2 inches. Other liquid temperature sensors shall be provided with wells.

- D. Duct Sensors: Provide sensors in ductwork; specific location within duct shall be selected to accurately sense air properties. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Installation shall be within the vibration and velocity limits of the sensing element. Where an extended surface element is required to sense the average or lowest air temperature, position and securely mount sensor within duct in accordance with sensor manufacturer's recommendations. Temperature sensing elements shall be thermally isolated from brackets and supports. Provide separate duct flange for each sensing element; securely seal ducts where elements or connections penetrate duct. Seal penetrations of duct insulation vapor barrier with vapor barrier coating compound to provide a vapor-tight covering. Mount sensor enclosures to allow easy removal and servicing without disturbance or removal of duct insulation or vapor barrier. On downstream side of each sensor, provide access doors.
- E. Pipe Sensors: Provide wells for sensors measuring temperatures in pressure vessels or in pipes. Wells shall be noncorrosive to the medium being measured and shall have sufficient physical strength to withstand the working and test pressures and velocities. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in the piping at elbows to effect proper flow across the entire area of the well. Wells may either look upstream or downstream. Provide thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material and allow for easy removal. Wells shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area. Increase piping size as required to avoid restriction.

3.3 ADJUSTMENTS

- A. Adjust controls and equipment to maintain the conditions indicated, to perform the functions indicated, and to operate in the sequence specified.

3.4 DUCT SMOKE DETECTORS

- A. The Fire Alarm Contractor shall furnish and wire duct smoke detectors. Installation shall be accomplished by the sheetmetal contractor and be wired by the Fire Alarm Contractor.

3.5 INSTRUCTING OPERATING PERSONNEL

- A. Upon completion of the work and when designated by the Architect, furnish the services of a competent technician regularly employed by the temperature control manufacturer for the instruction of Owner in the operation and maintenance of each automatic space temperature control system. The period of instruction shall be for not less than three (3) 8-hour non-concurrent working days (twenty-four (24) hours total) and shall include video tape demonstration of controllers.

3.6 FIELD INSPECTION AND TESTS

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- A. Tests shall be performed or supervised by employees of the ATC system or manufacturer of the ATC system, or by an authorized representative of the ATC manufacturer. Give Architect 14 calendar days advance written notice prior to the date of the field acceptance testing. If the Architect witnesses tests, such tests shall be subject to approval. If the Architect does not witness tests, provide performance certification.
- B. Plan for Inspections and Tests: Furnish a written inspections and tests plan at least 60 days prior to the field acceptance test date. This plan shall be developed by the manufacturer of the ATC system. The plan shall delineate the inspections and testing procedures required for the ATC system to demonstrate compliance with the requirements specified. Additionally, the test plan shall indicate how ATC system is to be tested, what variables will be monitored during test, names of individuals performing tests, and what criteria for acceptance should be used. Indicate how operation of H&V system and ATC system in each seasonal condition will be simulated.
- C. Field Acceptance Testing: Upon completion of 72 hours of continuous H&V and ATC systems operation and before final acceptance of work, test the automatic temperature control systems in service with the heating, ventilating and air conditioning systems to demonstrate compliance with contract requirements. Test controls through each cycle of operation, including simulation of each season insofar as possible. Test safety controls to demonstrate performance of required function. Adjust or repair defective or malfunctioning automatic space temperature control equipment or replace with new equipment. Repeat tests to demonstrate compliance with contract requirements.

SECTION 23 30 00

HVAC FOR DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.2 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the ductwork systems indicated.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
 - 1. Ductwork.
 - 2. Ductwork accessories.
 - 3. Air devices.
 - 4. Acoustical duct liner.
 - 5. Firestopping materials and methods.
 - 6. Louvers and dampers.
 - 7. Ductwork sealing products.
 - 8. Fabric ductwork.
 - 9. Duct supports.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Classification of Ductwork: Low pressure ductwork: up to 2" W.G. static pressure. Medium pressure ductwork: 2" to 6" W.G. static pressure. The duct pressure class shall be determined by multiplying the total static pressure scheduled in the fan schedules by 1.2.
- B. Materials: Unless otherwise indicated low pressure ductwork shall be galvanized steel. Galvanized sheet metal shall be new galvanized steel sheets of lock forming quality with zinc coating that will not flake or peel under forming operation.
- C. Construction for Low Pressure Round and Rectangular Ductwork:

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1. Material: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq.ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 2" W.G. pressure class.
 2. Fittings: Shall be constructed in accordance with SMACNA Standards and shall be of the types indicated (ONLY).
 3. Longitudinal seams shall be Pittsburgh lockseam (ONLY). Button punch snap locks are not acceptable.
 4. Joints and seams shall be sealed to SMACNA seal class B (Leakage Class 12 for rectangular ducts and Leakage Class 6 for round and flat oval ducts).
 5. Unless indicated otherwise, exhaust ductwork above the roof shall be Type 304 stainless steel construction.
- D. Construction for Spiral Seam Round and Flat Oval Ductwork:
1. Ductwork and fittings shall be United McGill Uni-seal or Uni-rib, Eastern Sheetmetal, Lindab, Semco or Monroe Sheetmetal, galvanized steel, factory fabricated, spiral lockseam or welded longitudinal seam, round or flat oval type, as indicated. Seams shall be solid welded or spot-welded and factory sealed airtight. Ducts and fittings shall be specifically designed for medium pressure application. Round or flat oval ductwork indicated as acoustically lined or double-wall (DW) shall be United-McGill Acousti-K27, double wall medium pressure construction with solid 26 gauge sheetmetal inner liner and 1" thick fiberglass insulation. Exterior ductwork shall have 3" thick insulation and aluminum shell with all joints sealed weathertight. Fittings shall be furnished with solid liners. Insulation shall be provided with thermal conductivity of 0.27 BTU/HR-°F-FT²-IN. Exposed ductwork in finished spaces specified to be painted shall be "Paint-Grip" galvanized material. Interior ductwork shall be constructed of galvanized sheetmetal. Exposed supply ductwork shall be double-wall construction with "Paint-Grip" galvanized outer shell.
 - a. Sheetmetal Gauges: Per SMACNA for listed pressure class.
 - b. Fittings: Fittings shall be machine formed type or welded multi-segment type. All seams shall be factory sealed or welded airtight. Tap offs shall be 90° conical type or 45° standard type, with smooth, machine formed entrance, designed for low pressure drop and low noise generation. 90° elbows shall be 5 piece construction (where space permits) or vaned type mitered elbow where space is restricted. Unless specifically indicated (and field-verified) as 5 piece construction, use vaned 90° elbows. Vanes shall be single thickness, solid-welded in place.
 - c. Joints on round spiral ductwork shall be slip type, coupling type, Van Stone flanges, or factory fabricated flange system type connectors, as standard with the manufacturer. Flat oval joints shall be Van Stone flanges (gasketed) or factory fabricated flange system type connectors. Joints shall be made up with joint sealer applied in strict accordance with the manufacturer's recommendations. Joint sealer shall be as recommended by the manufacturer.

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- d. Duct and fittings shall have been tested for air friction loss and leakage in an independent testing laboratory. Test results shall be submitted with the Shop Drawings for review.
 - e. External reinforcing angles shall be provided in accordance with the manufacturer's recommendations. External reinforcing angles shall be galvanized or painted with a rust inhibiting aluminum paint. Include reinforcing data with Shop Drawing submittal. Duct and reinforcing shall be designed for a positive static pressure of 6 inches of water gage.
 - f. No internal tie rod reinforcing will be allowed.
 - g. Hangers shall be of the clamp-on or trapeze type. Exposed ductwork shall use clamp-on hangers only. Holes shall not be drilled through the ducts.
- E. Acoustical duct liner for rectangular ductwork shall be Type AP Armaflex SA duct liner. The liner shall be elastomeric unicellular (closed cell) and have a thermal conductivity of 0.27 Btuh/°F.-sf-in. and be cleanable and suitable for duct velocities of 4000 FPM. Duct liner thickness shall be 1" unless indicated otherwise. The installation shall include 100% coverage of the manufacturer's recommended adhesive and protective Z-strips at all exposed upstream edges. Mechanical fasteners shall be used in addition to adhesive. Insulation shall comply with NFPA 90A and NFPA 90B and be approved by Factory Mutual.
- F. Exposed Ductwork: Interior exposed ductwork shall be "Paint-Grip" galvanized, suitable for field-painting without dents or other visible cosmetic damage.

2.2 DUCTWORK ACCESSORIES

- A. Access Doors:
- 1. Medium Pressure Duct Systems: Ruskin Model ADHP-3, 12"x12" size, 16 gauge galvanized steel, foam gasket, insulated door, spring latches.
 - 2. Low Pressure Duct Systems: Ruskin Model ADC2, 12"x12" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 2 cam locks, no hinge.
- B. Counter Balanced Dampers (CBD): Aluminum frame and blades, extruded vinyl edge seals, 2-1/4" deep, set 0.06" WG.
- C. Backdraft Dampers (BDD): Ruskin Model CBD2 or American Warming and Ventilating aluminum frame and blades, extruded vinyl edge seals, field set at 0.10" W.G. pressure differential for full open operation.
- D. Fire Dampers: Greenheck DFD-series, Ruskin Model IBD2, or Cesco, curtain type, 100% free area (ONLY), Style C for round duct installations, and Style B or ODFD type for rectangular duct applications. Fire dampers located immediately behind transfer grilles may be Style A dampers. The dampers shall be UL rated for 1-1/2 hours and have a 165°F fusible link. Fire dampers shall be "dynamic" rated and shall comply with UL "Standard for Safety" 555.

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- E. Drawbands for Flexible Ducts: Clinch type stainless steel with screwdriver adjustment, or nylon with lever action tightening tool provided by the drawband manufacturer.
- F. Turning Vanes: (Low Pressure):
 - 1. Solid blade, mounted with the long edge down stream in accordance with duct construction details indicated. Submit a 12"x12" sample elbow for review prior to fabrication.
- G. Volume Dampers:
 - 1. Factory fabricated as specified, or shop fabricated in accordance with SMACNA "HVAC Duct Construction Standards".
 - 2. Rectangular: Ruskin Model MD-35, or American Warming and Ventilating, 12 gauge galvanized steel, locking quadrant, opposed blade over 11", single blade 11" and under.
 - 3. Round: Ruskin Model MDRS25, or American Warming and Ventilating, 20 gauge galvanized steel with locking quadrant(ONLY). Dampers may be provided integral with spin-in fittings.
- H. Flexible Ductwork:
 - 1. Not allowed.
- I. Joint Sealer:
 - 1. Duro-Dyne DDS181, Design Polymerics DP 1010 water-based polymeric duct sealant, Hardcast DT tape and FTA-50 activator or Airseal #33 fiber-reinforced water-based brush-on sealer by Polymer Adhesive Sealant Systems, Inc. (UL181A-M or 181B-M labeled).
 - 2. Provide waterproof sealer where watertight seal is specified.

2.3 AIR DEVICES (Krueger, Price, Metal Aire, Titus) ONLY

- A. Material and Finishes: Construct diffusers, registers, and grilles of aluminum. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc-phosphate treated prior to priming and painting or have a baked-on enamel finish. Aluminum parts shall be finish painted. Provide frame style compatible with ceiling or wall type. Colors shall be selected by Architect. Devices to be installed on exposed duct installations shall be furnished in primer suitable for field application of color coat.
- B. **Sound Level:** Manufacturer certified sound level rating of inlets and outlets in accordance with ADC 1062 R4. Conform with the maximum permissible room / diffuser noise criteria (NC) level for each device as scheduled. Provide submittal data accordingly.
- C. Throw: Defined as distance from the diffuser, register, or grille to the point which the resultant room air velocity is 50 to 35 feet per minute.

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- D. Ceiling Diffusers: Equip with core styles required to provide air distribution pattern indicated. Internal parts shall be removable through the diffuser-neck for access to the duct and without the use of special tools. Construct each diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction. The interior elements of square and rectangular ceiling diffusers may be square or rectangular as manufacturer's standard. Screws or bolts in exposed face of frames or core elements are not acceptable. Diffusers shall have an opposed blade volume damper in the diffuser neck if no damper is indicated in the branch duct (see Drawings). Diffusers shall have a 24"x24" lay-in panel for areas with acoustical ceilings and surface-mount frame for GWB ceilings. Ceiling diffusers shall be Price AMX series, high induction type with induction vanes.
- E. Grilles and Registers: Construction and finish as indicated, 1/2" louver spacing, 45° curved blade. Registers shall have opposed-blade volume dampers with screwdriver adjuster. Unless otherwise indicated, registers shall be provided.
- F. General: The interior of all sheetmetal connections to grilles, registers and diffusers shall be painted with a non-specular flat black paint so that no sheetmetal surfaces are visible from the finished space.

2.4 FABRIC DUCTWORK (Ductsox) ONLY

- A. Material and Finishes: Fabric ductwork shall be DuctSox Model FTS with Model HIS Internal Hoop System Track or Cable Supports / Hangers. Furnish with tracks, cables and other suspension hardware as required.
- B. Furnish with adjustable directional airflow nozzles with a total maximum sound level of NC30 at full airflow.
- C. Fabric shall be Sedona-XM fire retardant polyester UL classified and NFPA90A compliant. Fabric color shall be selected by the Architect.

2.5 DUCT SUPPORTS

- A. Duct supports for exterior ductwork shall be RTS Model RTSDSFSD60, or equal, heavy duty rooftop galvanized steel duct supports, installed per the manufacturers recommendations.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
 - 2. Verify that the duct systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 INSTALLATION OF DUCTWORK AND AIR DEVICES

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- A. Provide and erect in accordance with the best practice of the trade ductwork shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Architect. Sizes given are "inside - clear" dimensions and not necessarily that of sheet metal. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards", NFPA, and the requirements of the IBC code.
- B. Joint Sealing: See PRODUCTS section.
- C. Longitudinal joints: See PRODUCTS section.
- D. Turns shall be made with long radius elbows or, if physically impossible to use long radius elbows, shall be square turns with specified turning vanes. CAUTION: Turns not conforming to this requirement shall be ordered removed and replaced with properly built turns.
- E. Access Doors: Provide access doors for concealed apparatus requiring service and inspection in the duct system including but not limited to dampers, sensors and motors, and upstream and downstream from duct coils.
- F. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Insure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
- G. Duct Supports: Unless otherwise indicated, provide one-inch wide by 16 gage galvanized steel sheet metal strips on each side of ducts. Anchor risers in the center of the vertical run to allow ends or riser free vertical movements. Attach supports only to structural framing members. Do not anchor supports to metal decking unless a means is provided (architectural review required) for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- H. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, except where fans are internally connected to the casing with flexible connectors. For round ducts, securely fasten flexible connections using stainless steel clinch-type draw-band. Nylon drawbands may be used if installed using the drawband manufacturer's lever-action tightening tool. For rectangular ducts, lock flexible connections to metal collars. All air handling equipment fan connections to the duct systems shall have flexible connections, factory or field-installed.
- I. Flexible Ducts: Provide where indicated. No fiberglass shall be exposed or in contact with air flow. Flexible duct length shall not be more than 4'-0". Install with metal band hangers and without excess length, provide maximum extension of flex duct. Securely fasten flexible ducts to metal collars using a stainless steel or tool-tightened nylon drawband on the duct core and a second drawband on the insulation vapor barrier. If the duct exceeds 12 inches diameter, position the drawband behind a bead on the metal collar. Taping in lieu of drawbands is not allowed.

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- J. Any deviation in the duct system must be submitted as a shop drawing and stamped. CAUTION: Any deviation not submitted and favorably reviewed will be ordered removed from the system and replaced with that which is shown on the Drawings.
- K. Discrepancies between actual field conditions and the Contract Documents shall be brought to the attention of the Architect prior to fabrication.
- L. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- M. Transitions with a slope greater than 4 to 1 shall be ordered removed from the system and replaced with a transition which meets this criteria.
- N. Joints and seams at intake and exhaust plenums and joints on intake and exhaust ductwork for a distance of 3 feet from the plenum shall be sealed watertight on the bottom and side joints and seams.
- O. Isolation dampers at intake and exhaust louvers and vent hoods shall be sealed to the ductwork to provide an airtight assembly with similar performance characteristics to the isolation damper.
- P. The inside of sheetmetal connections to grilles, registers and diffusers shall be painted flat black so that no sheetmetal is visible from the finished space.
- Q. All sharp edges and corners on ductwork, hangers or equipment located within 7'-0" of the finished floor shall be protected with a suitable padding material and identified with fluorescent orange paint.

3.3 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

3.4 TEST AND ADJUST

- A. Ductwork shall be leak tested in accordance with Section 23 05 93 "Testing and Balancing for HVAC". Provide end cap and closure pieces. Close off and seal openings in ductwork to be tested. Ductwork shall be tested before it is insulated.
- B. Before operating any system, the system shall be cleaned out to remove dust and foreign materials.
- C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- D. Correct defects which develop during the test period, conduct additional testing until defect free operation is achieved.

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3.5 CLEANUP AND CORROSION PREVENTION

- A. Ductwork and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to duct systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces.

3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.7 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 078400 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

* END OF SECTION *

SECTION 260000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Divisions 26, 27 and 28 Sections.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI C2 - National Electrical Safety Code.
- C. ANSI/NFPA 101 - Life Safety Code.

1.03 RELATED REQUIREMENTS

- A. Conditions of the Contract and Division 1 - General Requirements, apply to all work, including work of this Division. Examine all contract documents for requirements affecting this work.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable local, State and Federal Building Code for the State of Maine.
- B. Electrical: Conform to NFPA 70, NFPA72, NFPA 99, NFPA 101, ANSI C2, 2 FM, UL, and applicable ASTM and ANSI Standards.
- C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim shall be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.
- D. Obtain permits and request inspections by local authority having jurisdiction.

1.06 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

1.09 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. It is to be understood that drawings accompanying these specifications are intended to show general arrangement and extent of work to be done, but exact location and arrangement of all components shall be determined as work progresses. Anything shown on the drawings and not specifically mentioned in specifications or vice versa shall be considered as required in both.
- B. Locations of equipment, and materials, etc., as given on drawings are approximate unless dimensioned. It shall be understood they are subject to such modifications as may be found necessary or desirable at time of installation in order to meet any structural conditions. Such changes shall be made by the contractor without extra charges.
- C. Because of small scale drawings, all required offsets, etc., as may be required to clear work of other Contractors, may not be shown. Contractor, however, shall provide all necessary offsets, etc., as required to complete the installation of their work and not conflict with that of others.
- D. It is the intention that wiring systems shall be complete and fully operational. The contractor shall identify system components during the bid process that clearly constitute conditions that would cause the system to be incomplete. Clarification: The remedy to these discrepancies shall be communicated by the engineer to all bidders or included as an addenda.

1.10 MATERIALS AND LABOR

- A. Bidders for this work shall carefully examine the Plans and Specifications, as the Contractor shall be required to furnish all materials and labor necessary to deliver to the Owner a complete system installed in full accordance with Local State and Federal laws. The system shall be furnished as specified, tested, and turned over to the Owner in perfect operating condition.
- B. All materials shall be new and of best quality of their respective kinds. Workmanship in all respects shall be of highest grade and all construction shall be done according to best practices of the trade. Materials shall be warrantied directly by the manufacturer.
- C. Contractor shall provide, when required for review of Engineer, labeled samples of any material or equipment specified herein or proposed to be used on this project.
- D. Where words "furnish", "provide" or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install," including all materials complete with all connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to all materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or schedule information.

1.11 PROTECTION OF WORK AND MATERIALS

- A. Contractors shall be responsible for the care and protection of all materials delivered and labor performed until the completion of the work.

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- B. Cap all uncompleted lines, raceways, and ducts until ready for final connections, or future work as indicated.
- C. All portions of the work liable to damage by weather or by those engaged on the project, must be securely protected by temporary, but substantial covering which must be maintained in position until Engineer authorizes removal.

1.12 REPLACEMENTS

- A. In the event of damage to any equipment or materials, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to the Owner.

1.13 SAFETY REGULATIONS

- A. All work to be performed and/or installed shall conform to all requirements of the Occupational Safety and Health Act (OSHA) of 1970 and all Amendments thereto.

1.14 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with 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 a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work using persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and physical distortion or disfigurement.

1.15 UNDERWRITER'S APPROVALS

- A. All electrical materials and equipment shall bear label of Underwriter's Laboratories, shall be listed by them in their list of electrical fittings and shall be approved by them for purpose for which they are to be used, unless materials and equipment are of a type for which Underwriter's Laboratories does not list or provide label service.

1.16 RECORD DRAWINGS

- A. During construction, the Contractor shall keep an accurate record of all deviations to the installation of the work as indicated on the drawings. Upon completion of the work, the Contractor shall furnish a copy of this record to the Engineer, on a black line of the original

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which will be available from the Engineer. Submit record drawings before requesting final payment.

1.17 MANUFACTURERS' INSTRUCTIONS, AND OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, care, lubrication, cleaning, servicing, adjustment, etc., together with any special safety instructions.
- B. Manufacturers' data shall further include performance data (time current curves, where applicable), complete parts lists, recommended spare parts lists, and wiring diagrams.
- C. Data shall be arranged in complete sets, properly indexed and marked.
- D. Data shall include complete set of shop drawings.

1.18 EXISTING UTILITIES AND EQUIPMENT

- A. Extreme care shall be taken to protect existing utilities and equipment above and below grade and in all other locations. Information contained on drawings is not guaranteed as to location, invert, etc. but represent the best information available as to the location of underground and concealed utilities and equipment. The Contractor shall be responsible for the replacement of all damaged or broken utilities or equipment due to their work or operations.

1.19 ENERGIZING EQUIPMENT

- A. Obtain Owner's written approval before energizing any equipment.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 CONNECTION TO EQUIPMENT

- A. The Contractor shall be responsible for proper wiring and raceway connections to equipment, make sure of alignment, both initially and under operating conditions, and provide proper supports, brackets, means of expansion, etc., to make sure that no excessive stresses are applied to equipment. Raceways shall be run to the equipment and alignment checked before final bolting and fastening.
- B. At the request of the Engineer, dismantle equipment connections to demonstrate proper installation and make such corrections necessary without additional compensation for disassembly, re-connection, or the required corrective work.
- C. Equipment shall be installed in such a manner as to permit disconnecting for service and repairs without the necessity of rigging.

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3.02 CLOSING IN UNINSPECTED WORK

- A General: Do not cover up or enclose work until it has been properly and completely inspected and approved. Engineer may waive this requirement by written permission.
- B Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

3.03 CLEANING OF SYSTEMS

- A All wiring systems shall be thoroughly cleaned prior to initial operation and in accordance with manufacturer's instructions for equipment to be furnished and/or installed.
- B Furnish all detergents, solvents, cleaning compounds, tools, etc., required in connection with cleaning operations.
- C Thoroughly clean all exposed portions of all equipment, remove all labels, and wipe clean with a damp rag.

3.04 TESTING, BALANCING, AND ADJUSTING

- A Electrical loads shall be balanced on all phase legs to a tolerance of plus or minus 10 percent. Include testing circuits for shorts to ground. Measure grounding system resistance. Correct all deficiencies. Provide all test equipment.

3.05 INSTRUCTIONS

- A On completion of the job, Contractor shall provide competent technicians to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed 2 hours and be performed in a minimum of one interval. The time of instruction shall be arranged with the Owner. The Electrical subcontractor shall be present and participate in the Owner's instruction.

3.06 FIRESTOPPING

- A Firestopping shall be performed in accordance with Specification Section "Firestopping". All penetrations of fire-rated assemblies including walls and floors by electrical system components (conduits, cables, trays, etc.) shall be firestopped as specified. Coordinate size, location and type of sleeves as required by firestopping systems.

*** END OF SECTION ***

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. General Cable Technologies Corporation.
 - 2. Southwire Incorporated.
 - 3. The Okonite Company.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Metal Clad cable, Type MC.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

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2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. All conductor sizes shown on drawings are for copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal Clad Cable, Type MC.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL.
- B. Make splices, terminations, and taps that are compatible with conductor material.

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- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
- B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:

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- a. Material: Steel or die cast.
 - b. Type: Setscrew.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Metal Floor Boxes:
- 1. Material: Cast metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- J. Gangable boxes are allowed.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
- 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: GRC.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed: EMT.
 - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 4. Damp or Wet Locations: GRC.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

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- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
- Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- S. Locate boxes so that cover or plate will not span different building finishes.

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- T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- V. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF ELECTRICAL BOXES IN FIRE RATED WALLS

- A. Outlet boxes on opposite sides of the wall shall be separated as follows:
 - 1. By a horizontal distance of not less than 24 inches;
 - 2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rockwool or slag mineral wool insulation.
 - 3. By protecting both outlet boxes by listed putty pads, 3M Catalog # MPP+ or equal.
- B. Boxes exceeding 16 sq. in. must be protected by listed putty pads, 3M Catalog # MPP+ or equal.

END OF SECTION 260533