



STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION  
16 STATE HOUSE STATION  
AUGUSTA, MAINE 04333-0016

Paul R. LePage  
GOVERNOR

October 8, 2013

David Bernhardt  
COMMISSIONER

Subject: **Rockland**

Federal Project No: FBD-1834(210)

State WIN: 018342.10

**Amendment No. 1**

Dear Sir/Ms:

Make the following changes to the Bid Documents:

In the Bid Book (page 14) "NOTICE TO CONTRACTORS" **CHANGE** the bid opening date in the first sentence from "October 23, 2013" to read "**October 30, 2013**". Make this change in pen and ink.

In the Bid Book (pages 110 thru 141) **REMOVE** "SPECIAL PROVISION, SECTION 815, BUILDINGS" 32 pages dated September 20, 2013 and **REPLACE** with the attached new "SPECIAL PROVISION, SECTION 815, BUILDINGS" 41 pages dated October 7, 2013.

In the Plans, **REMOVE** sheet numbers G2 (2 of 9) GENERAL NOTES AND DESIGN CRITERIA, M1 (5 of 9), M2 (6 of 9) and M3 (7 of 9) HVAC MODIFICATIONS AND DETAILS and **REPLACE** with the attached new plan sheets.

**NOTE:** Individuals who purchased plans will be FedExed/mailed replacement sheets in the size and quantity ordered.

The following question has been received:

**Question:** Stated in the spec's that electrical is incidental to mechanical. Is that to mean the mechanical contractor is to purchase the TEKMAR Snowmelt Controller and Sensor?

**Response:** The assignment of equipment purchases by subcontractors is the responsibility of the prime contractor.

Consider this change and information prior to submitting your bid on **October 30, 2013**.

Sincerely,

George M. A. Macdougall P.E.  
Contracts & Specifications Engineer



PRINTED ON RECYCLED PAPER

SPECIAL PROVISION  
SECTION 815  
BUILDINGS  
(Interior Aluminum-Framed Glazed Partition)

All work and materials shall conform to the Contract Drawings and the provisions of the State of Maine Department of Transportation Standard Specifications, Revision December 2002, and the MaineDOT Supplemental Specifications dated July 2013, with the following additions:

ADDITIONS:

815.01 Description

The work shall consist of procuring and installing a glazed partition wall within the first bay of the steel frame work of the lobby ticketing room located inside the ferry terminal building. Installation of the aluminum framed glazed partition shall include nominal modifications and finishing to the existing sheetrock wall. In addition, a new electrical exit sign and four push-button automatic door openers shall be installed as shown on the Plans. One new door and one existing door shall receive an automatic door openers, which work in conjunction with the new push-button devices. The work shall also consist of securing building permits necessary to perform the work and meeting all state and local building codes.

815.02 General

The proposed interior glazed partition shall mimic the existing exterior glazed wall with its three doors, vertical side windows, horizontal top windows, and special-fit trapezoidal windows. All windows shall be of similar construction using interior-grade materials.

Glass windows and doors shall be of the approximate dimensions shown on the Plans and shall be constructed using aluminum frames and tempered glass. Doors shall not be lockable. The existing steel structural frame within which the proposed glazing system will be installed, does not exactly match the exterior glazing system. In addition, a new steel beam shall be installed as shown on the Plans, to reduce the size of the opening and creating a similar entryway appearance. The Contractor shall submit the design of the proposed framed entryway through the shop-drawing process to verify the dimensions and layout of the aluminum frame, doors, and windows.

The Contractor is responsible to field verify all dimensions associated with the fabrication and installation of the interior aluminum-framed entranceway. Measure all existing openings, structural members, and tolerances prior to ordering materials. The Contractor shall note that the proposed location of the framed entranceway contains a sheetrock soffit which will require modification prior to measuring the size of the framed entrance opening. Shop drawings and designs shall reflect as-built conditions prior to field installation of any materials.

815.03 Materials

The following paragraphs are added:

Installation of the interior glazed partition shall comprise but not be limited to the following:

<u>Aluminum:</u>	Sheet and Plate: ASTM B209
	Extruded Bars, Rods, Profiles, and Tubes: ASTM B221
	Extruded Structural Pipe and Tubes: ASTM B429
	Structural Profiles: ASTM B308
	Welding Rods and Bare Electrodes: AWS A5.10

Steel Reinforcement: Structural Shapes, Plates, and Bars: ASTM A36  
Cold-Rolled Sheet and Strip: ASTM A1008  
Hot-Rolled Sheet and Strip: ASTM A1011

Glazing: Tempered Insulated Glass

Gaskets: EPDM: ASTM C864  
Silicone: ASTM C1115  
Thermoplastic Polyolefin Rubber: ASTM C1115

#### 815.04 Submittals

The following paragraphs are added:

The Contractor shall submit product technical data sheets and certifications for the following items to the Resident for review and approval:

1. Aluminum Framed Entrances
2. Aluminum Windows
3. Doors, Hardware, and Miscellaneous Items
4. Glazing
5. Exit Sign
6. Automatic Push-Button Devices and Automatic Door Openers
7. Architectural design of interior aluminum-framed glazed partition (see below)

The Contractor shall submit a design package for the layout of the interior aluminum framed glazed partition signed and stamped by an architect licensed in the State of Maine. The submittal shall be submitted to the Resident for review and approval. The designer shall be proficient with the design and understanding of aluminum framed glazed systems and have a minimum of five years experience in architectural design and have designed a minimum of three aluminum framed systems in the State of Maine. The submittal shall include all shop drawing diagrams, dimension drawings, materials, and certify compliance with local building codes. Designer shall note that the existing concrete floor within the terminal lobby contains a radiant heat system within the floor; therefore, anchorage to the floor (beyond that of standard grouts or adhesives) will require coordination with the Contractor.

#### 815.05 Framed Entranceway

The following paragraphs are added:

##### Performance Requirements:

The aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

**Movements:** Aluminum frame entranceway shall be capable of accommodating movements from the supporting steel frame structure including thermal and wind effects. Thermal effect range shall be +/- 50 degrees F from an interior ambient temperature of 75 deg F.

**Wind Loads:** Positive and negative pressure of 20 psf at non-corner zones, and 31 psf at corner zones.

**Air Infiltration:** Air leakage through fixed glazing and framing areas shall be minimized through the use of appropriate seals and gaskets.

**Condensation Resistance:** Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested in accordance with AAMA 1503.

**Thermal Conductance:** Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.40 Btu/sq.ft x hr x deg F when testing in accordance with AAMA 1503.

Fabrication:

Prior to fabrication, the Contractor shall field verify opening dimensions and account for sheetrock modifications as shown on the Plans. The framed entranceway shall be fully affixed within the steel frame opening, and shall maintain a wider aluminum side frame in order to build-out the sides of the entranceway beyond that of the soffit.

Form or extrude aluminum shapes before finishing. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Framing members shall have straight profiles free of defects or deformations. Joints shall be accurately fitted with ends coped or mitered. Components shall be fabricated to provide physical and thermal isolation of glazing from framing members, and providing accommodations for thermal and mechanical movements of glazing and framing. Glazing components shall be capable of field replacement if necessary. All fasteners, anchors, and connection devices shall be concealed to the greatest extent possible.

Entrance door frames shall be reinforced as required to support loads imposed by door operation and for installing entrance door hardware. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames.

The threshold height of the framed entranceway at the door openings shall be no higher than 1/2-inch from the finished floor elevation.

Finishes:

All finishes shall match the existing finish of the exterior aluminum-framed entranceway.

Installation:

All installations shall comply with the manufacturer's written instructions. Fit joints to produce hairline joints free of burrs and distortion; rigidly secure non-movement joints. Do not install damaged components. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

Contractor shall note that the concrete slab in the terminal lobby area has an active radiant heating system located within the floor.

Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as

recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior. Set continuous sill members and flashing in full sealant bed to produce weathertight installation. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length. Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch. Limit difference between diagonal measurements to 1/8 inch. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

#### 815.06 Windows

The following paragraphs are added:

##### Performance Requirements:

The windows shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

**Air Infiltration:** Air leakage through fixed glazing and framing areas shall be minimized through the use of appropriate seals and gaskets. With ventilators closed and locked, test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf. Air infiltration shall not exceed 0.10 cfm/sq. ft. of unit.

**Water Infiltration:** Air leakage through fixed glazing and framing areas shall be minimized through the use of appropriate seals and gaskets. With ventilators closed and locked, test unit in accordance with ASTM E 331 / ASTM E547 at a static air pressure difference of 10 psf. There shall be no uncontrolled water leakage.

**Uniform Load Test:** Air leakage through fixed glazing and framing areas shall be minimized through the use of appropriate seals and gaskets. With ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 97.5 psf (4668 Pa), both positive and negative. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage that would cause the window to be inoperable.

**Condensation Resistance:** Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 42 (glass) when tested in accordance with AAMA 1503. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.

**Thermal Conductance:** Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.59 Btu/sq.ft x hr x deg F when testing in accordance with AAMA 1503. With ventilators closed and locked, test unit in accordance with AAMA 1503.1.

Fabrication:

Form or extrude aluminum shapes before finishing. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Framing components shall be mortise and tenon. Other means of mechanically fastening, i.e., screws shall not be permitted. Appearance of frame shall replicate the existing exterior aluminum frames.

Finishes:

All finishes shall match the existing finish of the exterior aluminum-framed entranceway.

Installation:

All installations shall comply with the manufacturer's written instructions. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications. Plumb and align window faces in a single plane for each wall plane, and erect windows and materials square and true. Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads. Adjust windows for proper operation after installation. Furnish and apply sealants to provide a weather tight installation at all joints and intersections and at opening perimeters. Wipe off excess material and leave all exposed surfaces and joints clean and smooth. Do not install damaged components.

Adequately anchor to maintain positions permanently when subjected to normal thermal movement, specified building movement, and specified wind loads. Contractor shall note that the concrete slab in the terminal lobby area has an active radiant heating system located within the floor.

Upon completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc.

815.07 Doors

The following paragraphs are added:

Performance Requirements:

The doors shall withstand the similar effects of the Framed Entranceway described in Section 815.05 above. In addition, the following requirements shall be achieved:

Opening: Not more than 5 lbf to fully open doors. Provide 3-second closer sweep period for doors to move from a 70-degree open position to 3-inches from the latch, measured to the leading door edge. Opening force shall be adjustable to the satisfaction of the Resident.

Fabrication:

Fabrication of the doors shall be of similar quality to that of the Windows described in Section 815.06 above. Corners shall be mechanically fastened with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods. Appearance of doors shall replicate the existing exterior aluminum doors.

Finishes:

All finishes shall match the existing finish of the exterior aluminum-framed entranceway.

Installation:

All installations shall comply with the manufacturer's written instructions. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications. Plumb and align doors within the jamb and erect doors and materials square and true. Install doors to produce smooth operation and tight fit at contact points. Do not install damaged components.

Upon completion of door installation, doors shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc.

815.08 Automatic Door Openers

The following paragraphs are added:

General:

The new interior door (on the side closest to the restrooms) to be installed within the entranceway frame, and the existing exterior door (also on the side closest to the restrooms) shall receive automatic door openers. The automatic door openers shall be wired to the push-button devices such that two buttons associated with the existing exterior door operate only the exterior door, while the two buttons associated with the new interior door operate only the interior door.

Performance Requirements:

The door openers shall open the doors to a full 90-degree opened position, using a low-energy type device complying with ASNI/BHMA A156.19. The openers shall provide 3 seconds minimum to open to backcheck, and no more than 15 lbf to stop door movement.

Finishes:

All finishes shall match the existing finish of the exterior aluminum-framed entranceway.

Installation:

All installations shall comply with the manufacturer's written instructions. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications. Plumb and align doors within the jamb and erect doors and materials square and true. Install door openers to produce smooth operation and tight fit at contact points. Do not install damaged components.

Upon completion of door opener installation, doors shall be inspected, adjusted, put into working order and left clean, free of labels, dirt, etc.

### 815.09 Push-Button Devices

The following paragraphs are added:

#### Finishes:

Push button devices shall be stainless steel and enclosed in a weatherproof box.

#### Installation:

All installations shall comply with the manufacturer's written instructions. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications. Do not install damaged components.

Push buttons shall be located at the positions shown on the Plans. Metallic conduits shall be installed in locations where wiring is exposed (either interior or exterior openers). Wiring shall be routed from the push button device to the breaker panel in the Utility Room.

At the entrances to the restrooms, the Contractor shall install new trim boards in order to build-out the mounting surfaces for the push-button devices. Conduits and wiring may be housed in the block-out space as shown on the Plans. Interior trim boards, both new and existing at the restroom entrance, shall all be painted a color similar to that of the existing boards.

### 815.10 Exit Sign

The following paragraphs are added:

#### Description:

The exit sign shall match the general shape, dimensions, and finish of the existing exit sign currently present above the exterior aluminum-framed entranceway.

#### Installation:

All installations shall comply with the manufacturer's written instructions. Use only skilled tradesmen with work done in accordance with approved shop drawings and specifications. Do not install damaged components.

The exit sign shall be located at the position shown on the Plans. Metallic conduits shall be installed in locations where wiring is exposed. Wiring shall be routed from the exit sign to the breaker panel in the Utility Room.

### 815.11 Soffit Modifications

The following paragraphs are added:

#### General:

Installation of the framed entranceway will require modification to the existing soffits along both side walls of the lobby ticketing area. See as-built Plans for existing details. Removal of the existing soffits shall be limited so as to reduce the amount of rework after installation of the framed entranceway, yet sufficient to prevent any excessive heat from affecting the existing building materials.



The contractor shall take precautions to prevent adjacent wall studs and or insulation from secondary heating due to the welding operations as part of the installation of the tube steel beam. Precautions and preventive measures shall be considered incidental to this pay item.

Finishes:

The soffits shall be reconstructed in-kind using similar materials and finishes. Where necessary, additional wood framing may be added to support sheetrock and/or new trim boards.

815.12 Glazing

The following paragraphs are added:

Performance Requirements:

The glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

Fabrication:

Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

Finishes:

All glazing shall be fully tempered glass.

815.13 Structural Steel Beam

The following paragraphs are added:

The structural steel beam shall be fabricated, delivered, and erected in accordance with Section 504, Structural Steel, of the MaineDOT Standard Specifications.

815.20 Method of Measurement

Interior Aluminum-Framed Glazed Partition will be measured by the lump sum completed and installed in accordance with the Plans and these Specifications. All materials and accessories incidental to the Interior Aluminum-Framed Glazed Partition including but not limited to frames, windows, doors, hardware, perimeter anchorages including floor attachments, changes to and finishing of modified walls, testing, and design shall be incidental to this pay item.

The structural steel beam shall not be measured herein, but rather shall be measured under the respective structural steel and coating pay items.

815.21 Basis of Payment

Interior Aluminum-Framed Glazed Partition will be paid for at the lump sum Contract price which shall be full compensation for all materials, tools, equipment, labor, and all incidentals necessary for the

installation of frames, windows, doors, hardware, perimeter anchorages including floor attachments, and changes to and framing of modified walls to the satisfaction of the Resident.

The structural steel beam shall not be measured for payment herein, but rather shall be paid for under the respective structural steel and coatings pay items.

Payment will be made under:

<u>Pay Item</u>		<u>Pay Unit</u>
815.655	Interior Aluminum-Framed Glazed Partition	Lump Sum

SPECIAL PROVISION  
SECTION 815  
BUILDINGS  
(Plumbing)  
CSI Section 22 00 00

All work and materials shall conform to the Contract Drawings and the provisions of the State of Maine Department of Transportation Standard Specifications, Revision December 2002, and the MaineDOT Supplemental Specifications dated July 2013, with the following additions:

ADDITIONS:

815.61 Plumbing

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. The drawings and the specifications including Section 815 (CSI Section 230500) "Common Work Results for HVAC" 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 provide a complete and functional plumbing system.
- B. Work shall be in accordance with the current edition of the Maine Internal Plumbing Rules and applicable local ordinances.

1.3 SUBMITTALS

- A. Substitutions: None allowed.
- B. Information for the following products shall be submitted by the Contractor in accordance with MaineDOT Specifications and Special Provision 105.7.4 of these contract documents:
  - 1. Piping materials.
  - 2. Valves.
  - 3. Pipe hangers.
  - 4. Hybrid Water Heater and Accessories.
  - 5. Miscellaneous equipment.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Domestic Water Piping and Condensate Drain Piping: Type L hard copper tubing and cast bronze or wrought copper solder fittings, lead-free solder, "Permalynx" push-to-connect fittings by Victaulic, "Installation-Ready" grooved joint couplings by Victaulic, or "Flowguard Gold" by Noveon or Watts "SeaTech" Quick-Connect type, Schedule 40 solvent-welded CPVC pipe and fittings, or approved equal. CPVC pipe and fittings shall be rated at 100 psig at 180°F. and shall meet or exceed the requirements of ASTM D2846, the IBC, and be certified by the ANSI/NSF for potable water applications. Installation, including supports, shall be per the manufacturer's recommendations.
- B. Push-to-Connect Fittings: ASME B16.22 wrought copper or ASME B16.18 cast bronze, with stainless steel internal components and EPDM seals, rated to a maximum +230°F. at 200 psig operating pressure, Victaulic "Permalynx".
- C. Solder: Lead-free (ONLY), Englehard Silvacore 100, 440°F melting point, ASTM B32.

### 2.2 VALVES AND ACCESSORIES

- A. General Service Ball Valves: Apollo Model 77-100 (threaded) or 77-200 (solder), Victaulic PL-300 (push-to-connect), or Nibco, bronze body, full port, with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B, or approved equal. Blowout proof stem, reinforced PTFE seal. Sizes 2" and larger shall have threaded ends. Provide lever or tee handle with stem extension as required to allow operation without interfering with pipe insulation. For CPVC piping systems (ONLY), ball valves shall be Hayward, or approved equal, "True Union Ball Valves", full port design, Corzan PVC construction with Viton or EPDM seals and tee handle.
- B. Check Valves: Horizontal Swing, MSS SP-80, Type 3, Class 125.
- C. Drain Valves: Provide ball valves with 3/4" hose connection and brass cap and chain.
- D. Temperature and Pressure Relief Valves: Bronze body, tested under ANSI Z21.22, AGA and ASME rated, 125 psig/210°F relief settings.

### 2.3 VALVES (CPVC Piping Systems)

- A. Ball Valves: Spears, CEPEX, IPEX, Nibco or Plast-O-Matic, or approved equal, CPVC, 150 psig at 73°F. pressure rating.
- B. Check Valves: Spears, Hayward Industrial or Nibco, or approved equal, CPVC, 150 psig at 73°F. pressure rating.

### 2.4 PIPE HANGERS

- A. Adjustable Swivel Hangers:
  - 1. Pipe sizes 2" and less: Carpenter and Paterson Fig. 800, oversize for insulated piping systems.

2. Pipe sizes larger than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 CT, or Cooper B-Line, copper plated for copper piping, Fig. 126 for iron and PVC piping.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

## 2.5 HYBRID WATER HEATER

- A. **(EWH)** The hybrid electric water heater shall be AO Smith, State, Bradford-White, or approved equal, with performance and capacities as scheduled, heat pump with back-up electric elements, operating on electricity.
  1. The water heater shall be a combination air to water heat pump and electric resistance heater. The refrigerant circuit shall use R134A. An LCD control panel and touchpad shall monitor and control unit functions and provide access to setpoints. The display shall be backlit. The setpoint shall be 120F. Route the condensate drain to a floor drain.
  2. The tank shall be insulated with 2" thick foam insulation. Furnish with isolation valves and pressure relief valve. The unit shall have a 5 year parts warranty in commercial service. Units shall be CSA listed and be certified by the Uniform Plumbing Code and the NSF.

## 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 plumbing may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

### 3.2 INSTALLATION OF PIPING

- A. 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 Engineer.
- B. 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 Engineer.
- C. Piping shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions.

- D. Install unions to facilitate removal of equipment. Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)
- E. Copper pipe shall be reamed to remove burrs.
- F. Connections between copper and steel piping shall be made with brass fittings.
- G. Solder joints shall be made with lead free 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. Caution: Lead-bearing solder is not permitted.

3.3 PIPE HANGERS

- A. Impact driven studs are prohibited.
- B. Copper Tubing: supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	8'	3/8"
1-1/2"	8'	3/8"
2"	10'	3/8"

- C. Cast Iron Pipe: Supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Cast Iron Size	Hanger Intervals	Rod Sizes
1-1/2"	5'	3/8"
2"	5'	3/8"
2-1/2"	5'	1/2"
3"	6'	1/2"
4"	7'	5/8"

- D. PVC Pipe: Supported at 4-foot intervals.
- E. Verticals: Supported by use of clamp hangers at every story height, and at not more than 6 feet intervals for copper piping 1-1/4" and smaller size.

3.4 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and review, uncover the work as required for the test and review. After review, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Engineer and at no additional cost to the Owner.

3.5 DISINFECTING

- A. After the entire potable water system is completed, cleaned and tested, and just before the building is ready to be occupied, disinfect the system as follows: After flushing the mains, introduce a water and chlorine solution for a period of not less than three hours before final flushing of the system.

3.6 TESTS

- A. Water piping shall be tested to a pressure of 100 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two pounds per square inch. Leaks shall be repaired and system retested. Notify Engineer 24 hours before test is to be performed.

PART 4 - MEASUREMENT AND PAYMENT

- 4.1 METHOD OF MEASUREMENT: Plumbing will be measured by the lump sum, and shall include all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications.

- 4.2 BASIS OF PAYMENT: Plumbing shall be full compensation for all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications. Plumbing will not be paid for separately but rather will be considered incidental to the Pay Item listed below. See Special Provision 102, Notice to Contractor Regarding Arrangement of Pay Items for Heating Improvements, for a list of other construction elements to be included in the Pay Item.

- A. Payment will be made under the following Pay Item:

<u>Pay Item</u>		<u>Pay Unit</u>
815.795	Heating Improvements	Lump Sum

SPECIAL PROVISION  
SECTION 815  
BUILDINGS  
(Heating, Ventilating, and Air Conditioning)  
CSI Section 23 00 00

All work and materials shall conform to the Contract Drawings and the provisions of the State of Maine Department of Transportation Standard Specifications, Revision December 2002, and the MaineDOT Supplemental Specifications dated July 2013, with the following additions:

ADDITIONS:

815.62 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. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. The drawings and the specifications including Section 815 (CSI Section 230500) "Common Work Results for HVAC" are hereby made a part of the work of this section.

1.3 SUBMITTALS

- A. Substitutions: None allowed.
- B. Information for the following products shall be submitted by the Contractor in accordance with MaineDOT Specifications and Special Provision 105.7.4 of these contract documents:
  - 1. Piping materials.
  - 2. Fittings for steel pipe.
  - 3. Hangers.
  - 4. Piping, valve and equipment identification.
  - 5. Valves.
  - 6. Hydronic specialties.
  - 7. Air-to-Air Heat Pumps.
  - 8. Cabinet unit heaters.
  - 11. Variable Refrigerant Volume System (VRVS).
  - 12. Vibration isolation and sound attenuation.
  - 13. Firestopping materials and methods.



## 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 threaded joints and malleable iron fittings (2½" pipe size and under). Pipe sizes 3" and over shall be butt-welded with flanged connections. Hot water piping 2" and smaller may be Type L hard copper tubing with lead-free soldered joints. 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 Schedule 40 CPVC (solvent-welded).

### 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. 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™.

### 2.3 HANGERS

- A. Adjustable Swivel Hanger: Pipe Sizes 2" and Less: Carpenter and Paterson Fig. 800 conforming to MSS-SP-58, Cooper B-Line, or approved equal, 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 or Cooper B-Line, conforming to MSS-SP-58, provide copper plated clamps on copper pipes.

### 2.4 VALVES

- A. Ball Valves: Victaulic PL-300 (push-to-connect) and Series 589/569 (Vic-Press), Apollo 70-100 Series (threaded) or 77-200 (solder), Watts, or Milwaukee, or approved equal, bronze, brass or stainless steel body, full 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, Watts, Milwaukee, Redline, or approved equal, bronze body Fed. Spec. WW-V-54, wedge disc, rising stem, screwed connection for steel pipe, sweat connection for copper tube, 150-pound class.

## 2.5 PIPING, VALVE AND EQUIPMENT IDENTIFICATION

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

Hot Water Supply Piping, Hot Water Return Piping.  
Refrigerant 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.
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 815, Plumbing (CSI Section 22 00 00) and when completed this work shall have been done sequentially.

## 2.6 HYDRONIC SPECIALTIES

- A. Thermometers: Weiss Instruments Model DVU35, solar-operated, Tel-Tru, Terrice or Ashcroft, or approved equal, 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 <sup>0</sup>F. Accuracy shall be +/- 1% of the displayed value or 1<sup>0</sup>, 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, or approved equal, 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. Strainers: Victaulic Style 732 / W732 (grooved ends), Watts Model 77S, MIL-S-16293, or Nibco, or approved equal, 150 psig minimum rating wye strainers, ductile, cast iron or bronze body, 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.
- D. Automatic Air Vents: Armstrong No. 1-AV, Bell and Gossett, Thrush, or approved equal, 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.
- E. 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.
- F. Temperature and Pressure Test Ports: Peterson Equipment Co. Model 110 "Pete's Plugs" temperature and pressure test capability, brass body, 1/4" NPT fitting, Nordel valve cores, 275°F maximum temperature, 500 psig maximum pressure. Provide with (1) pressure and temperature test kit.
- G. Automatic Flow Control Valves: Flow Design, Inc., Autoflow Model AC (up to 2") and Model WS (larger than 2"), Griswold, Hays, or approved equal. The valves shall be factory set to maintain the specified flow rates within +/- 5% over an operating range of 2-32 psid. Each valve shall have a five (5) year warranty and free first year cartridge exchange. The internal wear surfaces of the valve cartridge shall be electroless nickel or stainless steel. The valve body shall be forged brass and permanently marked with the flow rate and spring range. Minimum pressure and temperature ratings shall be 400 psig at 250°F. Valve accessories shall include a union and pressure and temperature test ports. Installation shall be in accordance with the manufacturer's recommendations. The ball valve shall have a teflon packing, brass packing nut and blowout-proof stem, large diameter plated ball and a full size steel handle with vinyl grip. Provide an automatic flow control valve for each terminal heating unit as indicated on the drawings.

## 2.7 CABINET UNIT HEATERS

- A. Construction:
  - 1. Cabinet unit heaters shall be manufactured by the Trane Co., Sterling, Vulcan or American Air Filter, or approved equal. Unit configuration shall be inverted airflow, wall-mounted or floor-mounted as indicated. Cabinets shall be surface-mounted, semi-recessed or fully recessed, as indicated. Coils shall be copper tube mechanically expanded into aluminum fins and pressure rated at 200 psig at 250°F. Fans shall consist of multiple squirrel cage blowers on a common shaft. Coils shall be certified in accordance with ARI Standard 410. Casings shall be galvanized steel. Cabinets

shall be finish painted in a factory-applied baked enamel with color selection by the Architect.

2. Furnish units with a 3-speed fan switch, disconnect switch and throwaway dust filter (with 2 spare sets per unit).

B. Performance:

1. Performance and capacity shall be as scheduled.

## 2.8 VARIABLE REFRIGERANT VOLUME HEAT PUMP SYSTEMS

- A. The Variable Refrigerant Volume Heat Pump systems shall be Mitsubishi “HyperHeat”, LG, Fujitsu, Daikin, or approved equal, with capacities and performance as scheduled, Variable Refrigerant Flow, R410A, 2 pipe heat pumps with inverter driven compressors, ceiling cassette or wall mounted indoor units, as indicated with outdoor units. Furnish each unit with a wired wall-mounted simple controller, Mitsubishi Model PAC-YT51CRB, or equal. Cooling capacity shall be as scheduled with entering conditions of 75°F. EDBT, 67°F. EWBT and 95°F. ambient. The indoor units shall operate on 208V. and the outdoor units shall operate on 208V.-3 phase power. Furnish with **integral “Maxi-Blue” or “Mini-Blue”** condensate pumps by Charles Austen Pumps, LTD, or Aspen Model ASP-MW-230, size as required, condensate overflow safety switches, refrigerant piping, pipe insulation, wiring and condensate piping as recommended by the manufacturer. Furnish with wired Model AG-150 central controller(s). The heat pumps shall be suitable for heating operation down to -10°F. outside ambient and cooling operation down to 23°F. outside ambient. Indoor units shall be wall-mounted or ceiling cassette type, as indicated.
- B. The units shall be suitable for the refrigerant line lengths and arrangement indicated. Outdoor units shall be set on the ground (as indicated). Ground-mounted units shall be mounted on a 6” high reinforced concrete pad with gravel base. The indoor units shall be piped in an aesthetically pleasing manner with a minimum of exposed piping. Exposed interior piping shall have a finished molded PVC cover. Installation shall be per the manufacturers recommendations with all necessary accessories and options.
- C. Furnish with a central controller(s) to display and control unit functions remotely. Provide start-up services by an authorized representative of the manufacturer. Indoor and outdoor units shall have a corrosion resistant coating, suitable for marine environments.
- D. The Contractor shall provide a three (3) year written service agreement for the heat pump equipment and components. The agreement shall include a minimum of one (1) site visit each year, servicing and inspection of the equipment, a review of system operation with Owner personnel, training, and replacement / repair of any defective components during the course of the three year period. The site visits shall be coordinated with the Owner and shall occur during the heating / cooling changeover period.

## 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 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 or welded 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.
- J.

Steel Piping 2½" 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 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 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. Victaulic Joints (Hot Water Piping Only):
- 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 or dielectric 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 1-1/2" 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.
- N. 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.
- O. 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.
- P. 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 manufacturer's 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.
- Q. Automatic Air Vents: Shall be installed with a manual isolation ball valve. The vent discharge shall be piped to a local floor drain.
- R. Refrigeration Piping:
  1. Provide and install refrigeration piping, hangers, and accessories as specified and required. The piping installation shall be performed by a qualified refrigeration mechanic under the direct supervision of the equipment manufacturer. Submit records of tests.
  2. Refrigeration piping shall be Type ACR copper tube with brazed joints, nitrogen-charged equal to BCUP-2 Classification of American Welding Society.



3. The refrigeration system shall be tested as follows:

High pressure Side	300 psi
Low Pressure Side	150 psi
4. Support risers, offsets, and equipment, in an acceptable manner.
5. Piping shall be installed to meet Codes and regulations, applicable to the installation and in accordance with the best practice of the trade. Brazing shall be accomplished while sweeping piping with nitrogen.
6. Refrigerant accessories shall include required valves and fittings to provide a complete installation. Refrigerant suction piping shall be insulated with 3/4" thick Armaflex Type AP, or equal, elastomeric unicellular insulation. Exterior insulation shall have .032" thick circumferentially corrugated aluminum jacketing by Childers, UV-resistant PVC, or approved equal.
7. Parts of the system not factory charged and field installed piping of components shall be evacuated to within .10 MM/Mercury of a perfect vacuum. Break the vacuum to 0 psig with oil-free nitrogen before charging. Hold vacuum overnight for leak test.
8. Provide complete charges of refrigerant and oil to be maintained for the guarantee period.
9. Elbows shall be long radius.
10. The installation shall be in accordance with the above, with equipment manufacturer's instructions, and with established recommended practices.
11. System installation shall include the following:
  - a. Pitch lines down in direction of flow a minimum of 1/2 inch per 10 feet.
  - b. Trap suction risers as verified with the equipment manufacturer.
  - c. Provide service valves on liquid and suction piping at air cooled condensing units.
  - d. Maximum filter-dryer pressure drops:  
1 psi for liquid line filter-dryer.
  - e. Liquid line solenoid valve on each refrigeration circuit.
  - f. Thermal expansion valve on each refrigeration circuit.

### 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.
- F. 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.

### 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.
- F. Base-mounted pumps shall have the impellers trimmed to match system design parameters as determined by the Balancing Contractor.

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 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.

3.8 FIRESTOPPING

- A. All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

PART 4 - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT: Heating, Ventilating, and Air Conditioning will be measured by the lump sum, and shall include all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications.

4.2 BASIS OF PAYMENT: Heating, Ventilating, and Air Conditioning shall be full compensation for all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications. Heating, Ventilating, and Air Conditioning will not be paid for separately but rather will be considered incidental to the Pay Item listed below. See Special Provision 102, Notice to Contractor Regarding Arrangement of Pay Items for Heating Improvements, for a list of other construction elements to be included in the Pay Item.

- A. Payment will be made under the following Pay Item:

<u>Pay Item</u>		<u>Pay Unit</u>
815.795 Heating Improvements		Lump Sum

SPECIAL PROVISION  
SECTION 815  
BUILDINGS  
(Common Work Results for HVAC)  
CSI Section 23 05 00

All work and materials shall conform to the Contract Drawings and the provisions of the State of Maine Department of Transportation Standard Specifications, Revision December 2002, and the MaineDOT Supplemental Specifications dated July 2013, with the following additions:

ADDITIONS:

815.63 Common Work Results for HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

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.

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 site and examine the existing conditions prior to submitting a bid.

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 MaineDOT Standard Specification.

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:

- American Society for Testing and Materials (ASTM)
  - Underwriters' Laboratories, Inc. (UL)
  - Air Moving and Conditioning Assoc. (AMCA)
  - 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

### 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.

#### 3.3 SLEEVES AND PREPARED OPENINGS

- A. Perform core-drilling, cutting, patching and setting of sleeves, frames, framing and lintels for openings associated with mechanical work. Coordinate placement of 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.

#### 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 fans, 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 unless the starter is an integral part of a factory packaged item of equipment. Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters 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:

<u>MOTOR HORSEPOWER</u>	<u>PERCENTAGE EFFICIENCY</u>		
	<u>(1200RPM)</u>	<u>(1800 RPM)</u>	<u>(3600 RPM)</u>
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.**

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.
- 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. 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.

PART 4 - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT: Common Work Results for HVAC will be measured by the lump sum, and shall include all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications.

4.2 BASIS OF PAYMENT: Common Work Results for HVAC shall be full compensation for all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications. Common Work Results for HVAC will not be paid for separately but rather will be considered incidental to the Pay Item listed below. See Special Provision 102, Notice to Contractor Regarding Arrangement of Pay Items for Heating Improvements, for a list of other construction elements to be included in the Pay Item.

A. Payment will be made under the following Pay Item:

<u>Pay Item</u>		<u>Pay Unit</u>
815.795	Heating Improvements	Lump Sum

SPECIAL PROVISION  
SECTION 815  
BUILDINGS  
(Instrumentation and Controls for HVAC)  
CSI Section 23 09 00

All work and materials shall conform to the Contract Drawings and the provisions of the State of Maine Department of Transportation Standard Specifications, Revision December 2002, and the MaineDOT Supplemental Specifications dated July 2013, with the following additions:

ADDITIONS:

815.64 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 local direct digital control (DDC) system with 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 control-related components and devices and associated interlock wiring furnished and/or required by the packaged HVAC equipment manufacturers for a complete, seamless installation meeting all Sequence of Operations and Systems Points Lists as specified in this Section 230900, including sensors, controllers, valves, etc. Coordinate with the respective equipment manufacturers. Wiring shall be in accordance with the specifications and NFPA 70, National Electrical Code. See "System Input-Output Summary" for additional requirements and information, if applicable.
- 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 automatic temperature controls system shall be provided and installed by trained control mechanics regularly employed in the installation and calibration of ATC equipment by the manufacturer of such equipment. Control installation by any Contractor whose principal business is not direct manufacture and installation is prohibited.

1.2 ACCEPTABLE MANUFACTURERS / INSTALLERS

- A. Iworx.
- B. Reliable.
- C. Honeywell.
- D. Johnson.
- E. Maine Controls.

### 1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- A. The drawings and the specifications including Section 815 (CSI Section 230500) "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 815, HVAC (CSI Section 23 00 00).
- C. Work of this Section requiring equipment associated with a complete, seamless installation with the ATC System meeting all Sequence of Operations and Systems Points Lists as specified in Section 815 (CSI Section 230900), Instrumentation and Controls for HVAC shall be the responsibility of the General Contractor and /or the equipment manufacturers.

### 1.4 SUBMITTALS

- A. Substitutions: None allowed.
- B. Information for the following products shall be submitted by the Contractor in accordance with MaineDOT Specifications and Special Provision 105.7.4 of these contract documents:
  - 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.
  - 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.
- C. Experience: Submit a list of a minimum of fifteen (15) projects that include the control system components and software. Provide software licenses as applicable.

## 1.5 WARRANTY

- A. The automatic temperature control system shall have a **one (1) 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, or approved equal.
  - 2. Modulating Dampers: All modulating dampers shall be of the opposed blade type.
  - 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 approved 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 way 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.
- 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 or Kele, 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 SEQUENCE OF CONTROL

- A. Provide and install electronic/electric DDC components to enable the mechanical system to operate in the following sequences:
1. **VRFS Heat Pumps:**
    - a. Occupied Mode:
      - 1) The units shall operate to maintain the heating / cooling setpoints.
      - 2) Room Temperature Control: A room sensor shall control the unit heating and cooling functions by interfacing with the unit controls.
      - 3) The units shall also operate from their packaged control system. Coordinate with the equipment manufacturer and provide wiring as required.
    - b. Unoccupied Mode:
      - 1) The units shall operate to maintain a reduced heating setpoint during scheduled “unoccupied” periods.
      - 2) Occupied/unoccupied mode shall be determined and scheduled by the VRFS central controller.
  2. Snowmelt System:
    - a. Provide a Tekmar Model 665 snowmelt controller and ice-snow sensor or approved equal to operate the snowmelt system in conjunction with the existing outside temperature sensor.
  3. Cabinet Unit Heater:
    - a. On a call for heating by the room sensor, the fan shall operate subject to the pipe mounted aquastat (set at 100°F.) to satisfy the heating setpoint (68°F). The 2-way control valve shall open on a call for heat.
  4. Energy Recovery Ventilators (**Existing**):
    - a. Provide a programmable 7 day electronic time switch to control the unit to operate continuously during occupied periods and remain off during unoccupied periods.

## 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 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 Siemens technician regularly employed by the temperature control manufacturer (Siemens) for the instruction of the Owner in the operation and maintenance of each automatic space temperature control system. The period of instruction shall be for not less than two (2) 4-hour non-concurrent periods (eight (8) hours total) and shall include video tape demonstration of controllers.

### 3.6 FIELD INSPECTION AND TESTS

- 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 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.

## PART 4 - MEASUREMENT AND PAYMENT

- 4.1 METHOD OF MEASUREMENT: Instrumentation and Controls for HVAC will be measured by the lump sum, and shall include all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications.

- 4.2 BASIS OF PAYMENT: Instrumentation and Controls for HVAC shall be full compensation for all labor, materials, incidentals, and equipment necessary to satisfactorily complete the work in accordance with the Plans and Specifications. Instrumentation and Controls for HVAC will not be paid for separately but rather will be considered incidental to the Pay Item listed below. See Special Provision 102, Notice to Contractor Regarding Arrangement of Pay

Items for Heating Improvements, for a list of other construction elements to be included in the Pay Item.

A. Payment will be made under the following Pay Item:

<u>Pay Item</u>	<u>Pay Unit</u>
815.795 Heating Improvements	Lump Sum

**GENERAL NOTES:**

1. THESE DRAWINGS FORM PART OF THE CONTRACT DOCUMENTS AND SHALL BE WORKED IN CONJUNCTION WITH THE CONTRACT SPECIFICATIONS.
2. ALL DIMENSIONS AND CONDITIONS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO THE START OF WORK. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE RESIDENT BEFORE ORDERING MATERIALS AND PROCEEDING WITH THE AFFECTED PARTS OF THE PROJECT.
3. THE EXACT SIZE AND LOCATION OF ALL EXISTING UTILITIES SHALL BE FIELD VERIFIED BY THE CONTRACTOR. CARE SHALL BE TAKEN TO PROTECT ANY UTILITIES PRESENT AND ALL CONSTRUCTION SHALL BE COORDINATED WITH THE RESIDENT.
4. IT IS CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE CONSTRUCTION MEANS AND METHODS TO ENSURE THE INTEGRITY OF THE EXISTING FACILITIES, AS WELL AS THE SAFETY OF TERMINAL EMPLOYEES AND THE GENERAL PUBLIC DURING DEMOLITION AND CONSTRUCTION ACTIVITIES. THIS INCLUDES THE USE OF TEMPORARY BARRIERS, ENCLOSURES, AND SIGNAGE TO CLEARLY DEMARK CONSTRUCTION ZONES AND PREVENT DEBRIS FROM LEAVING THE CONSTRUCTION AREA.
5. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO PROVIDE AND MAINTAIN ENVIRONMENTAL CONTROLS AS REQUIRED BY FEDERAL, STATE, AND MUNICIPAL REGULATIONS AND PERMITS. ENVIRONMENTAL CONTROLS SHALL INCLUDE BUT NOT BE LIMITED TO NOISE, LIQUIDS, AND DUST.
6. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO FOLLOW APPLICABLE FEDERAL, STATE, AND MUNICIPAL REGULATIONS INCLUDING THE FEDERAL DEPARTMENT OF LABOR, SAFETY, AND HEALTH; AMERICANS WITH DISABILITIES ACT.
7. THE CONTRACTOR MAY BE CHARGED ANY ADDITIONAL COST OF REINSPECTION OR RETEST WHEN PRIOR TO REJECTION MAKES REINSPECTION OR RETEST NECESSARY.
8. DRAWING PLAN VIEWS WITH SCALES ARE INTENDED FOR FULL SIZE 22x34-INCH DRAWINGS.

**DEMOLITION NOTES:**

1. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY DAMAGE DONE TO THE EXISTING FACILITIES.

**ABBREVIATIONS:**

AC	AIR CONDITIONING
BLDG	BUILDING
CIP	CAST-IN-PLACE
CJR	CLEAR
CY	CUBIC YARD
DIA	DIAMETER
EA	EACH
EF	EACH FACE
EL	ELEVATION IN FEET
EW	EACH WAY
FS	FAR SIDE
GWB	GYPSUM WALL BOARD
HDB	HOT DIPPED GALVANIZED
HSS	HOLLOW STRUCTURAL SECTIONS
ID	INSIDE DIAMETER
K (KIP)	1000 POUNDS
LBS	POUNDS
LF	LINEAR FEET
MAX	MAXIMUM
MIL	.001 INCHES
MIN	MINIMUM
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	ON CENTER
PSF	POUNDS PER SQUARE FOOT
REF	REFERENCE
REQD	REQUIRED
SF	SQUARE FEET
SS	STAINLESS STEEL
STD	STANDARD
TEMP	TEMPORARY
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED

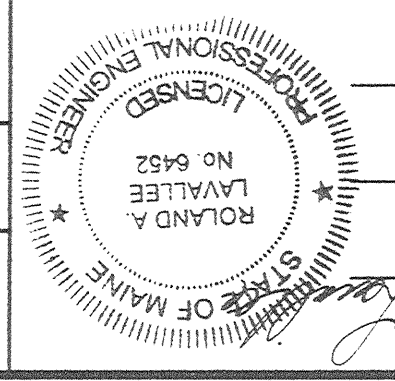
**LEGEND:**

R	PLATE
C	CENTER LINE
#6	REINFORCING BAR SIZE
12.22	SPOT ELEVATION (FEET)
+	PROJECT BENCHMARK
⊕	FIRE HYDRANT
⊗	UNDERGROUND ELECTRIC BOX
⊙	EXISTING LIGHT POLE
⊖	SANITARY MANHOLE
⊘	WATER GATE
⊚	CATCH BASIN
⊛	DRAIN MANHOLE
⊜	MANHOLE
⊝	TELEPHONE MANHOLE
⊞	ELECTRICAL MANHOLE
⊟	EXISTING CHAIN LINK FENCE
⊠	PROPOSED CHAIN LINK FENCE
⊡	TEMPORARY CHAIN LINK FENCE
⊢	JERSEY BARRIER WITH CHAIN LINK FENCE
⊣	GUARD RAIL
⊤	OVERHEAD ELECTRIC
⊥	UNDERGROUND ELECTRIC
⊦	SANITARY SEWER
⊧	STORM DRAIN
⊨	TELEPHONE
⊩	WATER
⊪	GAS
⊫	OVERHEAD SANITARY SEWER
⊬	OVERHEAD WATER
⊭	CURBING
⊮	CONCRETE
⊯	SAND
⊰	STEEL

**ROCKLAND FERRY TERMINAL  
HVAC IMPROVEMENTS  
GENERAL NOTES AND  
DESIGN CRITERIA**

SHEET NUMBER  
**G2**  
2 OF 9

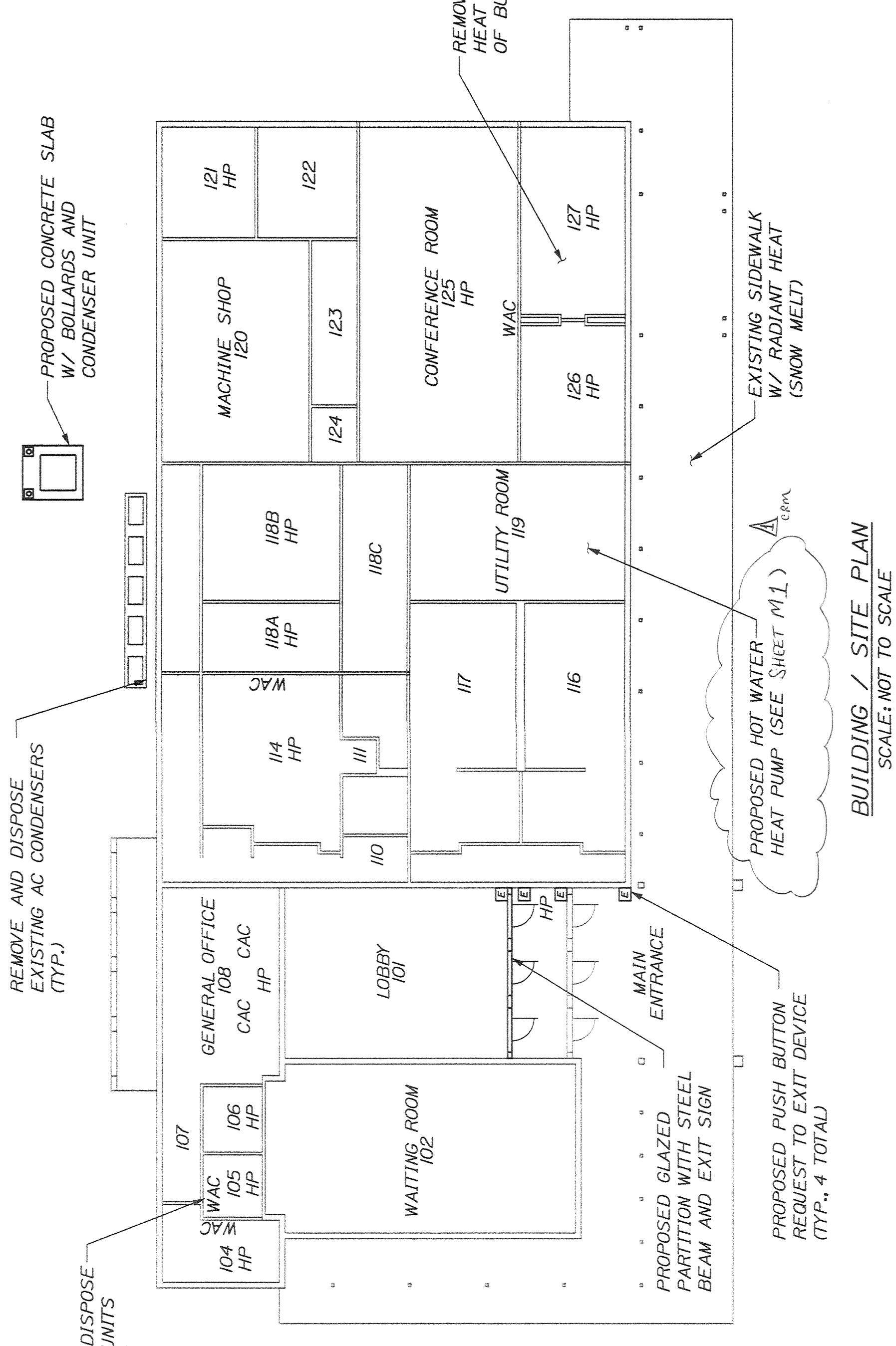
PROJ. MANAGER	DATE	BY	DATE
DESIGN-DETAILED			
CHECKED-REVISED			
DESIGN-DETAILED			
REVISIONS 1	APPROVED BY #1	DATE	
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			



SIGNATURE  
DATE  
P.E. NUMBER  
9/17/13

STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION  
FBD -1834 (210)  
WIN  
018342.10

**NOTES:**  
1. MECHANICAL AND ELECTRICAL RUNS AND CONDUITS NOT SHOWN FOR CLARITY. SEE MECHANICAL SHEETS FOR DETAILS.

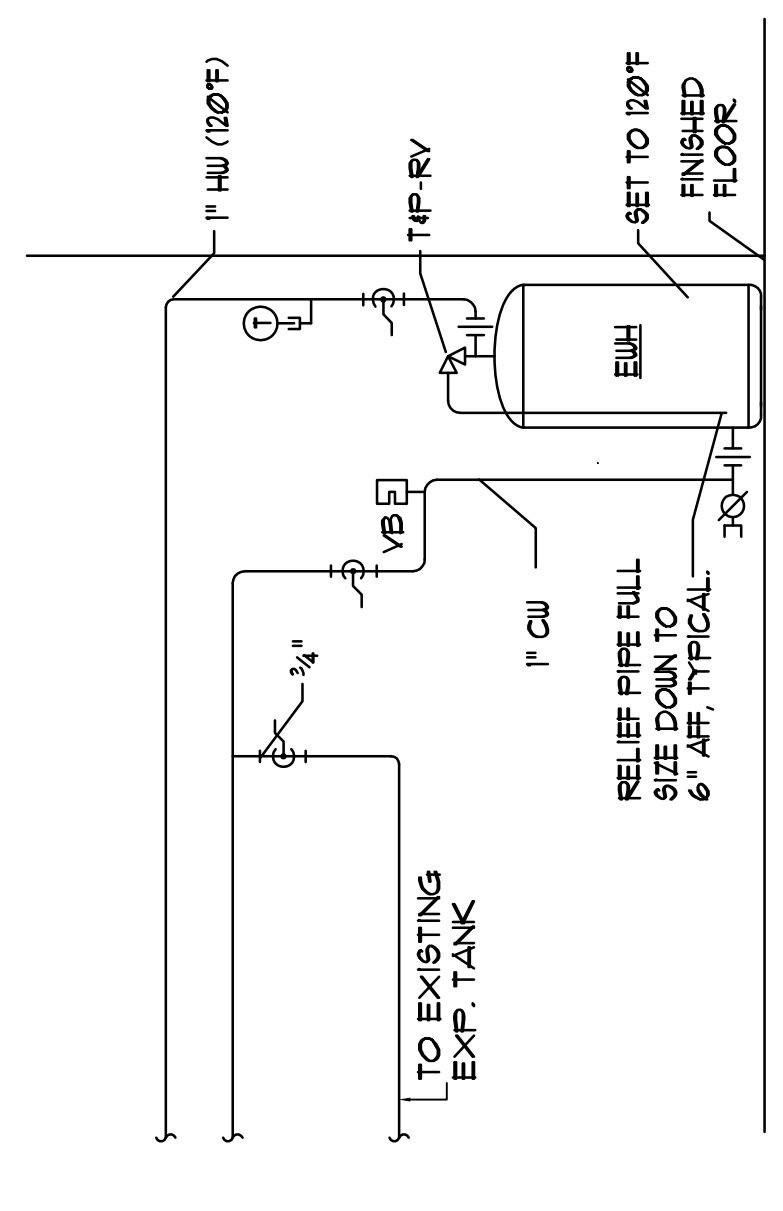


**LEGEND:**

HP	PROPOSED HEAT PUMP
E	PROPOSED REQUEST TO EXIT DEVICE
WAC	EXISTING WALL MOUNTED AC UNIT
CAC	EXISTING CEILING MOUNTED AC UNIT
101	ROOM IDENTIFICATION NUMBER

**BUILDING / SITE PLAN**  
SCALE: NOT TO SCALE

Mechanical Existing Conditions (Discipline Notes):  
 RI - Remove existing air-cooled condensing units (roof / ground mounted). Remove associated refrigerant piping, condensing piping, wiring, etc. Patch and patch to match existing.  
 ES - Remove existing Bulletin indirect water heater. Disconnect 1" hot, cold water piping from the tankless coil on the boiler and route to the new tankless.  
 1. Mount temperature sensors as 48" AFF.  
 2. Connect new condensate piping into existing. The minimum size of condensate piping shall be 3/4".



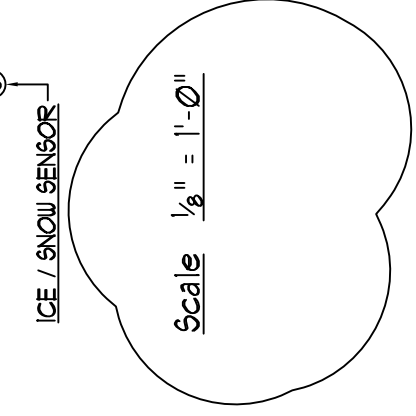
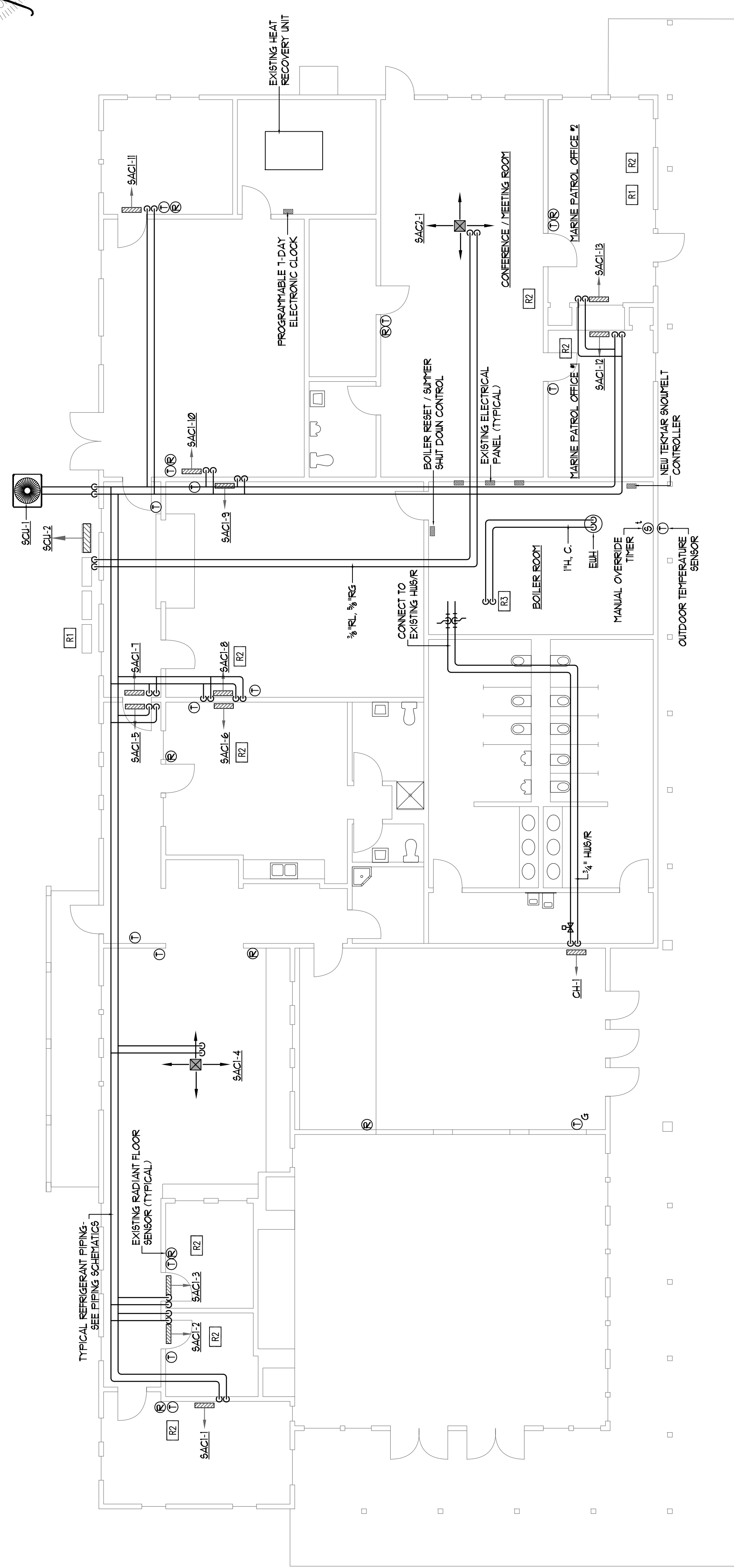
DOMESTIC HOT WATER PIPING SCHEMATIC  
 NTS

**CABINET UNIT HEATER PERFORMANCE SCHEDULE**

TAG	CH	15.2	2.0	1.0	150	3	30" AFF	30	1.0	20/160	80
HEATING PERFORMANCE BASED ON 60°F ENTERING AIR TEMPERATURE W/IN	OUTPUT (MBH)	15.2	2.0	1.0	150	3	30" AFF	30	1.0	20/160	80
BASES OF DESIGN	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE
HEATING PERFORMANCE BASED ON 60°F ENTERING AIR TEMPERATURE W/IN	OUTPUT (MBH)	15.2	2.0	1.0	150	3	30" AFF	30	1.0	20/160	80
BASES OF DESIGN	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE

**ELECTRIC / HEAT PUMP WATER HEATER PERFORMANCE SCHEDULE**

TAG	CH	60	4.5	64.0	60	4.5	64.0
STORAGE (GALL)	60	4.5	64.0	60	4.5	64.0	60
HEATING PERFORMANCE BASED ON 60°F ENTERING AIR TEMPERATURE W/IN	OUTPUT (MBH)	60	4.5	64.0	60	4.5	64.0
BASES OF DESIGN	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE



**SYMBOLS AND ABBREVIATIONS LEGEND**

NOTE: USE SYMBOLS AND ABBREVIATIONS AS APPLICABLE FOR THIS MECHANICAL DRAWING SET. SOME SYMBOLS AND ABBREVIATIONS IN THIS LEGEND MAY NOT APPLY.

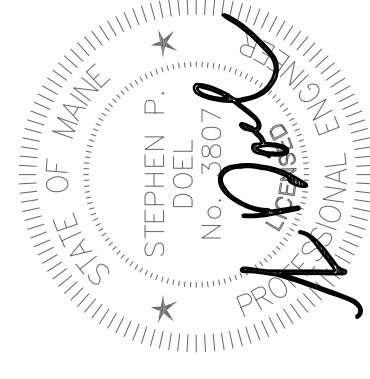
SYMBOL	DESCRIPTION	ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
(Symbol)	COMPRESSED AIR PIPING (CA)	CA	EXHAUST AIR VENT	EA	BURNING PICTURE TAG
(Symbol)	CONDENSATE DRAIN PIPING (CD)	CD	ACCESS DOOR	AD	FLORINATOR
(Symbol)	COOLING TOWER RETURN PIPING (CTR)	CTR	ABOVE FINISHED FLOOR	FF	PADLOCK FAN TAG
(Symbol)	COOLING TOWER SUPPLY PIPING (CTS)	CTS	AIR HANDLING UNIT TAG	AHU	POUND PER SQUARE INCH ABSOLUTE
(Symbol)	CHILLED WATER SUPPLY PIPING (CWS)	CWS	AIR HANDLING UNIT TAG FOR DISPLACEMENT DIFFUSERS	ADU	POUND PER SQUARE INCH ABSOLUTE
(Symbol)	CHILLED WATER RETURN PIPING (CWR)	CWR	AIR SEPARATOR TAG	AS	POLY(VINYL CHLORIDE) (PVC)
(Symbol)	FUEL OIL RETURN PIPING (FOR)	FOR	AIR PRESSURE PROOF	APP	RETURN AIR
(Symbol)	FUEL OIL SUPPLY PIPING (FOS)	FOS	AIR SEPARATOR TAG	AS	RECOGNIZED DUAL ELEMENT PUMP APPS
(Symbol)	HOT WATER RETURN PIPING (HWR)	HWR	AIR SEPARATOR TAG	AS	RADIANT FLOOR MAINFOLD TAG
(Symbol)	HOT WATER SUPPLY PIPING (HWS)	HWS	AIR SEPARATOR TAG	AS	RETURN GRILLE TAG
(Symbol)	REFRIGERANT GAS PIPING (RG)	RG	AIR SEPARATOR TAG	AS	RETURN REGISTER TAG
(Symbol)	LOW TEMP HOT WATER RETURN PIPING (LTHWR)	LTHWR	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	LOW TEMP HOT WATER SUPPLY PIPING (LTHWS)	LTHWS	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	SANITARY PIPING BELOW FLOOR (SAN)	SAN	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	SANITARY PIPING ABOVE FLOOR (SAB)	SAB	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	RAN/WATER LAYER ABOVE SLAB (RALS)	RALS	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	DOMESTIC COLD WATER PIPING (CW)	CW	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	DOMESTIC HOT WATER PIPING (HW)	HW	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	REGULATED HOT WATER PIPING (RHWR)	RHWR	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	DIRECTION OF FLUID FLOW	→	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	ELBOW UP	↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	ELBOW DOWN	↘	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	PIPE REDUCER	↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	PIPE WITH ANGLER	↘↗↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	PIPE WITH VALVE	↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	PIPE WITH GATE VALVE	↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	CHECK VALVE	↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	BALANCING VALVE (ADJUSTABLE)	↘↗	AIR SEPARATOR TAG	AS	ROTARY REGISTER TAG
(Symbol)	BALANCING VALVE (CONTROL VALVE)	↘↗	AIR SEPARATOR TAG </tr		



DATE	9/20/13	DATE	
BY	PK	DATE	
DESIGNER	PK	DATE	
DESIGN-DETAILED	SPD	DATE	
APPROVED #1	SPD	DATE	
P.E. NUMBER		DATE	

ROCKLAND FERRY TERMINAL  
 HVAC IMPROVEMENTS  
 HVAC MODIFICATIONS AND DETAILS



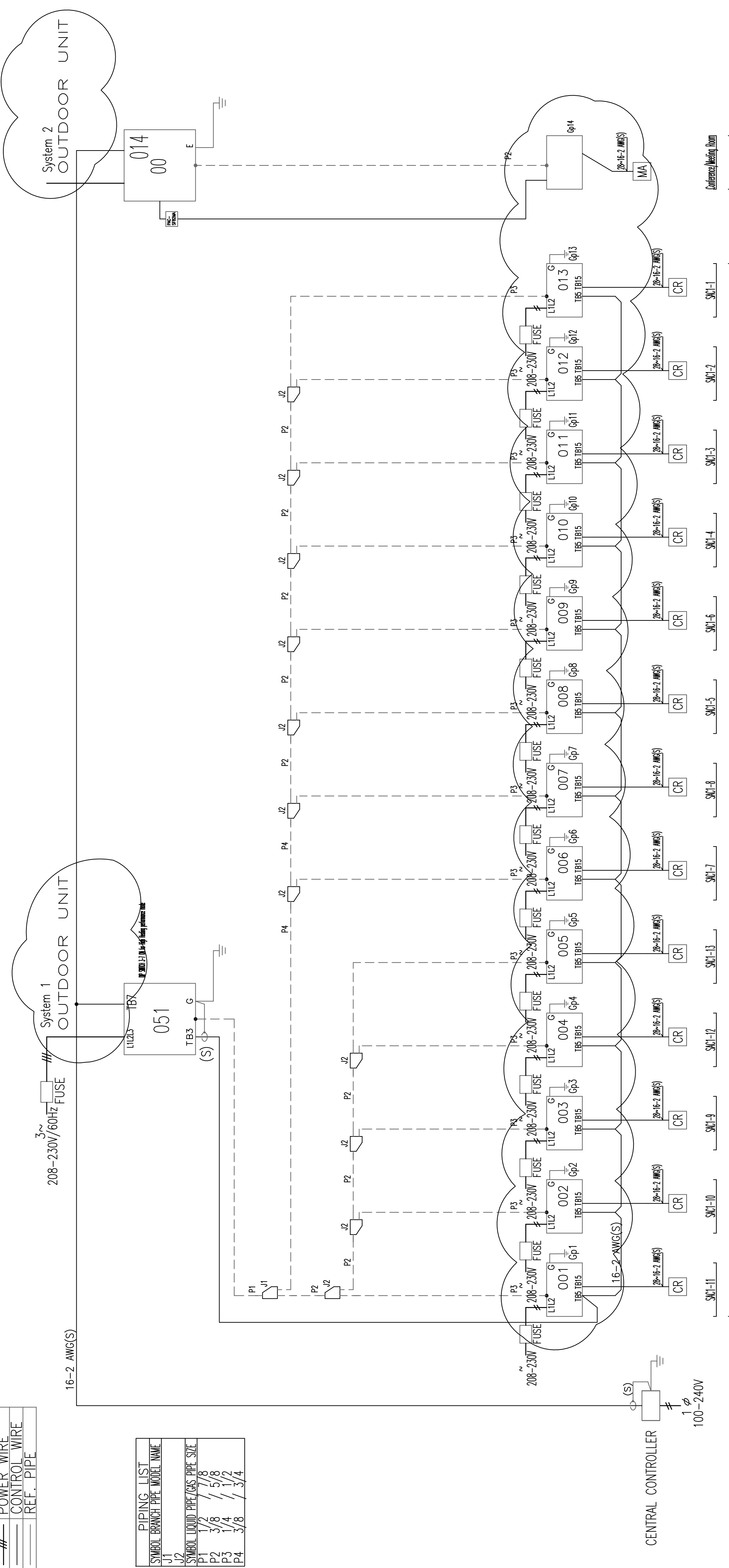


Rockland Ferry Terminal

DIAGRAM	SYMBOL LEGEND	CONTINO	PAGE
DISPLAY	DESCRIPTION		
---	POWER WIRE		
---	CONTROL WIRE		
---	REF. PIPE		

Additional refrigerant charge is needed depending on the size and length of extended piping. Please refer the amount of pre-charge and the formula of calculation which is mentioned on the data book.  
1.25mm(16 AWG) : 1.25mm(16 AWG) or more. 0.75mm(20 AWG) : between 0.5mm(24 AWG) and 0.75mm(20 AWG).

SYSTEM SCHEMATIC DWG.



PIPING LIST

SYMBOL	BRANCH PIPE	MODEL NAME
J1		
P1	LIQUID	PREV (AS) PIPE SIZE
P2	3/8	1/8
P3	1/4	1/2
P4	3/8	3/4

Reference: [www.hvac.com](http://www.hvac.com)

**VRF OUTDOOR UNIT SCHEDULE**

System Tag	Tag Reference	MA-Net Address	Model Number	Modules	Nominal Cooling Capacity (BTU/h)	Nominal Heating Capacity (BTU/h)	Design Cooling Outdoor Temp DB (°F)	Design Heating Outdoor Temp WB (°F)	Corrected Cooling Capacity (BTU/h)	Corrected Heating Capacity (BTU/h)	Corrected Heating Capacity (BTU/h)	Voltage / Phase	Electrical-Per Module	Notes / Options
System 1	51		HP96		96,000.0	108,000.0	88.0	-7.5	94,702.9	91,376.6	27,280.0	208/230V, 3-phase 3-wire	MCA RFS MFS	1, 2, 3, 4, 5
System 2	14				30,000.0	32,000.0	88.0	-7.5	30,201.3	27,280.0	27,280.0	208/230V	75 75/75	1, 2, 3, 4, 5

**Notes & Options:**

- Nominal cooling capacities are based on indoor coil EAT of 80/67°F (DB/WB), outdoor of 95°F (DB)
- Nominal heating capacities are based on indoor coil EAT of 70°F (DB), outdoor of 43°F (WB)
- Efficiency values for EER, IEER, COP are based on AHRI 1230 test method for mixture of ducted & non-ducted indoor units
- For systems with multiple modules, refrigerant pipe dimensions indicate total system combined piping downstream of module
- Added field charge listed is in addition to factory charge, this must be updated based upon final as-built piping layout.

**VRF INDOOR UNIT SCHEDULE**

System Tag	Room Number	Model	Type	Remote Sensor	Nominal Cooling Capacity (BTU/h)	Nominal Heating Capacity (BTU/h)	Cooling Design Entering Temp DB/WB (°F) / [Water in temp]	Heating Design Entering Temp DB/WB (°F) / [Water in temp]	Cooling Diversity Full/Partial (See Note 5, 6)	Heating Diversity Full/Partial (See Note 5, 6)	Corrected Cooling Capacity (BTU/h)	Corrected Heating Capacity (BTU/h)	Heating Capacity (BTU/h)	Refing Pipe Dim Liquid/Suction (inch)	Peak Fan Airflow (cfm) / [Design gpm GUS]/min	Max Fan ESP Setting 208V/230V (IN WG)	Voltage / Phase	Electrical MCA/MFS	Notes / Options
System 1	SAC1-11	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-10	Wall mounted	Wall mounted	12,000.0	13,500.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	8,246.4	8,246.4	10,194.9	10,194.9	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-9	Wall mounted	Wall mounted	6,000.0	6,700.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	3,964.3	3,964.3	5,059.7	5,059.7	1/4 / 1/2	208	0.19/0.19/15	0.19/0.19/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-12	Wall mounted	Wall mounted	6,000.0	6,700.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	3,964.3	3,964.3	5,059.7	5,059.7	1/4 / 1/2	208	0.19/0.19/15	0.19/0.19/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-13	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-7	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-8	Wall mounted	Wall mounted	6,000.0	6,700.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	3,964.3	3,964.3	5,059.7	5,059.7	1/4 / 1/2	208	0.19/0.19/15	0.19/0.19/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-5	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-6	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-4	Ceiling cassette (4-way airflow)	Ceiling cassette (4-way airflow)	18,000.0	20,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	11,382.2	11,382.2	15,103.6	15,103.6	1/4 / 1/2	494	0.64/0.64/15	0.64/0.64/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-3	Wall mounted	Wall mounted	6,000.0	6,700.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	3,964.3	3,964.3	5,059.7	5,059.7	1/4 / 1/2	208	0.19/0.19/15	0.19/0.19/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-2	Wall mounted	Wall mounted	6,000.0	6,700.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	3,964.3	3,964.3	5,059.7	5,059.7	1/4 / 1/2	208	0.19/0.19/15	0.19/0.19/15	1, 2, 3, 4, 5, 6	
System 1	SAC1-1	Wall mounted	Wall mounted	8,000.0	9,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	6,446.4	6,446.4	6,796.6	6,796.6	1/4 / 1/2	413	0.38/208V/0.38(230V)/1-phase	0.38/208V/0.38(230V)/15	1, 2, 3, 4, 5, 6	
System 2	Conference/Meeting Room		Ceiling cassette (4-way airflow)		30,000.0	32,000.0	80.0/67.0	70.0	FULL DEMAND	FULL DEMAND	21,285.5	21,285.5	27,280.0	5/8 / 3/8	740			Powered by Outdoor	1, 2, 3, 4, 5, 6

**Notes & Options:**

- Nominal cooling capacities are based on indoor coil EAT of 80/67°F (DB/WB), outdoor of 95°F (DB)
- Nominal heating capacities are based on indoor coil EAT of 70°F (DB), outdoor of 43°F (WB)
- See outdoor unit schedule for outdoor ambient-conditions, connected capacity, and other factors associated with connected capacities.
- See schematic piping/control diagram for indication of required indoor unit remote controllers, system controllers, and integration devices.
- Full demand connected capacity includes de-rate associated with indoor vs. outdoor connected capacity indicated on outdoor unit schedule for associated system. Partial connected capacity assumes sufficient diversity exists such that the connected capacity de-rate does not apply. It is the designer's responsibility to ensure "Diamond System Builder" is set in the appropriate output capacity setting (full demand/partial demand) prior to generating this schedule.
- It is recommended to always base heating corrected capacity on full demand.



DATE	
P.E. NUMBER	
SIGNATURE	
DATE	9/29/13
BY	CAT
DESIGN-DETAILS	SFD
ADJOURNMENT	SFD
PROJECT MANAGER	MECHANICAL/ELECTRICAL

STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION  
MDOT PROJ #BD-1834(210)  
WIN 01834210

ROCKLAND FERRY TERMINAL  
HVAC IMPROVEMENTS  
HVAC MODIFICATIONS AND DETAILS