PROJECT MANUAL

for

PLAINVILLE HIGH SCHOOL
BOILERS REPLACEMENT

47 ROBERT HOLCOMB WAY
PLAINVILLE, CONNECTICUT 06062

Bemis Associates LLC
185 Main Street
Farmington, Connecticut 06032

May 30, 2023

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SUMMARY

A. This Section requires the selective removal and subsequent off-site disposal of the following:

1. Removal of a portion of the existing masonry chimney as indicated on drawings or required to accommodate new construction.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner's Representative prior to start of work.

1.4 JOB CONDITIONS

A. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

B. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items on site will not be permitted.

C. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.

1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
3. Protect floors with suitable coverings when necessary.
4. Construct temporary insulated dust-proof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dust-proof doors and security locks.
5. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
6. Remove protections at completion of work.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

E. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise - obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

G. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
3. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
2. Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
3. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner s Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.4 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION
024119

SECTION 200050 - GENERAL CONDITIONS FOR MECHANICAL AND ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General provisions of the Contract, including General and Supplementary Conditions, and Division 1, General Requirements apply to the work specified in this Section.

B. Scope of Work: This Section contains special provisions for Divisions 22, 23 and 26.

1.2 EXAMINATION OF SITE AND DRAWINGS:

A. Before submitting his bid, Contractor shall visit site with plans and specifications in hand, shall consult with the Engineer and shall become thoroughly familiar with all conditions under which his work will be done since he will be held responsible for any assumptions he may make in regard thereto.

B. The Contractor shall verify and obtain all necessary dimensions at the building.

C. Certain present building clearances are available for handling equipment.

1.3 INTENT:

A. Finished Work: The intent of the specifications and drawings is to call for finished work, completed, tested and ready for operation.

B. Good Practice: It is not intended that the drawings show every pipe, fitting or minor detail and it is understood that while the drawings must be followed as closely as circumstances will permit, the systems shall be installed according to the intent and meaning of the Contract Documents and in accordance with good practice.

C. Work under each Section shall include giving written notice to the Town within 15 days after the Award of the Contract of any materials of apparatus believed inadequate or unsuitable or in violation of any laws or codes, or items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items and labor for the satisfactory functioning of the entire system without extra compensation.

D. Any apparatus, appliance, material or work not shown on drawings but mentioned in specifications or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished and installed by Contractor at no additional cost to the Town.

E. Prior to receipt of bids, Contractors shall give written notice to Engineer of any materials or apparatus believed inadequate, unsuitable or in violation of laws, ordinances, rules or regulations of authorities having jurisdiction and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed that Contractor has included the cost of all required items in his proposal and that he will be responsible for approved satisfactory functioning of systems without further compensation.

F. In all cases where apparatus is herein referred to in singular number, it is intended that such reference include as many such items as are required to complete work.

G. If not otherwise specified or shown on plans, apparatus and materials shall be installed in accordance with manufacturer's published recommendations and instructions and to the complete satisfaction of the Engineer.

H. It is the intent of these specifications for Mechanical and Electrical Contractors and/or their subcontractors or equipment suppliers to furnish all equipment complete with all accessories.

1.4 REGULATIONS:

A. Codes: All work shall be done in strict accordance with the 2022 Connecticut State Building Code, 2022 Connecticut State Fire Safety Code, 2021 IBC, 2021 IPC, 2021 IMC, Connecticut Public Health Code, 2021 NFPA 101, all applicable NFPA Codes, NEC, UL, NEMA, O.S.H.A., with all requirements of local utility companies and the requirements of all governmental departments having jurisdiction. Codes: All work shall be done in strict accordance with the 2022 Connecticut State.

B. Precedence: Requirements of the above shall take precedence over plans and specifications.

C. Equipment construction standards shall be as follows: Pressure vessels shall be constructed in accordance with the ASME Code, all electrical equipment shall be UL listed and approved and conform to the N.E.C., gas equipment shall be approved by A.G.A. and conform to N.F.P.A. Codes, piping materials, fittings, valves and accessories shall be constructed in accordance with A.S.T.M. and A.N.S.I. standards for class of work involved. All equipment and materials shall be new and of domestic manufacture. All the above codes shall be referenced and dated in the Connecticut Basic Building Code.

D. Wherever discrepancies occur between above regulations and agencies and contract drawings and specifications, the requirements of above shall take precedence, except that the contract drawings and specifications shall be minimum requirements and that contractors shall advise engineer of any required changes before proceeding with work.

1.5 APPROVED FITTINGS:

A. No material other than that contained in the "Latest List of Electric Fittings" approved by the Underwriters' Laboratories, Inc., shall be used in any part of the work.
All wiring, conduit, switches and other material for which label service has been established, shall bear the label of the Underwriters' Laboratories, Inc.

1.6 PERMITS, FEES:

A. Include all necessary notices, obtain all permits and pay all governmental taxes, fees, and other costs. File all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction. Obtain all required Certificates of the Town before request for acceptance and final payment for the work.

1.7 DEFINITIONS:

A. Words "finish" or "finished" refer to all rooms and areas listed in Finished Schedule on Drawings. All rooms and areas not covered in Schedule, including underground tunnels and areas above ceilings, shall be considered not finished except as otherwise noted.

B. The word "provide" means to "furnish and install" reference item.

1.8 PROTECTION:

A. Work under each section shall include protecting the work and materials of all other sections from damage by work or workmen, and shall include making good any and all damage thus caused.

B. Each section shall be responsible for work and equipment until finally inspected, tested and accepted. Protect work against theft, weather, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing materials.

C. If so specified under the respective section, work may include receiving, unloading, uncrating, storing, protecting, setting in place and connecting up completely of any motor starters, control equipment having mechanical/electrical service connections which may be furnished by Town or furnished under another section. Work under each section shall include exercising special care in handling and protecting equipment and fixtures. Any of the above equipment and fixtures which are missing or damaged by reason of mishandling or failure to protect shall be replaced at no additional cost to the Town.

1.9 EQUIPMENT SUBSTITUTIONS AND DEVIATIONS:

A. Wherever more than one manufacturer is mentioned in specifications and drawings, any of these named are considered equally acceptable to that on upon which design was based and, providing all requirements are met, insofar as performance, space requirements, noise levels and special accessories or materials are concerned, any of those named may be included in Contractor's bid.

B. Where Contractor proposes to use an item of equipment which differs from that upon which design was based, which required any redesign of structure, partitions, foundations, piping, wiring or of any other part of Mechanical or Electrical Layout, all such redesign, new drawings or detailing required shall be prepared by Contractor at his own expense for approval of Engineer.

C. Where approved substitutions or deviations require a different quantity, size or arrange of structural supports, wiring, conduit, piping, ductwork, and equipment from that upon which design was based, all additional items required by the systems shall, with the approval of Engineer, be furnished by Contractor at no additional cost to Town.

1.10 ELECTRICAL WORK:

A. The Electrical Section includes all power wiring for all electrical switches, motor starters and unmounted motors, furnished at the job site by other sections or furnished under the Electrical Sections as stated in other sections of the specifications.

B. The Electrical Section shall install and wire all starters, switches and controls, as specified and/or shown on drawings. This shall include all operating and safety controls. Refer to sections 260000 and 260500 for additional information.

C. Electrically operated equipment supplied by other sections which will be installed and wired by Electrical Section shall be delivered to him with detailed instructions for their installation and wiring in sufficient time and proper sequence to enable him to meet his work schedule.

D. Control devices that include mechanical elements, such as float switches, shall be installed by the section furnishing them, but be wired by the Electrical Sections.

E. Equipment which includes a number of correlated electrical control devices mounted in a single enclosure or on a common base with equipment shall be supplied for installation completely wired as unit with terminal boxes and ample leads and/or terminal strips, ready for electrical wiring.

F. Electrical Contractor shall furnish local disconnect switch for all equipment and manual motor starter for fractional HP motors.

1.11 DRAWINGS:

A. The mechanical and electrical drawings are intended to supplement each other and are to be considered as a unit which, taken together in conjunction with the specifications, completely describes the work to be done. All drawings shall be checked to verify spaces in which work will be installed. Where headroom or space conditions appear inadequate, notification shall be given to Engineer before proceeding with installation.

B. The Engineer may without charge, make modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

C. Note that the drawings are diagrammatic and indicate the general arrangement of the Mechanical and Electrical Equipment and systems, without showing every detail and fitting.

D. Where conflicts occur between drawings and specifications or within either, the item or arrangement of better quality, greater quality or highest cost shall be included in Contract price. Engineer shall determine the manner or item with which work shall be installed.

E. Keep one complete set of all drawings, specifications, shop drawings and addenda on the premises at all times in good condition and available to the Engineer and Town.

1.12 REVIEWS:

A. The materials, workmanship, design and arrangement of all work installed under the Mechanical and Electrical sections shall be subject to the review of the Engineer.

B. Where any specific material process of method of construction or manufactured article is specified by name or by reference to the catalog number of a manufacturer, the specifications are to be used as a guide and not intended to take precedence over the basic duty and performance specified or noted on drawings. In all cases, the specific

characteristics of the equipment offered for approval, shall be indicated on the shop drawings.

C. All component parts of each item of equipment or device shall bear the manufacturer's nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable.

D. If material or equipment is installed before it is reviewed, it shall be removed and replaced at no extra charge to the Town if, in the opinion of the Engineer, the material or equipment does not meet the intent of the drawings and specifications.

1.13 SHOP DRAWINGS:

A. Contractor shall submit for review electronic shop drawings of all new equipment, materials, piping, lighting fixtures, devices, panels, wiring and reports. Engineer's review of shop drawings must be completed before any equipment is purchased or any work is installed.

B. Shop drawings shall consist of manufacturer's certified scale drawings, cuts or catalog, including descriptive literature and complete certified characteristics of equipment, showing dimensions, capacity, code requirements, motor and drive testing as indicated on the drawings or specifications. Also, sheet metal fabrication drawings drawn to scale of 1/4" to the foot or larger.

C. Certified performance curves for all pumping equipment shall be submitted for review.

D. Samples, drawings, specifications, catalogs, etc. submitted for review shall be properly labeled indicating specific service for which material or equipment is to be used, division and article number of specifications governing Contractor's name and name of job.

E. Catalog, pamphlets or other documents submitted to describe items on which review is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

F. Review stamp rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions.

Where drawings are reviewed, said review does not mean that drawings have been checked in detail. Said review does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications.

G. Failure by the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of Contract and no claim for extension by reason of such default will be allowed.

H. Prior to submission to shop drawings, the Contractor shall thoroughly check each shop drawing, reject those not conforming to the specifications and indicate by his signature that the shop drawings submitted in his opinion meet Contract requirements.

1.14 CUTTING AND PATCHING:

A. All cutting of openings in walls, floors, partitions, etc. must be done by the Electrical and/or Mechanical Contractor as required to install the work including all cutting of existing construction work. Cutting shall be neatly done and limited to the minimum size necessary. Contractor shall patch and restore to its original condition any work disturbed as a result of work under this Contract.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

A. All materials and apparatus used shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail. No materials or apparatus used shall be discontinued or about to be discontinued items.

B. The Engineer shall have the right to reject any part of the work in case material or workmanship is not of satisfactory quality.

C. Any unacceptable work and material shall be replaced with acceptable work and material at no additional expense to the Town.

D. In case there is any doubt of the acceptability of any material, submit samples to the Engineer for approval and only definite approval in writing from the Engineer shall be evidence of such approval.

E. Such approval shall also be subject to the satisfactory installation of the material.

F. The work in each of these sections shall be constantly under the direction of a competent superintendent who shall be on the premises during such period as the work is in progress. The superintendent shall familiarize himself with the work of all other sections involved insofar as they relate to or in any way affect the work of these sections, and shall coordinate the work.

G. Unless otherwise noted, all equipment and materials shall be installed and/or applied in accordance with the recommendations of the manufacturer of said equipment, including the performance of any tests recommended by the manufacturer.

2.2 EQUIPMENT VARIATIONS:

A. In these specifications and on the accompanying drawings, one or more makes of materials, apparatus or appliances have been specified for use in this installation.
This has been done for convenience in fixing the standard of workmanship performance of any materials, apparatus or appliance which shall be substituted for those mentioned herein shall also conform to these standards.

B. Where no specified make or material, apparatus or appliance is mentioned, any first class product made by a reputable manufacturer may be used, providing it conforms to the requirements of these specifications and meets the approval of the Engineer prior to installation.

C. Refer to Article 15 of the General Conditions of the contract for substitution procedures.

D. To substitute other makes of materials, apparatus or appliance, than those mentioned under the mechanical or electrical sections, a request in writing to be allowed to make the substitution shall be made. This request shall be accompanied by complete plans and specifications of the substitution offered. If so requested by the Engineer, also submit samples of both the specified material or appliance and the substitute.

2.3 MOTOR CONTROL:

A. All motors will be fed from a motor starter. Motor starters shall be furnished by each respective trade for motor driven equipment provided by them. The Electrical Contractor shall install the starters and shall provide all power wiring to the starters, and from the starters to the motors they control. Where required, remote pushbuttons, plates and pilots will be furnished with the starter and will be installed by the Electrical Contractor, unless otherwise called for under the Temperature Control Section of these specifications. All starters for motors which are to be interlocked with another motor shall have suitable auxiliary contacts.

B. All small motors without built-in thermal protection shall be furnished with thermal switches. These switches and pilots shall be furnished by the Electrical Contractor.

2.4 ELECTRIC MOTORS:

A. All motors 1/2 h.p. and above shall be integral horsepower polyphase induction motors conforming to NEMA standards MG-1-1967 and shall be T-frame design in sizes 143 T through 445 T. Each shall be NEMA design B with minimum torque valves per MG 1-12.37 and 12.38.

B. Duty shall be continuous, ambient temperature 40 degrees maximum, allowable temperature rise for open drip-proof -90 degrees, TEFC, 80 degrees C with Class B insulation rating all per MG 1-12.42.

C. Horsepower, speed and frame sized per MG 1-10, 32, 13.02 and 13.06a.

D. Enclosures - open drip-proof and TEFC per MG 1-1.25, 1.26 and 1.27.

E. All dimensions per MG 1-11.31a, 11.32a and 11.34a. All motors shall have stainless steel nameplates with NEMA voltage standards shown.

F. Locked rotor KVA per horsepower shall be designated by proper NEMA code letter per MG 1.10.37.

G. All motors shall be premium efficiency type with a full load efficiency range of 80 percent to 95 percent. High efficiency motor rating shall meet Northeast Utilities Energy Action Program in accordance with the following schedule:

MINIMUM NOMINAL MOTOR EFFICIENCIES

HP	OPEN DRIP PROOF MINIMUM EFFICIENCY			HP	TOTALLY ENCLOSED MINIMUM EFFICIENCY		
	1200	1800	3600		1200	1800	3600
1	82.5%	85.5%	80.0%	1	82.5%	85.5%	78.5%
1.5	86.5%	86.5%	85.5%	1.5	87.5%	86.5%	85.5%
2	87.5%	86.5%	86.5%	2	88.5%	86.5%	86.5%
3	89.5%	89.5%	86.5%	3	89.5%	89.5%	88.5%
5	89.5%	89.5%	89.5%	5	89.5%	89.5%	89.5%
7.5	91.7%	91.0%	89.5%	7.5	91.7%	91.7%	91.0%
10	91.7%	91.7%	90.2%	10	91.7%	91.7%	91.7%
15	92.4%	93.0%	91.0%	15	92.4%	92.4%	91.7%
20	92.4%	93.0%	92.4%	20	92.4%	93.0%	92.4%
25	93.0%	93.6%	93.0%	25	93.0%	93.6%	93.0%
30	93.6%	94.1%	93.0%	30	93.6%	93.6%	93.0%
40	94.1%	94.1%	93.6%	40	94.1%	94.1%	93.6%
50	94.1%	94.5%	93.6%	50	94.1%	94.5%	94.1%
60	95.0%	95.0%	94.1%	60	94.5%	95.0%	94.1%
75	95.0%	95.0%	94.5%	75	95.0%	95.4%	94.5%
100	95.0%	95.4%	94.5%	100	95.4%	95.4%	95.0%

H. Service Factors - open-drip-proof, 1 h.p. through 200-1.15 TEFC all horsepower - 1.0.

I. Noise level within NEMA standard MG 1-12.49.

J. In addition to the above, all motors 1 through 20 h.p. shall be TEFC with drain holes for both horizontal and vertical positions. Each shall be equipped with deep groove double shielded ball bearings prelubricated with provisions for regreasing.

K. Motors smaller than 1/2 h.p. shall be capacitor-start or split-phase type designed for 120 volts, single phase, 60 cycles alternating current.

2.5 ELECTRICAL MOTOR STARTERS:

A. Motor starters shall be furnished by each respective trade for motor driven equipment provided by them. The Electrical Contractor shall install the starters and shall provide all power wiring to the starters, and from the starters to the motors they control.

B. Motor starters shall conform to requirements of NEC, NEMA, UL, CSA, and ANSI and shall be suitable for the required horsepower, duty, voltage, phase, frequency, service, and location. All starters shall be furnished in NEMA enclosures suitable for the environment in which they are to be located.

C. All starters shall be of the same manufacture and shall be furnished in Cutler-Hammer, Square D, General Electric, or Allen Bradley.

D. Thermal Overloads:

1. All motors 1/8 horsepower or larger shall be provided with thermal-overload protection. Thermal overloads shall be melting alloy ambient temperature compensating type.
2. Thermal overloads shall be sized in accordance with NEC requirements for the nameplate data of the motor(s) as actually delivered to the site.

E. Starters for manual control of single phase motors up to one (1) horsepower furnished without integral thermal overloads shall be combination manual disconnect switch and starters with thermal overload protection for each ungrounded leg. Starters shall be inoperable if a thermal unit is removed. These starters shall be 2-pole and shall be provided with green neon pilot light and handle guard/lock-off.

F. Starters for three phase motors shall be full voltage, circuit breaker combination magnetic starters. All circuit breaker combination magnetic starters shall include melting alloy type thermal overload protection, low voltage protection, and two (2) sets of auxiliary normally open and normally closed contacts. Thermal overload protection shall be provided in each ungrounded leg. Starters shall be inoperable if a thermal unit is removed.

All circuit breaker combination magnetic starters shall be equipped with control power circuits. Provide starters with control power transformers of secondary voltage required for the control power circuitry. Provide control power transformers with secondary fusing.

The disconnect handle on circuit breaker combination magnetic starters shall always be in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "on" or "off", and shall include a two-color handle grip, the black side visible in the "off" position, and the red side visible in the "on" position.

1. All circuit breaker combination magnetic starters for manual control of three phase motors shall have start-stop push buttons in the cover and shall be provided with red and green pilot lights.
2. All circuit breaker combination magnetic starters for automatic or interlocking control of three phase motors shall have hand-off-automatic selector switches in the cover and shall be provided with red and green pilot lights.

G. Starters shall be furnished as part of respective equipment furnished under each Division.

PART 3 - EXECUTION

3.1 CONNECTING TO EXISTING UTILITIES:

A. Connections to existing utilities that will interrupt the service to the present buildings shall be made at a time agreed upon by the Town,

B. If it is necessary to make connections to existing utilities outside the regular working hours, this shall be noted on the written work order and the respective Contractor will be paid for the additional cost of labor over and above what it would cost at regular day time rates.

3.2 FREIGHT, CARTING AND RIGGING:

A. Contractor shall pay all freight and carting charges necessary to deliver all equipment furnished under his Contract to the site and furnish all necessary rigging to properly rig and set the apparatus on the foundations, frames, etc.

B. All scaffolding, blocks and tackle, ropes and chains and other equipment necessary to rig and set the apparatus shall be furnished by the Contractor.

C. The Contractor shall set, level and align all equipment before starting operations.

3.3 SEISMIC RESTRAINTS:

A. It is the intent of this seismic restraint portion of the specification to provide restraint of all non-structural building system components provided in Sections 15 and 16 in Seismic Zone II. Restraint systems and devices are intended to withstand, without failure, the "G" forces detailed in the chart below:

Design Level of Acceleration At Equipment Center of Gravity Seismic Zone 2)
(Av - >0.1 to 0.19)

Elevation (feet rel. to grade level)	Rigid* Mnt'd Equip	Non-Struct. Architect Component	Flexible* Mnt'd Equip	Pipe, Duct, Cable trays, Conduit, Etc.	Life Safe. Equip
Below Grade up to 20 feet above grade	0.125 "g"	0.250 "g"	0.500 "g"	0.350 "g"	1.000 "g"
21 ft. - 300 ft.	0.500 "g"	0.550 "g"	0.750 "g"	0.650 "g"	1.000 "g"
301 ft. - 600 ft.	0.750 "g"	0.900 "g"	1.000 "g"	1.000 "g"	1.000 "g"

* Rigid mounted equipment is any equipment mounted directly to structure. Flexible mounted equipment is any equipment mounted on resilient supports, ceiling suspended, roof supported or mounted on an independent frame with any primary natural frequency below 16 Hz.

B. Seismic restraints shall be as required by 2012 IBC, Chapter 16 and State of Connecticut Building Code, 2016 edition.

C. Seismic Certificant and Analysis

1. Seismic restraint calculations must be provided for all connections of equipment to the structure.
2. Calculations to support seismic restraint designs must be stamped by a registered professional engineer licensed in the State of Connecticut.
3. Analysis must indicate dead loads, derived loads, and materials used for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameters, embedment, and weld length.
4. A seismic design errors and omissions insurance certificate must accompany submittals.

D. Submit drawings showing locations of all seismic restraints for equipment, piping, and conduit provided under Sections 15 and 16:

1. The term EQUIPMENT includes ALL non-structural components. These specifications are applicable within the facility and 5 feet outside of the foundation wall. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is a partial list; (equipment not listed is still included in this specification).

Air Separators	Water Heater
Light Fixtures	Bus Ducts
Piping	Boiler
Pumps (All types)	Cable Trays
Switching Gear	Tanks (All types)
Conduit	All Electrical Panels

E. Submittals shall include a listing of all isolated and non-isolated equipment to be restrained.

F. Seismic restraints shall not be required for the following installations:

1. Piping in mechanical rooms less than l 1/4-inch inside diameter.
2. All other piping less than 2 1/2-inch inside diameter.
3. All electrical conduit less than 2 1/2-inch inside diameter.
4. All rectangular air-handling ducts less than 6 square feet in cross-sectional area.
5. All round air-handling ducts less than 28 inches in diameter.
6. All piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the support for the hanger.
7. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the support for the hanger.

G. Life safety systems defined:

1. All systems involved with fire protection including sprinkler piping, service water supply piping, fire dampers and smoke exhaust systems.
2. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
3. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

3.4 COOPERATION WITH OTHER TRADES:

A. No piping, conduit, valves, boxes, etc., shall be installed until the entire run has been checked for clearance and the work has been coordinated between all the trades. Each tradesman shall be responsible for taking his own field measurements and maintaining proper clearance from the Town's equipment and the work of other trades, and for coordinating his work with that of other Contractors and Town. Furnish all necessary information, dimensions, templates, etc. in order that a perfectly coordinated job will result.

B. Contractor shall carry out his work in conjunction with other trades and shall give full cooperation to other trades. Contractor shall furnish all information necessary to permit work of all trades to be installed in a satisfactory manner.

C. Where space is so limited that Contractor's work shall be installed in close proximity to the work of other trades or where it is evident that Contractor's work will interfere with other trades, he shall assist in working out space conditions to make satisfactory adjustments.
If required or directed by Engineer, the Contractor shall prepare composite working drawings and sections of not less than 3/4" -1'-0" scale clearly showing how his work is to be installed in conjunction with other trades; he shall make corrections necessary to satisfactorily complete installation at no additional cost to Town.

D. All supports for hanging material to be connected to steel structure shall be installed prior to installation of fire proofing material. Any damage to fireproofing caused by late installation of hanging material shall be repaired by the Fire-proofing Contractor at the expense of the Contractor responsible.

E. The Heating Contractors shall give to the Electrical Contractor all information on switches, controls, pilots, etc. furnished under the Heating Contracts, together with makes and catalog numbers where required to permit the Electrical Contractor to leave the proper boxes to receive same. This information shall be given well in advance so that the Electrical Contractor may install his work as construction progresses. In the event that this information is not given in time to permit the Electrical Contractor to leave proper boxes, etc. as construction progresses, it shall be the responsibility of the Contractor to pay all costs of cutting and patching.

3.6 INFORMATION FOR ELECTRICAL CONTRACTOR:

A. Deliver to the Electrical Contractor all information on motors and controls furnished under the Mechanical Contract, together with makes and catalog numbers, to permit the Electrical Contractor to leave the proper boxes and wiring.

3.7 SLEEVES, INSERTS AND ANCHOR BOLTS:

A. All pipes and conduits passing through floors, walls or partitions shall be provided with sleeves sized to give a minimum of 1/2" clearance between sleeve and the outside diameter of the pipe, conduit or insulation, enclosing the pipe or conduit.

B. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 steel pipe, set flush with finished wall or ceiling surfaces, but extending 2 inches above finished floors or shall be in accordance with details on drawings. In all mechanical equipment rooms sleeves shall extend 6 inches above finished floor.

C. Inserts shall be individual or strip type of steel or malleable iron construction for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment.

3.8 FIRE STOPPING:

A. General

1. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

B. General Description of The Work

1. Only tested firestop systems shall be used in specific locations as follows:
Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

C. References

1. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).
2. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
3. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
4. Test Requirements: ASTM E 84-96, "Surface burning characteristics".
5. All major building codes: ICBO, SBCCI, BOCA, and IBC.
6. Test Requirements: ASTM E-119, “Fire Test of Building Construction and Materials” (UL 263)

D. Quality Assurance

1. Firestop System installation must meet requirements of ASTM E-119, ASTM E-814, ASTM E-84-96, UL 236, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
2. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. Submittals

1. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with this section.
2. Submit material safety data sheets provided with product delivered to job-site.

F. Installer Qualifications

1. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacture's products per specified requirements.

G. Products, General

1. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
2. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
3. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

H. Acceptable Manufacturers

1. Subject to compliance with through penetration firestop systems (XHEZ) and joint systems (XHBN) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

    a. Hilti, Inc., Tulsa, Oklahoma 800-879-8000
    b. Other manufacturers listed in the U.L. Fire Resistance Directory – Volume 2

I. Materials

1. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
2. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
3. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

J. Preparation

1. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

    a. Verify penetrations are properly sized and in suitable condition for application of materials.

b. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may effect proper adhesion.
c. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
d. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
e. Do not proceed until unsatisfactory conditions have been corrected.

K Coordination

1. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
2. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

L. Installation

1. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
2. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

a. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
b. Consult with project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
c. Protect materials from damage on surfaces subjected to traffic.

M. Field Quality Control

1. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
2. Keep areas of work accessible until inspection by applicable code authorities.
3. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

N. Adjusting and Cleaning

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
2. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.9 ACCESSIBILITY:

A. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include but not be limited to motors, controllers, switchgear, drain points, etc.

B. In the event that any equipment is not installed to permit convenient servicing, disassemble, removal of parts, etc. the Contractor shall, at his own expense, make all corrections necessary to accomplish this.

3.10 LUBRICATION:

A. All equipment having moving parts and requiring lubrication which is installed under this Contract, shall be properly lubricated according to manufacturer's recommendations prior to testing and operation. Any such equipment discovered to have been operated before lubrication is subject to rejection and replacement at no cost to the Town. Units furnished with sealed bearings are accepted.

3.11 TAGS, CHARTS AND NAMEPLATES:

A. Each valve, control, switch, electrical panel, motor and any piece of apparatus installed under these sections shall be properly identified.

B. Each sectional shutoff valve shall have a brass tag with identifying number. Tag shall be secured to valve stem with sufficient length of copper coated jack chain to allow tag to be easily read.

C. All other equipment, including panels and switches, shall be proved with a suitable laminated plastic nameplate fastened with screws or rivets. Small equipment labels may use a pressure sensitive tape.

D. All nameplates and labels shall identify components by proper nomenclature and numbered according to equipment schedule or as designated.

E. Charts shall be furnished in duplicate and shall include the valve identification number, location and purpose. One chart shall be mounted in frame with a clear glass front and secured to wall in location directed.
Second chart shall be for use throughout building and shall be provided with transparent plastic closure for top and attached 8" bead chain for hanging. Holes to be reinforced with brass grommets. Tags and closures as manufactured by Seton Name Plate Corp., New Haven, Conn., or approved equal.

3.12 INSTRUCTIONS:

A. Prepare written instructions frames for the proper maintenance and operation of any special equipment furnished and installed under this Contract.

B. Personally instruct the Town's Maintenance personel or official representative in addition to furnishing all manuals, diagrams, etc. in the proper operation and maintenance of all equipment and piping installed under this Contract.

C. Prepare a portfolio with all tags, operating manuals, parts lists, guarantees, etc. that are packed with all equipment furnished under this Contract and submit same to the Engineer.

3.13 PIPING CODE MARKERS:

A. All service piping which is accessible for maintenance operations shall be identified with vinyl plastic color bands and legends at each branch and riser take-off, at each passage through wall, floor and ceiling, adjacent to each valve and on all pipe runs marked each 20'-0". Pipe markers to conform to A.S.A. Bulletin A-13. Where pipes are too small for legends, brass identification tags 1-1/2" in diameter with depressed 1/2" high black filled letters shall be fastened with chain. Pipe markers and tags as manufactured by the Seton Name Plate Corp., New Haven, Conn., or equal approved.

3.14 CLEANING PIPING, CONDUITS AND EQUIPMENT:

A. Thoroughly clean all piping and equipment of all foreign substances inside and out before being placed in operation.

B. If any part of a system should be stopped by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and remove obstructions.
Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Town.

C. During the course of construction, all pipe and electrical conduits shall be capped in an approved manner to insure adequate protection against the entrance of foreign matter.

3.15 CLEANING UP:

A. After completion of the work, remove all waste, rubbish and other materials left as a result of operations and leave the premises in clean condition.

B. All fixtures, equipment, etc. installed under the Mechanical and Electrical Sections shall be free of dirt, grease and other foreign material and left in perfectly clean condition and ready to use.

3.16 GUARANTEE:

A. All parts of the work and all equipment shall be guaranteed for a period of 18 months from the date of substantial completion.

B. If during that period of general guarantee, any part of the work installed fails, becomes unsatisfactory or does not function properly due to any fault in material or workmanship, whether or not manufactured or job built, each section shall upon notice from the Town, promptly proceed to repair or replace such faulty material or workmanship without expense to the Town, including cutting, patching and painting or any other work involved and including repair or restoration of any damaged sections of the premises resulting from such faults.

C. In the event, that a repetition of any one defect occurs, indicating the probability of further failure, and which can be traced to faulty design, material or workmanship, then repairs or replacement shall not continue to be made but, the fault shall be remedied by a complete replacement of the entire defective unit.

D. In addition to the general guarantee, obtain and transmit to the Town any guarantees or warranties from manufacturers of specialties but only as a supplement to the general guarantee which will not be invalidated by same.

3.17 TOWN'S INSTRUCTIONS AND SYSTEM OPERATION:

A. At the time of the job's acceptance by the Town, Contractor shall furnish maintenance and operating instructions for all equipment including parts list. These instructions shall be written in layman's language and shall be inserted in vinyl covered three-ring loose leaf binder. This information in binder shall be first sent to the approved by the Engineer before turning over to the Town.

B. Upon completion of all work and of all tests, each Division shall furnish the necessary skilled labor and helpers for operating the system and equipment for a period of one (1) day of eight (8) hours, or in two (4) hours separate sessions. During this period, instruct the Town or his representative fully in operation, adjustment and maintenance of all equipment furnished. Give at least forty-eight (48) hours notice to the Town in advance of this period.

3.18 TOWN'S ACCEPTANCE TEST:

A. After the various systems are complete as determined by preliminary operating tests, the Contractor shall arrange for the Town's final acceptance tests.

B. The Contractor shall have present at each acceptance test, representatives of the several Contractors whose work is directly or indirectly involved, with instruments as necessary in accordance with the design and to include the following.

1. All equipment installed and operating in accordance with manufacturer's instructions and performance guarantee.
2. All systems operating in accordance with specifications.
3. All distribution systems properly adjusted for distribution to equipment as specified.
4. The various systems properly flushed, cleaned, and free of entrapped air and dirt.
5. All motors installed with proper thermal overload protection and not operating under overload conditions as determined by ammeter readings.
6. All valve charts, etc. as specified in various parts of the specifications installed or ready for delivery to the Town.

C. The date of the Town's acceptance of the equipment shall be the start of the 18 months guarantee period.

3.19 TEST:

A. Conducting Tests: Conduct all tests called for under the various sections or as required and repair or replace any defects. Perform all tests in the presence of and to the satisfaction of the Engineer and such other parties as may have legal jurisdiction.

B. Defective Work: The Town shall have the privilege of stopping any of the work not being properly installed. All such defective work shall be repaired or replaced and the tests shall be repeated.

C. Repair Damaged Work: Repair all damages resulting from tests and replace damaged materials.

END OF SECTION 200050

SECTION 220500 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this section.

1.2 SCOPE OF WORK:

Gas systems
Domestic water systems

A. This contract includes all labor, material, equipment, tests and appliances required to furnish and install all plumbing as shown on drawings, implied and herein specified.

B. The location of the building will be as shown on drawings. A visit to the site and examination of other Mechanical trades showing all details of construction is a requirement before submitting a proposal.

C. The drawings are diagrammatic and indicate the general arrangement of piping and equipment, and do not show all minor details and fittings. Such items shall be included, as well as reasonable modifications, in the layout as directed to prevent conflict with other trades.

D. Connect all equipment shown on drawings. Check all Mechanical drawings and coordinate all the work accordingly.

E. Provide seismic restraints in accordance with Section 230548.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: All work shall comply with the Connecticut State Building Code, BOCA Plumbing Code, and NFPA Standards.

1. 2022 Connecticut State Building Code with all the Amendments.
2. 2021 International Building Code
3. 2021 Life Safety Code- NFPA 101
4. 2021 International Plumbing Code
5. 2021 International Mechanical Code
6. 2021 National Fuel Gas Code-NFPA 54.
7. 2021 International Energy Conservation Code
8. State of Connecticut Public Health Code
8. Current State of Connecticut Public Health Code
9. 2009 Accessible and Usable Buildings and Facilities - ICC/ANSI A117.1
10. Americans with Disabilities Act – ADA

1.4 SUBMITTALS:

A. Shop Drawings: Submit the following shop drawings:

Valves
Pipes, fittings and couplings
Hangers and supports
Gas fired condensing domestic water heater

1.5 PLUMBING SYSTEM DESCRIPTION:

A. Furnish and install all plumbing equipment shown on the drawings and herein specified. All equipment shall be complete and perfect and properly connected to water supply as required and left in complete operation.

B. Before ordering equipment, Contractor shall submit brochures of all equipment and trim to the Engineer for review.

C. Contractor shall include all permit fees and connection charges.

1.6 WATER SERVICE:

A. Existing

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Listed below are references to the specification standards or recognized authorities to which pipe and fitting materials must conform.

B. All reference shall be the current edition as recognized by the active codes. Each pipe length shall have the manufacturer's name cast, stamped or rolled on. Each fitting shall have the manufacturer's symbol and pressure rating cast, stamped or rolled on.

C. Copper Tubing: shall be Type "K" or "L" seamless conforming to ASTM B 88. Cast bronze fittings to conform to ANSI B16.18 and wrought copper fittings to conform to ANSI B16.22.

D. Solder: To be 95% tin, 5% antimony (lead free) conforming to ASTM B-32, grade 5A.

E. Gas Piping:

1. The pipe shall be steel pipe, Schedule 40 complying with the ASTM A 53 Specification for Pipe, Steel, Black and hot–dipped, Zinc–Coated Welded and Seamless. The fittings shall be steel, malleable iron or ductile iron.

2. Gas pipe shall be clear and free from cutting burrs and defects. Any defective pipe or fitting shall be replaced and shall not be repaired.

3. Provide gas valves at all pressure regulators, at each piece of equipment, as shown on drawings and as required by codes. Gas solenoid valve for Kitchen is to be normally closed. Size as indicated on drawings.

4. No branch lines shall be taken from the bottom of horizontal runs.

5. Provide drips at any points in line where condensate may collect.

6. All gas piping shall be graded not less than 1/4" in 15'-0". All horizontal piping shall be graded to risers; provide capped drip at bottom of riser.

7. Provide dirt legs, gas valves, and unions at each equipment connection.

2.2 HANGERS:

A. Securely hang and anchor pipe as shown and required with proper provision for expansion, contraction and elimination of undue stress and strain on piping.

B. Provide a pipe hanger within two (2) feet of each elbow, tee, wye, valve, strainer and similar device.

C. Secure and support runs at base and at sufficiently close intervals to hold pipe at alignment and to carry safely the weight of piping and contents without undue stress thereon.

D. Except as indicated to the contrary, secure and support all horizontal piping as follows and required to prevent sagging, undue pipe movement and preserve proper alignment in each run.

Piping	Size	Maximum Interval
Steel	2" & smaller	Six (6) feet
Steel	2 1/2" & larger	Ten (10) feet
Copper Tubing	1 1/4" & smaller	Five (5) feet
Copper Tubing	1 1/2" & larger	Eight (8) feet

E. Hangers up to and including 2" shall be the adjustable band type equal to Empire. Figure 310 for iron pipe and Fig. 310CT for copper tubing.

F. Hangers for piping 2-1/2" and up shall be the clevis type, equal to Empire. Figure 11 for iron pipe and Figure 110CT for copper tubing.

G. Hangers shall be suspended from one of the following devices:

1. "C" clamps.
2. Trapeze hanger assemblies consisting of back-to-back horizontal steel channels with end-type rod hangers.
3. Expansion shield embedded into concrete or masonry.

H. Provide seismic restraints in accordance with Section 230548.

2.3 INSULATION:

A. Refer to Section 230700.

2.4 VALVES:

A. This Contractor shall furnish and install valves where shown on plans and also wherever necessary to make the system complete in its operation. All valves shall be as manufactured by Stockham, Jamesbury, Appollo, Centerline or Milwaukee as specified.

Hot water and cold water (domestic)

2" and smaller	
Ball valves	Apollo - 71-100/200
Check valves	Stockham B-310-T

2-1/2" and larger	
Butterfly valves	Stockham - LG712-BS3-B (Lug Style)
Check valves	Centerline - CLC - S.S. plates and spring nypalon seats

Furnish all valve materials suitable for service intended.

2.5 BACKFLOW PREVENTERS:

A. 4" Reduced pressure Zone Assembly: Watts Model 957RPDA with non-rising stem gate valves, UL classified and FM approved. Provide with air gap fitting.

B. ¾", 1", & 2" Reduced pressure Zone Assemblies: Watts Model 909 with ball valves. Provide with air gap fitting.

C 1/2" Reduced pressure Zone Assembly: Watts Model 009 with ball valves valves, UL classified. Provide with air gap fitting.

2.6 GAS FIRED WATER HEATER:

A. The **WATER HEATER** shall be a **LOCHINVAR ARMOR** Model **AWN200PM** having a modulating input rating of 199,000Btu/Hr, a recovery capacity of **232** gallons per hour at a 100ºF rise and shall be operated on Natural Gas. The **WATER HEATER** shall be capable of full modulation firing down to 20% of rated input with a turn down ratio of 5:1.

B. The **WATER HEATER** shall bear the ASME "HLW" stamp and shall be National Board listed for inputs in excess of 200,000 Btu/Hr. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a five (5) year limited warranty.

C. The **WATER HEATER** shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US and Canada The **WATER HEATER** shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The **WATER HEATER** shall be 96% thermal efficiency. The **WATER HEATER** shall be certified for indoor installation.

D. The **WATER HEATER** shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The **WATER HEATER** shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating **WATER HEATER** firing rates for maximum efficiency. The **WATER HEATER** shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column.

E. The **WATER HEATER** shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The **WATER HEATER** shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

F. A **CIRCULATING PUMP** is required to deliver specified flow rates through the heat exchanger. A properly sized stainless steel PUMP is supplied with the standard “Pump Mounted” (PM) model. Upsized PUMPS are an available option for increased flow and better lime scale protection in hard water conditions. Factory supplied PUMPS shall operate on a 120 volt, 60 cycle, 1 phase power supply (unless otherwise specified). No PUMP models are also available.

G. The **WATER HEATER** shall feature the “Smart System” control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys, password security, pump delay with freeze protection, pump exercise, and USB PC port connection. The **WATER HEATER** shall feature night setback for the domestic hot water tank and shall be capable of controlling a building recirculation pump while utilizing the night setback schedule for the building recirculation pump. The **WATER HEATER** shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the water heater, and a 0-10VDC output of water heater modulation rate. The **WATER HEATER** shall have a built-in cascading sequencer with modulation logic options of “lead lag” or “efficiency optimized”. Both modulation logic options should be capable of rotation while maintaining modulation of up to eight water heaters without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.

H. The **WATER HEATER** shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent control of the Domestic Hot Water Pump and Building Re-circulation Pump.

I. The **WATER HEATER** shall be installed and vented with a **Direct Vent Vertical** system with a vertical roof top termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the **WATER HEATER** from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the roof top with the manufacturer's specified air inlet cap. The **WATER HEATER's** total combined air intake length shall not exceed 100 equivalent feet. The **WATER HEATER's** total combined exhaust venting length shall not exceed 100 equivalent feet. ***Foam Core pipe is not an approved material for exhaust piping.***

J. The **WATER HEATER** shall have an independent laboratory rating for Oxides of Nitrogen (NO_x) of 20 ppm or less, corrected to 3% O_2.

The **WATER HEATER** shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

K. Maximum unit dimensions shall be: Length 22 ¼", Width 15 ½" and Height 33 ¼". Maximum unit weight shall be 181 pounds.

L. The **WATER HEATER's** firing control system shall be **M9 Direct Spark Ignition with Electronic Supervision**

2.7 RECIRCULATING PUMP:

A. Existing

2.8 THERMOSTATIC MIXING VALVE:

A. Existing

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Check all plumbing and electrical drawings to make sure that this piping will not conflict with other work.

B. All piping work shall be installed with provisions to allow for expansion and contraction of lines so as to prevent any undue strains on pipe and fittings, any trapping of lines or lifting or dislocating of any appliances.
Rectify without cost to the Town any conditions of noisy circulation due to trapped or air bound lines, including the expense of cutting and repairing of the building structure incident to making such alterations.

C. Install the work to conform to space conditions and the work of other trades. The drawings indicate generally the runs and the sizes of piping and although the size must not be decreased, nor the drawings deviated from except as unforeseen space conditions may require, the right is reserved to make minor changes in the arrangement of the work to meet the conditions arising during construction.

3.2 TESTS:

A. Furnish all labor and materials for the performance of all tests as required by codes and by the authorized inspectors having jurisdiction.

3.3 GUARANTEE:

A. All parts of the work and all equipment shall be guaranteed for a period of 18 months from the date of substantial completion.

B. If during that period of general guarantee, any part of the work installed fails, becomes unsatisfactory or does not function properly due to any fault in material or workmanship, whether or not manufactured or job built, each section shall upon notice from the Town, promptly proceed to repair or replace such faulty material or workmanship without expense to the Town, including cutting, patching and painting or any other work involved and including repair or restoration of any damaged sections of the premises resulting from such faults.

C. In the event, that a repetition of any one defect occurs, indicating the probability of further failure, and which can be traced to faulty design, material or workmanship, then repairs or replacement shall not continue to be made but, the fault shall be remedied by a complete replacement of the entire defective unit.

D. In addition to the general guarantee, obtain and transmit to the Town any guarantees or warranties from manufacturers of specialties but only as a supplement to the general guarantee which will not be invalidated by same.

3.4 COLD WATER PIPING:

A. All water piping shall be run concealed in ceilings and in pipe spaces in ceilings and in finished area.

B. At low points, provide valved drain with hose connection. Arrange piping to pitch to low points or fixtures so that entire system may be drained.

C. Provide ball valves on all branches off main and sectional valves on main. Provide stops at each individual fixture. All valves shall be tagged.

D. All cold water piping shall be Type "L" hard tempered copper tubing with wrought copper sweat fittings or pro-press fittings

E. All exposed un-insulated water piping to individual fixtures in finished rooms shall be chrome plated.

3.5 HOT WATER PIPING:

A. Extend the hot water piping as shown on plans which, in general, will follow the cold water.

B. At low points, provide valved drain with hose connection with vacuum breaker.

C. Pipe shall be copper Type “K” or “L” with wrought copper sweat fittings.

3.6 HOT WATER RECIRCULATING PIPING:

A. Install recirculation from ends of hot water supply back to the recirculating pump properly valved and provide with check valves to prevent back circulation. At recirculating loop connections provide balance valve assemblies on start of each loop.

A. All recirculation lines shall be Type "L" copper tubing hard tempered.

3.7 FUEL GAS PIPING:

A. Pressure Testing

1. The customer piping shall be pressure tested in accordance with the National Fuel Gas Code (NFPA_54), current edition. The test medium shall be nitrogen (N2), carbon dioxide (CO2) or air. The test pressure and duration shall conform to NFPA-54 Section 4.14 and must be approved by the local authority having jurisdiction and the Local Gas Distribution Company (LDC).

B. Purging and Placing Gas Piping into Operation

1. Upon notification and meter being turned on by Local Distribution Gas Company, the house line can be placed in operation. All purging shall be done in accordance with NFPA-54 Section 4.3.2.

a. The air can be safety displaced with natural gas provided that a moderately rapid and continuous flow of gas is introduced at the meter and air is vented to the outside of the building by means of connecting a rigid pipe or a semi-rigid metallic tubing with appropriate fittings.
b. The purge piping must be located outside of the building at a safe distance away from fresh air intakes and away from any source of ignition. The end of the purge riser must be equipped with a flash back arrestor. The purge riser must be manned at all times. A fire extinguisher must be placed nearby while purging is in operation. A combustion gas indicator (CGI) can be used to assure the house line is purged properly to 100% gas.
c. In the event of multi-floor house lines, the longest house line (furthest from the meter) must be purged first, followed by the next longest, until all sections of house lines have been purged to 100% gas.

C. Odorant Level

1. All house lines must be continuously purged until such time that the Odorant level is sufficiently detachable by smell and confirmed with an ordinary level instrument such as Bacharach Model 5110-200, or equivalent.
The instrument shall have a range of to 1.2% gas in air. The line must be purged until a readily detachable Odorant reading of 0.25% or less gas in air is maintained.

   a. As soon as the acceptable level reading is maintained at all purging locations, turnoff the ends of house lines, disconnect the purging tubing, permanently plug all ends and leak test all plugs. Gas utilization equipment can now be purged and placed into operation.
   b. Odorant level readings shall be re-taken periodically to ensure proper level of Odorant is maintained. Odorant level may decay especially in low flow house lines. If this occurs purling procedure must be repeated as needed.

3.8 PIPING JOINTS:

A. Soldered Joints in Copper Tube: Cut the ends of tubes square, remove burrs, clean tube ends and fitting sockets with emery cloth, and remove all particles before applying flux and making the joint. Insert tubes to full socket depth. Use the following solders at the given conditions.

B. All solder joints shall be made up with 95/5 solder.

C. Plumbing Contractor shall be held responsible for any damages caused by water from poorly made joint.

3.9 REAMING OF PIPES:

A. All pipes to be carefully reamed after cutting and threading.

B. All steel pipe lines shall be reamed carefully before they are threaded. They shall be reamed smooth on the inside to give the full area of pipe in all cases.

C. All copper tubing shall be carefully cut square and true, carefully reamed and thoroughly cleaned. The inside of fittings shall be carefully cleaned. All tubing shall be inserted fully to the shoulder of fittings.

3.10 TESTING:

A. All piping testing to be performed in accordance with all applicable Codes including, but not limited to IFC and CT Health Code.

B. All involved parties are to be notified at least two weeks in advance of a scheduled test.

3.11 DISINFECTION:

A. Disinfect new water piping in accordance with AWWA C601.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with water/chlorine solution containing at least 200 parts per million (200mg/L) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.
5. After completion take bacteriological samples to provide a record by which the effectiveness of the procedure can be determined.

END OF SECTION 220500

SECTION 220700 PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 01, General requirements, apply to the work specified in this Section.

B. The General Requirements in Section 22 00 50 shall also govern the work under this Section.

C. Scope of Work: This Section contains details for the insulation of pipe, ductwork and equipment installed under Division 22.

D. Recycled Content: Provide data showing recycled materials content of materials and fabricated items provided for this project, stated as a percentage of the materials included in these items or materials provided as part of the Work of this Section.

E. Connecticut High Performance Building Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.2 SUBMITTALS:

A. In accordance with Section 20 00 50, the following items shall be submitted for approval.

Piping insulation
Fitting insulation
Equipment insulation

B. Recycled Content: Provide data showing recycled materials content of materials and fabricated items provided for this project, stated as a percentage of the materials included in these items or materials provided as part of the Work of this Section.

1.3 MECHANICAL SYSTEMS INSULATION:

A. Furnish and install all thermal and protective insulation as specified herein for piping and equipment as shown on the drawings.

B. The following mechanical items shall be insulated:

Domestic Hot, Cold, Recirculated Hot Pipes
Piping - hot and cold
Fittings - Valve bodies, Victaulic couplings, elbows, tees, etc.
Equipment insulation

1.4 SYSTEM PERFORMANCE

A. Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of ASHRAE 90.1 (2010), "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air Conditioning Engineers. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.

B. Insulation materials furnished and installed hereunder shall comply with NFPA 255 and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with the following testing standard:

Underwriters' Laboratories, Inc. UL 723

Adhesives used for applying the sealed jackets shall also conform to these same ratings. The use of wheat paste or any other material not meeting these requirements will not be allowed.

1.5 QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications.

B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

C. All covering and insulating materials shall be manufactured by Owens-Corning, Knauf, Johns Manville or Armstrong.

1.6 SEAMS:

A. On exposed insulation, all longitudinal seams shall be kept at the top and back of the pipe and circumferential joints shall be kept to a minimum. Raw end of insulation shall be concealed by neatly folding the ends of the jackets. Fittings, valve bodies and flanges shall be furnished with the same jacket materials used on adjoining insulation.

1.7 PRIOR TESTING:

A. Covering shall not be applied until all parts of the work have been tested by the Contractor and reviewed by the Engineer.

1.8 VAPOR BARRIER:

A. Vapor barrier shall be applied in accordance with the manufacturer's instructions to maintain the integrity of the vapor barrier on cold systems.

B. An approved vapor retarder mastic compatible with PVC must be applied between pipe insulation and fitting cover, and on fitting cover and throat overlap seam.

C. For fittings where operating temperature is below 45 deg. For where pipe insulation thickness is greater than 1 ½", two or more layers of Hi-Lo temp insulation inserts shall be installed beneath fitting cover.

1.9 METAL SHIELDS:

A. Metal shields, 16 gauge galvanized, shall be applied between hangers or supports and the pipe insulation. Shields shall be roll formed to fit the insulation and shall extend up to the center line of the pipe and the length specified for the insert. Insulation shall be rigid type for length of shield to prevent crushing.

1.10 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories (wick material, sealing tape, etc) before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

PART 2 - PRODUCTS

2.1 PIPING:

A. Insulate all new domestic hot, cold and recirculating hot water lines with Johns Manville Fiberglass ASJ with S.S.L. II, pipe insulation with double self-sealing lap having a factory applied jacket. All horizontal and vertical insulated piping located below 8'-0" AFF level and not protected with enclosures shall be protected with Zeston 2000 P.V.C. 30 Mil jacketing. Outdoor, exposed piping shall be protected with aluminum jacket. Acceptable equals are by SpeedLine or Proto.

B. All concealed piping shall be covered as follows: Apply insulation to clean dry pipe with side and end joints butted tightly. Seal lap of jacket and butt joint strips with Benjamin Foster 82-07 vapor barrier lap adhesive. Insulate fittings, flanges and valves of piping with mitered pipe insulation, or F/G premolded fittings made smooth with insulating cement and jacket with glass cloth saturated with Benjamin Foster 30-60 lagging adhesive. Vinyl or plastic fitting jackets will be allowed.

C. Insulate domestic cold water, water cooler waste, rainleaders, roof drain pans (70 degrees F. and below) in the same as for hot piping above except vapor seal all joints, seams, elbows and fittings.

D. Insulate horizontal rainleaders with A.S.J. - S.S.L. II pipe insulation with double self-sealing lap and vapor barrier. Include roof drain bowl and first vertical drop.

E. For pipes exposed to weather apply a 16 mil embossed aluminum jacket with 2" overlap at longitudinal and circumferential joints. Secure in place with 3/4" x .015" aluminum band 18" on centers. All seams shall be sealed weather tight.

F. Foam insulation:

1. Piping and Fittings. MicroLok plain pipe insulation shall be wired or taped in place over clean, dry pipe with all joints butted firmly together. Vapor retarder shall be Micro-Lok AP-T plus.

2. The insulation shall be finished with metal jacketing with a laminated moisture retarder. Metal jacketing shall be overlapped 2 to 3 inches (51 to 76 mm) and held in place with sheet metal screws or metal bands.

3. Elbows and tees shall be finished with matching metal fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

G. Provide minimum insulation thickness in accordance with the following table.

Minimum Pipe Insulation

Piping System Types	Fluid Temp. Range	Runouts 2 in +	1 in. and less	1-1/4 to 2 in.	2-1/2 to 4 in.	5 and Larger
	F	in.	in.	in.	in.	in.
Plumbing Systems						
Hot Water	100-200	1.0	1.0	1.0	1.5	1.5
Cold Water Rainleader Cond. Drains	Below 70	0.5	1.0	1.5	1.5	1.5

Reinsulate piping where insulation has been disturbed under this contract and feather to remaining insulation.

2.2 FITTING COVERS:

A. Fitting covers may be used in lieu of insulating cement and jacket. Provide fitting covers in Zeston - 2000 P.V.C. (20 Mil thickness) by Johns Manville. Acceptable substitutions are by SpeedLine or Proto. Fitting covers in Art Room and Project Room shall be color coded.

B. General - The matching insert (fiberglass) should either be wrapped completely around the fitting or snugly positioned inside the fitting for proper fit. The insert shall cover the full inner surface area of the fitting cover. The fitting cover is then to be applied over the fitting and insert, and the throat secured by either tack fastening, taping, or banding.

C. Cold Pipe - Fitting systems below ambient temperature must have a continuous vapor barrier, either with pressure sensitive PVC Tape, or an approved adhesive system. When PVC Tape is used, a 2" downward lap is required. On cold lines in severe ambient temperatures, the fiberglass insert shall be the same thickness as the adjacent pipe insulation. All joints shall then be sealed with PVC Tape.

D. Hot Pipe - For hot piping which requires pipe insulation over 1-1/2" wall, an extra inch of wall thickness in the pipe insulation shall be applied. If the surface temperature of insulation exceeds 155 degrees F. fitting covers should not be used. The throat seam shall be riveted or tacked on hot piping.

PART 3 – EXECUTION

3.1 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturer's recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

A. Ensure that insulation is clean, dry, and in good mechanical condition and that all factory-applied facings are intact and undamaged. Wet, dirty, or damaged insulation is not acceptable for installation.

B. Ensure that pressure testing of piping, duct and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

A. General

1. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.
2. Install insulation on piping/duct subsequent to painting, and acceptance tests.
3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

B. Fittings

1. Wrap valves, fittings, and similar items in each piping system with wicking material to ensure a continuous path (100% coverage) for the removal of condensation.
2. Cover valves, fittings, and similar items in each piping system using one of the following:

    a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
    b. PVC Fitting Covers insulated with material equal in thickness and composition to adjoining insulation.

3. Seal all fitting joints with contractor supplied VaporWick Sealing Tape or approved vapor retarder mastic compound.

C. Penetrations

Extend piping without interruption through walls, floors and similar piping penetrations.

3.4 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

B. Replace any ceiling damage caused by condensation due to improper covering and sealing during the guarantee period of this job.

3.5 PROTECTION

A. Replace damaged, removed or disturbed insulation with appropriate fiberglass insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.6 SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION 220700

SECTION 230548 VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

1.2 SECTION INCLUDES:

A. Vibration isolation and seismic restraints for all mechanical and electrical system including equipment, piping, conduit and ductwork within the building.

B. The work of this section includes but is not limited to the following:

1. Vibration isolation elements.
2. Equipment isolation bases.
3. Piping flexible connections.
4. Seismic restraints for isolated and non-isolated mechanical and electrical items.

1.3 REFERENCES:

A. State of Connecticut Building Code.

B. NFPA 13 - Installation of Sprinkler Systems.

C. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.

D. Mason Industries, Inc. Seismic Restraint Guidelines

1.4 QUALIFICATIONS:

A. Qualifications: Only firms having five years experience designing and manufacturing seismic devices shall be capable of work in this specification.

1.5 SUBMITTALS:

A. Submit under provisions of Section 200050.

B. The submittal material shall include copies of descriptive data for all products and materials including but not limited to the following:

1. Descriptive Data:

a. Catalog cuts and data sheets.
b. An itemized list showing the items to be isolated and/or seismically restrained, product type or model number to be used and loading and deflection data.
c. Seismic restraint calculations.
d. (Structural or civil engineer's State of Connecticut professional engineer's seal verifying design and calculations for seismic restraining system used.)

2. Shop Drawings:

a. Drawings showing equipment base construction for each machine, including dimensions, structural member sizes, and support point locations.
b. Drawings showing methods of suspension, support guides for conduit, piping and ductwork.
c. Drawings showing methods for isolation of conduits, pipes and ductwork penetrating walls and floor slabs.
d. Concrete and steel details for bases including anchor bolt locations.
e. Number location of seismic restraints and anchors for each piece of equipment.
f. Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe and duct locations.

1.6 GENERAL (MANUFACTURER) RESPONSIBILITIES:

A. Contractor shall have the following responsibilities:

1. Determine vibration isolation and seismic restraint sizes and locations per specifications.
2. Provide and install isolation systems and seismic restraints as scheduled or specified.
3. Guarantee specified isolation system deflection.
4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
5. Substitution of "Internally Isolated" mechanical equipment in lieu of the specified isolation of this section may be acceptable provided that all specified deflections and stamped seismic calculations are supplied by the equipment manufacturer.

1.7 PROJECT RECORD DOCUMENTS:

A. Submit under provisions of Section 200050.

B. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Mason Industries Inc. models listed below.

B. Other approved manufacturers providing equivalent products include:

1. Vibration Eliminator Co. 2. Amber/Booth Co.

2.2 SEISMIC RESTRAINT TYPES:

A. General: Installations shall be designed to safely accept external forces of one-half "G" load in any direction for all rigidly supported equipment without failure and permanent displacement of the equipment. Life safety equipment such as (fire pumps, sprinkler piping and emergency generators) shall be capable of safely accepting external forces up to one "G" load in any direction without permanent displacement of the supported equipment. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Type I (spring mount): Shall comply with general characteristics of spring isolators having a minimum o.d. to o.h. of .8 to 1 and minimum runout of 50% to solid. Shall incorporate snubbing restraint in all directions. Shall be capable of supporting equipment at a fixed elevation during equipment erection. Cast housings shall be ductile iron or aluminum. System to be field bolted or welded to deck with I G acceleration capability. Mason Type SSLFH or as approved.

C. Type II (snubber): Each corner of side shall incorporate a seismic restraint having a minimum 5/8" thick resilient pad limit stops working in all directions. Restraints shall be made of plate, structural members, or square metal tubing concentric within a welded assembly incorporated resilient pads. Angle bumpers are not acceptable. System to be field bolted or welded to a deck with 1 G acceleration capability. Mason Type Z-1011 and Z-1225.

D. Type III (cable braces): Metal cable type with approved end fastening devices to equipment and structure. System to be field bolted to deck or overhead structural members using two sided beam clamps to steel or appropriately designed insert for concrete. All parts of system including cables, clamps, excluding fastenings are to be single vendor furnished to assure seismic compliance. Mason Type SCB.

E. Type IV (neoprene mount): Double deflection neoprene isolator encased in ductile iron or steel casing minimum .30 static deflection. System to be field bolted or welded to deck with 1 G acceleration capacity. Mason Type BR, RBA.

F. Type V: Non-isolated equipment to be field bolted or welded (powder shots not acceptable) to resist seismic forces unless under 100 lb. Shear force required. Mason Type SAS, SAB.

2.3 VIBRATION ISOLATION – GENERAL:

A. Vibration Isolation shall control excessive noise and vibration in the building due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork, or conduit. (The installation of all vibration isolation units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative.)

B. All vibration isolators shall have either known non-deflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection can be verified.

C. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.

D. The theoretical vertical natural frequency for each support point, bases upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than +/- 10%.

E. All neoprene mountings shall have a Shore hardness of 30 to 60 +/- 5, after minimum aging of 20 days or corresponding oven aging.

2.4 VIBRATION ISOLATOR TYPES:

A. Type A: Spring isolators:

1. Minimum diameter of 0.8 of the loaded operating height.

2. Corrosion resistance where exposed to corrosive environment with:

   a. Springs cadmium plated or electro-galvanized.
   b. Hardware cadmium plated.
   c. All other metal parts hot-dip galvanized.

3. Reserve deflection (from loaded to solid height) of 50% of rated deflection.

4. Minimum ¼" thick neoprene acoustical base pad on underside, unless designated otherwise.

5. Designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

6. Non-resonant with equipment forcing frequencies or support structure natural frequencies.

7. Mason Type SLF.

8. When used in conjunction with seismic bracing, seismic restraint Type II shall be installed.

B. Type B: Spring isolators shall be same as Type A, except:

1. Provide built-in vertical limit stops with minimum ¼" clearance under normal operation.

2. Tapped holes in top plate for bolting to equipment when subject to wind load.

3. Capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.

4. Adjustable and removable spring pack with separate neoprene pad isolation.

5. Capable of accepting 1 G of acceleration.

6. Mason Type SLR.

C. Type C: Spring hanger rod isolators:

1. Spring element seated on a steel washer within a neoprene cup incorporating a rod isolation bushing.
2. Steel retainer box encasing the spring and neoprene cut.
3. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
4. Mason Type HS.

D. Type D: Seismic Restraint, Type IV: Double deflection neoprene isolator encased in ductile iron or steel casing minimum .30 static deflection. System to be field bolted or welded to deck with 1 G acceleration capacity. Mason Type BR, RBA.

E. Type E: Elastomer hanger rod isolators:

1. Molded unit type neoprene element with projecting bushing lining rod clearance hole.
2. Neoprene element to be minimum 1-3/4" thick.
3. Steel retainer box encasing neoprene mounting.
4. Clearance between mounting hanger rod and neoprene bushing shall be minimum of 1/8".
5. Minimum static deflection of 0.35".
6. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
7. Mason Type HD.

F. Type F: Combination spring/elastomer hanger rod isolators:

1. Spring and neoprene isolator elements in a steel box retainer. Neoprene double deflection type. Single deflection is unacceptable. Spring seated in a neoprene cup with extended rod bushing.

2. Characteristics of spring and neoprene as described in Type A and Type E isolators.

3. When used in conjunction with seismic bracing, seismic restraint Type III shall be installed.
4. Mason Type DNHS.

G. Type G: Pad type elastomer mountings:

1. ¾" Minimum thickness.
2. 50 PSI maximum loading.
3. Waffled design.
4. Deflection per pad thickness.
5. Galvanized steel plate between multiple layers or pad thickness.
6. Suitable bearing plate to distribute load.
7. Mason Type Super W.

H. Type H: Grommet type elastomer bushings:

1. One piece molded bridge bearing neoprene.
2. Washer / bushing shall surround the anchor bolt.
3. Flat washer face to avoid metal to metal contact.
4. Mason Type HG.

I. Type K: Pipe Anchors: All-directional acoustical pipe anchor consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum one-half inch thickness of heavy-duty neoprene and duck or neoprene isolation material. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material travel in either direction. Allowable loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction. Isolation to be bolted or welded depending on structure. Mason Type ADA.

2.5 EQUIPMENT BASES:

A. Integral Structural Steel Base, Type B-1:

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units. Centrifugal fan bases complete with motor slide rails.
2. Drills for drive and driven unit mounting template.
3. Must be utilized with seismic restraint Type I, II, or IV.
4. Mason Type M, WFB.

B. Concrete Inertia Base, Type B-2:

1. Vibration isolator manufacturer shall furnish rectangular structural concrete forms for floating foundation. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth shall be a minimum of 1/10 of the longest span but not less than 6" or greater than 14".

   Forms shall include minimum concrete reinforcement consisting of ½" bars or angles in place in 6" centers running ways and a layer 1 ½" above the bottom and a top layer of reinforcing steel as above for all bases exceeding 120" in one direction. Isolators shall be set into pocket housings which are an integral part of the base construction and set at the proper height to maintain a 1" clearance below the base. Bases shall be furnished with templates and anchor bolt sleeves as part of this system.

2. Must be utilized with seismic restraint Type I, II or IV.

3. Mason Type K, BMK.

C. Isolated Curb, Type B-3:

1. Curb mounted rooftop equipment shall be mounted on structural spring isolation curbs that directly sit on roof construction and are flashed and waterproofed into roof's membrane waterproofing system. Manufacturer's curb shall not be used.

2. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. All curbs shall be pitched. Contractor shall coordinate required pitch with the structural.

3. Curbs shall have a provision for an optional sound barrier kit.

4. All spring mounts shall be as Isolator Type A.

5. Curbs shall have static deflection.

6. Curbs shall be rated for 1 G of acceleration and shall be wind restrained for 110 mph wind loads.

7. Curbs shall have California OSHPD approval.

8. Sound barrier package, SBC-3. Two layers of waterproof sheetrock and sound insulating material shall be supplied and installed by this contractor.

9. Curbs to be welded to building steel or bolted to concrete decks to attain acceleration criteria.

10. Mason Type RSC.

D. Roof Isolation Rail System, Type B-4: Rooftop fans, condensing units, exterior ducted air handling units, etc., shall be installed on continuous equipment support piers which shall combine a regular equipment support and an isolation system into one assembly. The system shall be designed with 2" or 3" static deflection steel springs which are both adjustable, removable, and interchangeable after equipment has been installed. The system shall maintain the same operating and installed height both with and without the equipment load and shall be fully restrained during wind load conditions allowing no more than ¼" motion in any direction. The isolation pier shall be designed to accept the membrane waterproofing. The entire assembly shall be cold spray galvanized or plastic coated.

System design permits minimum 1 G of acceleration. Curbs to be welded to building steel or bolted to concrete decks to attain acceleration criteria. Mason Industries Model RSR.

E. Non-isolated seismic roof curbs, Type B-5:

1. Curb sections shall be either structural steel channels or 12GA. sheet metal.
2. Field assembled joints shall include a minimum of 2 rows of three bolts at each connection.
3. Curb to have a factory installed wood nailer.
4. System to be bolted or welded to deck.
5. System shall be designed for minimum 1/2G. of acceleration.
6. Mason Type RRC.

F. Dunnage steel mounted rooftop equipment. Type B-6:

1. Rooftop equipment shall be mounted on structural tubular steel boxed rail assembly.
2. Tubular steel rails shall be attached to seismic rated spring vibration isolators.
3. Isolators shall be bolted or welded to dunnage steel to meet seismic criteria of 1/2G acceleration.
4. Entire assembly shall be hot dipped galvanized.

5. Mason Type RSLR.

2.6 FLEXIBLE CONNECTORS:

A. Elastomer Type FC-1:

1. Manufactured of Kevlar reinforcement and EPDM, both molded and cured with hydraulic presses.
2. Straight connectors to have two spheres reinforced with a molded-in external ductile iron ring between spheres.
3. Elbows shall be long radius type.
4. Rated 250 psi at 170 degrees F. Dropping in a straight line to 170 psi at 250 degrees F for sizes 1-1/2" to 12" elbows. Elbows shall be rated no less than 90% of straight connections.
5. Sizes 10" to 12" to employ control cables with neoprene end fittings isolation from anchor plates by means of ½" bridge bearing neoprene bushings.
6. Minimum safety factor, 4:1 at maximum pressure ratings.
7. Systems bolted to victaulic type couplings or gate, butterfly, or check valves to have a minimum 5/8" flange spacer installed between conductor and coupling on flange.
8. Submittals to include test reports.
9. Mason Type Safeflex SFDEJ.

B. Flexible Stainless Hose, Type FC-2:

1. Type 321 stainless steel braided flexible metal hose.
2. 2" pipe size and smaller: threaded carbon steel fittings.
3. 1 ½" pipe size and larger: Class 150 carbon steel flanges.
4. Suitable for operating pressure with 4:1 minimum safety factor.
5. Flexible Metal Hose Company type DFC and MFC.

C. Unbraided Exhaust Hose, Type FC-3:

1. Low pressure stainless steel annularly corrugated.
2. Fitted with flanged ends.
3. Maximum temperature 1,500 degrees F.
4. Mason Type SDL-RF.

D. 60 Degree VEE assembly:

1. Type 304 stainless steel hose and braid.
2. 4" motion in all directions.
3. ASA 150 carbon steel flanges.

PART 3 - EXECUTION

3.1 GENERAL SEISMIC RESTRAINT REQUIREMENTS:

A. Install seismic restraints in accordance with manufacturers recommendations.

B. Seismic restraining system Type III: Install taut for non-isolated equipment and slack with ½" cable deflection for isolated systems.

C. Seismically restrain all piping, conduit and ductwork with Type III or Type V seismic restraint in accordance with guidelines outlined below. Restraints which are to be used in conjunction with vibration isolators shall be Type III.

1. Carbon steel piping shall be braced at maximum 40' intervals and at turns of more than 4'. Lateral bracing at maximum 80' intervals. No-hub piping to be braced at maximum 20' intervals or maximum 40' using ½ G acceleration rated couplings.
2. Ductwork shall be braced at maximum 30' and at every turn and duct run end. Lateral bracing at maximum 60'.

D. Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria. Mason Type HPA.

E. Seismic Restraints are not required for the following:

1. Piping in mechanical rooms or penthouses less than 1-1/4" O.D, except fire protection piping.
2. Piping in other areas less than 2-1/2" O.D. except fire protection piping.
3. Ducts which have a cross sectional area less than 6 square feet.
4. All piping suspended by individual hanger 12" or less in length from the top of the pipe to the bottom of the support for the hanger, except fire protection piping.
5. Fire protection feed mains and cross mains suspended by individual hangers 6" or less in length from the top of the pipe to the bottom of the support for the hanger.
6. All top supported ducts suspended by hangers 12" or less in length from the top of the duct to the bottom of the support for the hanger.
7. Electrical conduit less than 1-1/2" I.D.

F. For overhead supported equipment, over stress of the building structure must not occur. Bracing can occur from:

1. Flanges to structural beams.
2. Upper or lower truss chords in bar joist construction at panel points.
3. Cast-in-place inserts or drilled and shielded inserts in concrete structures.

G. Building seismic and expansion joints: Install hinged joints at piping crossing expansion and seismic joints and anchor the piping either side.

Anchors on each end are to be capable of accepting 1.5 times the operating pressure multiplied by the projected area of the pipe.
Fittings shall be able to compensate for 4"motions in all directions.

1. Offset shall be accomplished by the annular motion of a double sphere connector (TYPE FC-1) bolted to each end of an intermediate steel pipe. Bracket each joint with hinged steel connections. Hinge shall have a pin / slot assembly on both sides. The completed assembly shall be Mason Type Safeflex SFDEJ-HE.

3.2 GENERAL VIBRATION ISOLATION REQUIREMENTS:

A. Install isolators in accordance with manufacturer's recommendations. Vibration isolators shall not cause any change of position resulting in stresses or misalignment.

B. Mechanical equipment shall be isolated from the building structure by means of noise and vibration isolators.

C. Each fan and motor assembly shall be supported on a single structural steel frame (where noted on the isolation and seismic schedule). Flexible duct connections shall be provided at inlet and discharge ducts.

D. Provide pairs of horizontal limit springs (Thrust restraints) on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans where indicated

E. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch (1.5 mm) maximum clearance. Other snubbers shall have clearance between 0.15 inch (4 mm) and 0.25 inch (7mm).]

F. Ductwork connected to rotating equipment shall be supported with Type C or Type F isolators for the first three support points.

G. Installation of piping vibration isolators:

1. All piping, except fire protection standpipe systems, is included under this section.

2. Vibration isolators shall be installed on all piping outside the shafts as follows:

a. Piping in mechanical rooms.
b. Piping where exposed on roof.
c. Piping connected to rotating equipment and pressure reducing stations.

3. Horizontal suspended pipe 2" and smaller and all steam piping shall be suspended by Type E isolator with a minimum 3/8" deflection. Water pipe larger than 2" shall be supported by Type C or Type F isolator with minimum 1" whichever is greater.

4. Horizontal pipe floor supported at slab shall be supported via Type A with a minimum static deflection of 1" or same deflection as isolated equipment to which pipe connects, whichever is greater.

5. Vertical riser pipe supports under 2" diameter shall utilize Type G isolation pads.
6. Vertical riser guides, if required, shall avoid direct contact of piping with building.

7. Pipe anchors or guides, where required, shall utilize resilient pipe anchors, Mason Industries Type ADA, or equivalent, to avoid direct contact of piping with building.

8. Isolated piping which requires sway bracing shall utilize two neoprene elements, Type G to accommodate tension and compression forces.

9. Pipe extension and alignment connectors: Provide connectors at riser takeoffs, cooling and heating coils, and elsewhere as required, to accommodate thermal expansion and misalignment.

H. Pipe Isolation Schedule

PIPE SIZE - INCH (MM)	ISOLATED DISTANCE FROM EQUIPMENT
1 (25)	120 diameters (3.0m)
2 (50)	90 diameters (4.5m)
3 (80)	80 diameters (6.0m)
4 (100)	75 diameters (7.5m)
6 (150)	60 diameters (9.0m)
8 (200)	60 diameters (12.0m)
10 (250)	54 diameters (13.5m)
12 (300)	50 diameters (15.0m)
16 (400)	45 diameters (18.0m)
24 (600)	38 diameters (23.0m)

3.3 EQUIPMENT INSTALLATION:

A. Requirements for installation on concrete inertia bases shall be as follows:

1. Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 1".
2. The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
3. The isolators shall be installed without raising the machine and frame assembly.

4. After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
5. Install equipment with flexibility in wiring connection.
6. Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to ¼".
7. Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.

3.4 INSPECTION:

A. Upon completion of the installation of all vibration isolation, flexible connections and seismic restraints, the manufacturer's local representative shall visit the project job site, visibly inspect all installations and report, in writing, any and all deficiencies from the specifications. Any additional corrective measures required to put the system in total compliance shall be the responsibility of the installing contractor.

END OF SECTION 230548

SECTION 230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SCOPE OF WORK:

A. Provide all labor, materials, equipment and tools required to complete the work described and shown on the contract drawings.

PART 2 -PRODUCTS

2.1 PRODUCTS:

A. None required.

PART 3 - EXECUTION

3.1 GENERAL:

A. Work shall be performed only by a firm which employs certified testing, adjusting and balancing technicians as listed by the Sheet Metal Industry National Certification Board of TAB Technicians. The work may be performed by a certified Test, Adjusting and Balancing technician who may be assisted by other TAB technicians. This firm shall provide personnel trained and experienced in system balancing. This requirement will not be waived under any condition.

B. Before submitting system performance data for approval or acceptance, the firm shall perform all necessary tests and make all necessary adjustments as required to obtain the flow as called for on the Contract Documents.

C. The balance reports shall include the names, signatures and registration numbers of the technicians assigned to the project. Submit reports prior to final payment.

3.2 ACCEPTABLE FIRMS:

A. The following listed firms are approved to perform this work:

Environmental Testing and Balance
James Brennan Company
Wing's Testing and Balancing

RK Wing Company
Technical Associates Group, Inc.

B. Request to employ any other balancing and testing firm must be accompanied by a complete brochure of the firm listing previous installations successfully balanced, length of time in business, names and qualifications of employees and list of instruments available for use on the project.

3.3 HYDRONIC SYSTEMS:

A. Prior to the start of balancing, the firm shall check the rotation of all pumps.

B. The firm shall compile the following data for each pump insofar as they apply and shall include it on the final submittal:

PUMP DESCRIPTIVE DATA

Pump Number
System Served
Pump Size
Pump Make
Pump Horsepower
Motor Safety Factor
Motor Manufacturer & Size
Voltage & Phase

PUMP DESIGN & DELIVERED CONDITIONS

Pump Rpm
Pump Inlet & Outlet Pressure
Amperage
Brake Horsepower
Gpm Supply

SYSTEM DESIGN & DELIVERED CONDITIONS

Flow (Gpm) through each pump
Inlet & Outlet temperature at 3-way valve
Flow (Gpm) through each coil
Inlet & Outlet Pressure at each coil
Inlet & Outlet temperature at each coil
Type of instrument and method used

3.4 INSTALLATION TOLERANCES:

A. Adjust heating system to the following tolerances:

1. Supply water temperature 80 degree F to 120 deg. F 0% to +10% of design value.

2. Supply water temperature 120 degree F to 160 deg. F -5% to +10% of design value.

3. Supply water temperature above 160 degree F -10% to +10% of design value.

3.5 FIELD VERIFICATION:

A. The design Engineer may request verification of data contained in the balancing report. If requested the TAB technician whose initials appear on the data sheets shall take outlet and inlet readings selected at random by the Engineer who will compare these readings to those in the submitted report. If the field verification is not satisfactory, the firm doing the TAB work shall completely rebalance the system and a new report shall be prepared and submitted for approval.

END OF SECTION 230593

SECTION 230700 MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

C. Scope of Work: This Section contains details for the insulation of pipe, ductwork and equipment installed under Division 23.

1.2 SUBMITTALS:

A. In accordance with Section 200050, the following items shall be submitted for approval.

Piping insulation
Fitting insulation
Equipment insulation

1.3 MECHANICAL SYSTEMS INSULATION:

A. Furnish and install all thermal and protective insulation as specified herein for piping, and equipment as shown on the drawings.

B. The following mechanical items shall be insulated:
Piping - hot and cold
Fittings - Valve bodies, Victaulic couplings, elbows, tees, etc.
Equipment insulation

1.4 SYSTEM PERFORMANCE

A. Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of ASHRAE 90.1 (2001), "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air Conditioning Engineers. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.

B. Insulation materials furnished and installed hereunder shall comply with NFPA 255 and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with the following testing standard:

Underwriters' Laboratories, Inc. UL 723
Adhesives used for applying the sealed jackets shall also conform to these same ratings. The use of wheat paste or any other material not meeting these requirements will not be allowed.

1.5 QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications.

B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

C. All covering and insulating materials shall be manufactured by Owens-Corning, Knauf, Johns Manville or Armstrong.

1.6 SEAMS:

A. On exposed insulation, all longitudinal seams shall be kept at the top and back of the pipe and circumferential joints shall be kept to a minimum. Raw end of insulation shall be concealed by neatly folding the ends of the jackets. Fittings, valve bodies and flanges shall be furnished with the same jacket materials used on adjoining insulation.

1.7 PRIOR TESTING:

A. Covering shall not be applied until all parts of the work have been tested by the Contractor and reviewed by the Engineer.

1.8 VAPOR BARRIER:

A. Vapor barrier shall be applied in accordance with the manufacturer's instructions to maintain the integrity of the vapor barrier on cold systems.

B. An approved vapor retarder mastic compatible with PVC must be applied between pipe insulation and fitting cover, and on fitting cover and throat overlap seam.

C. For fittings where operating temperature is below 45 deg. For where pipe insulation thickness is greater than 1 ½", two or more layers of Hi-Lo temp insulation inserts shall be installed beneath fitting cover.

1.9 METAL SHIELDS:

A. Metal shields, 16 gauge galvanized, shall be applied between hangers or supports and the pipe insulation. Shields shall be roll formed to fit the insulation and shall extend up to the center line of the pipe and the length specified for the insert. Insulation shall be rigid type for length of shield to prevent crushing.

1.10 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories (wick material, sealing tape, etc) before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

PART 2 - PRODUCTS

2.1 PIPING:

A. Insulate all domestic hot water, recirculating hot water lines and supply and return hot water heating lines in the Boiler Room, with Owens-Corning Fiberglass ASJ with S.S.L. II, pipe insulation with double self-sealing lap having a factory applied jacket. All horizontal and vertical insulated piping located below 8'-0" AFF level and not protected with enclosures shall be protected with Zeston 2000 P.V.C. 30 Mil jacketing. Acceptable equals are by SpeedLine or Proto.

B. All piping shall be covered as follows: Apply insulation to clean dry pipe with side and end joints butted tightly. Seal lap of jacket and butt joint strips with Benjamin Foster 82-07 vapor barrier lap adhesive.

Insulate fittings, flanges and valves of piping with mitered pipe insulation, or F/G premolded fittings made smooth with insulating cement and jacket with glass cloth saturated with Benjamin Foster 30-60 lagging adhesive. Vinyl or plastic fitting jackets will be allowed.

C. Insulate domestic cold water, in the same as for hot piping above except vapor seal all joints, seams, elbows and fittings.

D. Foam insulation:

1. Piping and Fittings. MicroLok plain pipe insulation shall be wired or taped in place over clean, dry pipe with all joints butted firmly together. Vapor retarder shall be Micro-Lok AP-T plus.
2. The insulation shall be finished with metal jacketing with a laminated moisture retarder. Metal jacketing shall be overlapped 2 to 3 inches (51 to 76 mm) and held in place with sheet metal screws or metal bands.
3. Elbows and tees shall be finished with matching metal fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

E. Provide minimum insulation thickness in accordance with the following table.
Minimum Pipe Insulation

Piping System Types	Fluid Temp. Range	Runouts 2 in +	1 in. and less	1-1/4 to 2 in.	2-1/2 to 4 in.	5 and Larger
	F	in.	in.	in.	in.	in.
Heating Systems						
Low Temp	120-200	0.5	1.0	1.0	1.5	1.5

Plumbing Systems						
Hot & Recic. Hot Water	100-200	1.0	1.0	1.0	1.5	1.5
Cold Water	Below 70	0.5	1.0	1.5	1.5	1.5

2.2 FITTING COVERS:

A. Fitting covers may be used in lieu of insulating cement and jacket. Provide fitting covers in Zeston - 2000 P.V.C. (20 Mil thickness) by Johns Manville. Acceptable substitutions are by SpeedLine or Proto.

B. General - The matching insert (fiberglass) should either be wrapped completely around the fitting or snugly positioned inside the fitting for proper fit. The insert shall cover the full inner surface area of the fitting cover. The fitting cover is then to be applied over the fitting and insert, and the throat secured by either tack fastening, taping, or banding.

C. Cold Pipe - Fitting systems below ambient temperature must have a continuous vapor barrier, either with pressure sensitive PVC Tape, or an approved adhesive system. When PVC Tape is used, a 2" downward lap is required. On cold lines in severe ambient temperatures, the fiberglass insert shall be the same thickness as the adjacent pipe insulation. All joints shall then be sealed with PVC Tape.

D. Hot Pipe - For hot piping which requires pipe insulation over 1-1/2" wall, an extra inch of wall thickness in the pipe insulation shall be applied. If the surface temperature of insulation exceeds 155 degrees F. fitting covers should not be used. The throat seam shall be riveted or tacked on hot piping.

2.3 DUCTWORK:

A. Insulate all plenums, intake ducts, air conditioning ducts and warm air supply ducts in concealed locations with 1" thick fiberglass faced duct wrap type IV with factory applied flame retardant foil reinforced Kraft (FRK-25 U.L. labeled). Exhaust duct in the locker rooms shall be insulated the same as the supply ducts (including steam and sauna rooms exhaust ducts).

B. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum 2". Adhere insulation with 4" strips of Benjamin Foster 85-15 bonding adhesive at 8" o.c.

Additionally secure insulation to the bottom of concealed rectangular ductwork over 24" wide with suitable mechanical fasteners at not more than 18" o.c.

C. On circumferential joints, the 2" flame on the facing shall be stapled with 9/16" flare-door staples on 6" centers and taped with minimum 3" wide foil reinforced Kraft tape. On longitudinal joints, the overlap shall be stapled on 6" centers and taped with minimum 3" wide foil reinforced Kraft tape. All pin penetrations or punctures in facing shall also be taped.

D. Insulate air conditioning ducts or warm air ducts, all fresh air intake ducts, louver blanks, plenums in finished spaces, Boiler Room or Mechanical Equipment Rooms, with 1" thick fiberglass ASJ-25 equipment insulation.

E. Insulation shall be cut to fit the shape and contour of the equipment. All voids between equipment surface and insulation shall be packed with light density fiberglass. Impale insulation over welded pins on 12" centers and secure in place with speed washers.

F. The insulation shall be vapor sealed to provide a complete airtight envelope. Vapor barrier shall consist of one layer of Ludlow Foil Barrier Paper smoothly adhered to the insulation or cement surface with Benjamin Foster 82-07 Vapor Barrier Lap Adhesive.

Lap all joints a minimum of 3" and seal with B.F. 82-07.

G. It is not necessary to cover exhaust ductwork, return duct or ductwork which is called for to be lined. However, exhaust ductwork from motorized damper to exhaust louver shall be covered as called for above, or exhaust ductwork located on cold side of building insulation shall be covered as called for above.

H. Supply ducts located in vented/unvented attic shall be insulated with duct insulation with min. R-8 value. Return ducts and exhaust ducts associated with energy recovery systems located in vented/unvented attics shall be insulated with R-3.5 insulation.

PART 3 – EXECUTION

3.1 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturer's recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

A. Ensure that insulation is clean, dry, and in good mechanical condition and that all factory-applied facings are intact and undamaged. Wet, dirty, or damaged insulation is not acceptable for installation.

B. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

A. General

1. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.

2. Install insulation on piping subsequent to painting, and acceptance tests.

3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

B. Fittings

1. Wrap valves, fittings, and similar items in each piping system with wicking material to ensure a continuous path (100% coverage) for the removal of condensation.

2. Cover valves, fittings, and similar items in each piping system using one of the following:

   a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.

   b. PVC Fitting Covers insulated with material equal in thickness and composition to adjoining insulation.

3. Seal all fitting joints with contractor supplied VaporWick Sealing Tape or approved vapor retarder mastic compound.

C. Penetrations

Extend piping insulation without interruption through walls, floors and similar piping penetrations.

3.4 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.5 PROTECTION

A. Replace damaged, removed or disturbed insulation with appropriate fiberglass insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.6 SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION 230700

SECTION 230913 INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Sections 200050 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of the Section with all related and adjoining work.

1.2 GENERAL REQUIREMENTS

A. The Automatic Temperature Control Contractor shall furnish all material, engineering, and labor for the proper installation of a totally native BACnet-based system, based on a distributed control system in accordance with this specification. All building controllers, application, controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard135-2001, BACnet. In other works, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. New system shall communicate with the EMS installed in the building at the present time.

B. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide an open communications system. System shall be capable of utilizing standard protocols as follows as well as be able to integrate third-party systems via existing vendor protocols. Systems shall be BACnet communication according to ASHRAE Standard DPC 135A/95.

C. The intent of this specification is to provide a Building Automation System to control the system as defined for the project and to allow all objects (objects as defined in ASHRAE Standard SPC-135A/95) to be sent to the existing Trane system school server.

D. The control system shall be as manufactured by:

1. Trane.

E. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

F. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control

descriptions, logic drawings, configuration data, and bid documents.

G. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

H. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

I. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

J. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

K. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

L. Provide a comprehensive operator and technician training program as described herein. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

M. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections there of, shall govern design and selection of equipment and material supplied:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

2. ANSI/ASHRAE Standard 135-2001, BACnet.

3. Uniform Building Code (UBC), including local amendments.

4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

5. National Electrical Code (NEC).

6. FCC Part 15, Subpart J, Class A

1.3 SCOPE

Provide all necessary BACnet compliant hardware and software to meet the system's functional specifications. The control system operating software and hardware shall be fully interoperable and interfaced with the existing School Control System. Provide full color graphics. Control shall be furnished for the following:

Hot water system control
Domestic water heater

1.4 CONTROL WIRING

All Direct Digital Control wiring will be installed and terminated by the Temperature Control Contractor. Control wiring shall be defined as follows:

All wiring of electric/electronic/DDC temperature controls as shown on the drawings.

All temperature control panel wiring to terminal strips and field wiring from terminal strips to field mounted devices.

All wiring to the "Auto" side of the hand-off-auto switches on the units being controlled by the Temperature Control Contractor.

All wiring shall comply with National, State, and Local electrical codes.

1.5 POWER WIRING

All power wiring will be installed and terminated by the Electrical Contractor. Power wiring shall be defined as follows:

Wiring of all devices and circuits carrying voltages greater than 120 V.
Wiring of power feeds to all disconnects starters, and electric motors.
Wiring of 120VAC power feeds to all temperature control panels.
Power wiring to 120 V single phase motors.

1.6 WORK UNDER OTHER SECTIONS

The following work shall be preformed by the designated Contractor under the supervision of the Temperature Control Contractor.
The Heating, Ventilating, and Air Conditioning Contractor shall:
Install all water flow monitoring valves and separable wells furnished by the Temperature Control Contractor.
Furnish and install all necessary piping connections required for flow indication devices.
Furnish and install all necessary valve pressure taps and water drain and overflow connections and piping.
Provide, on magnetic starters furnished, all necessary auxiliary contacts with buttons and switches in the required configurations.

The Electrical Contractor shall:
Be responsible for the work as outlined under power wiring.

The Sheet Metal Contractor shall:
Install all control dampers.

1.7 MATERIALS

All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems, and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

The control system shall be manufactured by Alerton Technologies, Inc.

1.8 SUBMITTALS AND DRAWINGS

Electronic submittals of the following shall be submitted for approval prior to the system installation.
Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
Panel layouts.
Valve Schedules showing size, configuration, capacity, and location.
Data sheets for all control system components.
Upon completion of these installation and final system adjustments, the Control Contractor shall provide three (3) full sets of as-built drawings of the installation.

PART 2 - PRODUCTS

2.1 BUILDING CONTROLLER

A. General

1. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), at least 4 master slave token passing (MS/TP) LANs, a point-to-point (PTP – RS-232) connection and an on-board modem.
   a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
   b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
   c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.
3. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.

4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.

5. Building controller shall provide battery-backed real-time (hardware) clock functions.

6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).

7. Global control algorithms and automated control functions should execute via 32-bit processor.

8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

B. BACnet Conformance

1. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:

   a. Clock Functional Group

   b. Files Functional Group

   c. Reinitialize Functional Group

   d. Device Communications Functional Group

   e. Event Initiation Functional Group

2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

4. The Building Controller shall comply with Annex J of the BACnet

specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Remote Communications

1. Provide all functions that will allow remote communications via modem to off-site locations. Include one modem along with all cabling necessary for installation for the system. It shall be possible to use the onboard modem or a separate modem connected via the PTP / RS-232 connection.

2. Provide Windows XP software for off-site computer that allows operator to view and change all information associated with system on color graphic displays. Operator shall be able to change all parameters in this section from off-site location including all programming of building controllers and all programmable application controllers including all terminal unit controllers.

3. Building controller shall have capability to call out alarm conditions automatically. If desired, controller may also send encoded message to digital pager. If an alphanumeric pager is in use by the operator, building controller shall be capable of sending a text or numeric string of alarm description. All building controllers connected to the local LAN shall be capable of calling out alarm messages through one or more shared modems connected to one or more of the building controllers on the local LAN.

4. Building controller shall have capability to call a minimum of 20 different phone numbers. Numbers called may be controlled by type of alarm or time schedule.

5. Owner shall provide standard voice-grade phone line for remote communication function.

6. Building controller and internal modem shall be capable of modem-to-modem baud rates of 33.6 Kbps minimum over standard voice-grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require them.

D. Schedules

1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.

E. Logging Capabilities

1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.

2. Logs may be viewed both on-site or off-site via remote communication.

3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.

4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

F. Alarm Generation

1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

2. Each alarm may be dialed out as noted in paragraph 2 above.

3. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.

4. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

2.2 TERMINAL UNIT APPLICATION CONTROLLERS

A. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance

1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

a. Files Functional Group

b. Reinitialize Functional Group

c. Device Communications Functional Group

2. Please refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include as a minimum– Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

D. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

E. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.4 SENSORS/INPUT/OUTPUT DEVICES

A. Temperature Sensors

1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

2. Room Sensor: All space temperature sensors shall be the thermistor types. The range shall be -30 to 100 degrees F, at a factory calibration point of 77 degrees F. Accuracy shall be +/-

0.36 degrees F, at calibration point. Sensors where identified, shall contain push-button bypass switches and shall be of the SS plate type when located in student accessible areas. Areas such as teachers lounges and Administrative areas shall be standard sensors with bias levers and push-button bypass switches.

3. All space temperature sensors shall be the thermistor types. The range shall be -30 to 100 degrees F, at a factory calibration point of 77 degrees F. Accuracy shall be +/- 0.36 degrees F, at calibration point. Sensors where identified, shall contain push-button bypass switches and shall be of the SS plate type when located in student accessible areas. Areas such as teachers lounges and Administrative areas shall be standard sensors with bias levers and push-button bypass switches.

B. Rigid Element: Single point duct temperature sensors shall be the thermistor type. The range shall be 32 to 158 degrees F, with a factory calibration point of 77 degrees F. Accuracy shall be +/- 0.36 degrees F, at calibration point. These sensors shall be used in unit discharge and well sensor.

C. The outside air temperature sensor shall be the thermistor type. The range shall be –30 to 140 degrees F and have an accuracy, at the calibration point, of +/- 0.36 degrees.

D. Differential Pressure Switches: The differential pressure range of the switches shall be selected to suit the application, and shall have an adjustable setpoint. The switches shall have SPDT contacts. Dwyer AFS-262 for air and Penn P74 for liquid, or equal. The switches shall be mounted with the diagram in a vertical plan.

E. Current sensors shall have: fixed setpoint, .25A to 200A, shall be 100% solid-state, no moving parts to fail Veris series H-800 or equal.

F. Stainless Steel Pressure Transmitter: Utilizes a thin film strain-gauge bridge and stainless steel diaphragm to provide a highly accurate, stable means of measuring pressures up to 2000psig. Splash-proof cable connections protect the wiring, allowing the model PTX1 to be mounted near the medium being measured.

G. Two-Position Room Thermostat: Line or low voltage tamperproof without thermometers, concealed adjustment setpoints, sensing element (liquid charged or bimetal). Cooling thermostats to have sub-base with fan on-off and off-cool switches.

H. Low limit Thermostat: Shall have heavy-duty temperature cut-out controls incorporating a vapor-charged sensing element. It shall have a four-wire, two-circuit contact block that contains two isolated sets of contacts. The contacts are designed to transfer at setpoint so that when the main contact opens, the auxiliary contact closes simultaneously. Shall be manual reset.Temperature range of 15-55 degrees F with averaging capillary Penn model A70HA-1 or equal.

PART 3 - EXECUTION

3.1 INSTRUCTION AND ADJUSTMENTS

Upon completion of the project, the Temperature Control Contractor shall: Check, validate, and calibrate, where required, all controllers, controlled devices, valves, actuators, auxiliary devices, relays, etc. provided under this section.

3.2 COORDINATION

Coordinate the controls furnished under this section with the controls furnished with the boilers and chillers resulting in a complete system properly interfaced.

3.3 SYSTEM TURN OVER

Upon completion of the installation, the Control Contractor shall start-up the system and perform all necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative, the Architect, or the Engineer shall be preformed. The acceptance test shall consist of a point-to-point check-out within each terminal unit controller to insure proper operation of all system components.

When the system is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and place under warranty.

Problems which occur within approved hardware or software shall be corrected in an appropriate fashion under warranty. Any such occurrence shall not void previous approval; however, the Control Contractor shall be responsible to attend to, and remedy, such items within the warranty period. Appropriate logs, schedules, and reports shall be maintained to reflect these items and their redress.

3.4 TRAINING/OWNER'S INSTRUCTION

A. The Control Contractor shall provide two (2) copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Control Contractor shall instruct the owner's designated representative in these procedures during the start-up and test period. The duration of the instruction are to be conducted during normal working hours and shall be no less than sixteen (16) hours divide in (4), four hours sessions.

3.5 WARRANTY

A. The entire building control system shall be warranted for a period of (18) months following the date of substantial completion. Any manufacturing defects arising during this period shall be corrected without cost to the owner. This warranty shall become effective starting the date the owner begins to receive beneficial use of the system.

END OF SECTION 230913

SECTION 230993 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Sections 20 00 50 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of the Section with all related and adjoining work.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Section 23 09 13 “Instrumentation and Controls for HVAC” for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct Digital Control

1.4 HOT WATER CONTROL

A. Boiler Hot Control:

1. Below 65°F (adjustable) the DDC system shall enable the boiler package control panel. Wiring of the boiler control panel and its control components is the responsibility of the control contractor. The control contractor will interface all available control points and alarms from the boiler control panel into the DDC system through BACnet. It is the boiler manufacturer responsibility to supply a control panel capable of sending this information to the control system via BACnet.

2. Building Heating Hot water Pump Control:
Whenever the outside air temperature is 65°F or below, or there is a call for heat at one of the AHU heating coils or other heating terminal, the heating hot water system shall be enabled and the BAS shall signal the lead hot water pump to start.

The lead pump's variable frequency drive (VFD) shall modulate the lead pump's motor speed to maintain the differential pressure set point of 15 psig as sensed by the differential pressure sensor.

The BAS shall alternate the lead / lag position of the pumps every 200

hours. Upon change over from an operating lead pump to an idle lag pump, the idle lag pump shall be started and its operation proven prior to the stopping of the operating lead pump. If the lead pump fails to establish and/or maintain flow, as determined by the differential pressure sensor across the pump, the lag pump shall be started and an alarm shall be issued.

Coordinate and direct the installation of the differential pressure sensor in the piping with the Mechanical Contractor. Locate the pressure controller approximately 2/3 the longest hydraulic distance from the discharge of the pumps. Refer to piping plans. Review and coordinate sensor location with the Owner and Engineer.

Boiler Combustion Air Control. Boilers shall be interlocked with the combustion air unit HV-8. When any of the boilers is activated, HV-8 shall be activated. When only one boiler is commanded to run, HV-8 shall operate at 1/3 of its capacity. When two boilers are commanded to run, HV-8 shall operate at 2/3 capacity. When all three boilers are commended to run, HV-8 shall operate at full capacity. When any of the boilers is on, exhaust fan EF-11 shall not be allowed to operate. EF-11 shall be allowed to operate only when all the boilers are off.
Make-up air for EF-11 shall be controlled as previously programmed.
Make-up unit operation (including duct mounted coil control) shall be as previously programmed.

Domestic Water Heater Combustion Air Control shall be disabled

PART 2 - PRODUCTS

None

PART 3 - EXECUTION

3.1 INSTRUCTION AND ADJUSTMENTS

A. Upon completion of the project, the Temperature Control Contractor shall: Check, validate, and calibrate, where required, all controllers, controlled devices, valves, actuators, auxiliary devices, relays, etc. provided under this section.

3.2 COORDINATION

A. Coordinate the controls furnished under this section with the controls furnished with the boilers and chillers resulting in a complete system properly interfaced.

3.3 SYSTEM TURN OVER

A. Upon completion of the installation, the Control Contractor shall start-up the system and perform all necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative, the Architect, or the Engineer shall be performed. The acceptance test shall consist of a point-to-point check-out within each terminal unit controller to insure proper operation of all system

components.

B. When the system is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and place under warranty.

C. Problems which occur within approved hardware or software shall be corrected in an appropriate fashion under warranty. Any such occurrence shall not void previous approval; however, the Control Contractor shall be responsible to attend to, and remedy, such items within the warranty period. Appropriate logs, schedules, and reports shall be maintained to reflect these items and their redress.

3.4 TRAINING/OWNER'S INSTRUCTION

A. The Control Contractor shall provide two (2) copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Control Contractor shall instruct the owner's designated representative in these procedures during the start-up and test period. The duration of the instruction are to be conducted during normal working hours and shall be no less than sixteen (16) hours, divided in (4) four hours sessions or as directed by the Owner.

3.5 WARRANTY

A. The entire building control system shall be warranted for a period of (18) months following the date of beneficial use. Any manufacturing defects arising during this period shall be corrected without cost to the owner. This warranty shall become effective starting the date the owner begins to receive beneficial use of the system.

END OF SECTION 23 09 93

SECTION 231313 UNDERGROUND STORAGE TANK REMOVAL (Add Alternate #1)

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this section to the extent referenced. The publications are referenced in the text by basic designation only.

1. AMERICAN PETROLEUM INSTITUTE (API)
2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
3. CODE OF FEDERAL REGULATIONS (CFR)
4. ENVIRONMENTAL PROTECTION AGENCY (EPA)
5. LOCAL ORDINANCE K-2

1.2 MEASUREMENT AND PAYMENT

A. Compensation for removal of contaminated soil shall be paid as a unit cost. This unit cost includes testing, excavation, stockpiling, transportation and disposal of the contaminated soil and backfilling with non-contaminated soil. Payment for all other work shall be under the base bid for the tank removal and shall constitute full payment for all work defined in the contract documents including testing of the contents, excavation and disposal of the tank, and testing of the underlying soil.

1.3 SUBMITTALS

A. The following shall be submitted in accordance with the requirements of Section 200050 of the specifications.

1. Work Plan

a. The Contractor shall develop, implement, maintain, and supervise as part of the work, a comprehensive plan for tank removal and related operations. The Work Plan shall be based on work experience, on the guidance provided in this specification, and on the following references:

API RP 1604.
API RP 2015.
API RP 2003
API Publ 2217.
API Publ 2219.

b. The Work Plan shall be submitted within 30 days after notice to proceed. No work at the site, with the exception of site inspections and mobilization, shall be performed until the Work Plan is approved. The Contractor shall allow 30 days in the schedule for the Plainville Public Schools's review and approval.

c. No adjustment for time or money will be made for resubmittals required as a result of noncompliance. At a minimum the Work Plan shall include:

- Scheduling and operational sequencing.

- Discussion of the approach, tank cleaning, and tank cutting procedures.
- A Chemical Data Acquisition Plan which describes sampling procedures and lists analysis parameters, methods, laboratory or laboratories and:
- Soil sampling locations and rationale for locations.
- Explanation of how the analytical results will be used.
- Identification of applicable regulatory requirements and permits.
- Methods to be employed for residue, vapor, liquid, and contaminated water removal, purging and storage and methods proposed for control of surface water.
- Identification of waste, tank and contaminated soil transporters and means of transportation.
- Disposal facilities and alternate disposal facilities and means of disposal or remediation.
- Borrow source.
- Spill prevention plan.
- Spill contingency plan.
- Decontamination procedures.

2. Qualifications: A written statement that the Contractor meets the requirements in paragraph QUALIFICATIONS.

3. Test Reports: Test results for the fill material, underlying soil, contents of the tank and discharged water. The reports shall include the chain-of-custody records.

4. Records

   a. Shipping Manifest: Manifest in accordance with CFR 40 Part 262 Section 23 and State regulations.

   b. Closure Record: A report prepared in accordance with paragraph TANK CLOSURE REPORT.

1.4 QUALIFICATIONS

A. The Contractor shall have a minimum of 2 years of tank removal experience and shall be certified by the State of Connecticut for tank removal work.

1.5 REGULATORY REQUIREMENTS

A. Statutes and Regulations

1. Tank closure shall be carried out in accordance with the requirements identified in CFR 40 Part 280 as well as the applicable local and State of Connecticut regulations. Hazardous material shall be transported in accordance with CFR 40 Part 263 to disposal facilities that operate in accordance with CFR 40 Part 264 and CFR 40 Part 265.

B. Notification

1. The Contractor shall notify the Plainville Public Schools's representative 10 days prior to tank removal. The Contractor shall be responsible for contacting the Authorities having jurisdiction in accordance with the applicable reporting requirements.

1.6 PROJECT/SITE CONDITIONS

A. The work consists of removal, decontamination and disposal of the 20,000gal underground oil storage tank, associated piping and ancillary equipment. The tank is double wall, fiberglass model DTW-6 Type II, by Containment Solutions, and is at the location shown on the drawings. The tank was used for storing fuel oil. Prior to removal and disposal of the tank, the tank shall be emptied of any remaining fuel oil. The fuel oil shall be stored on site and shall be placed into the new tank to be installed. The contractor shall provide all temporary storage containers and appurtenances required. Residue remaining in the tank is considered a hazardous waste. The Contractor is responsible for verifying all actual site conditions prior to submitting a bid.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIAL

A. Non-contaminated material removed from the excavation may be used for backfill in accordance with Paragraph BACKFILLING, additional backfill material shall be obtained from off-site. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. If off-site materials are used, soil classification test results shall be approved prior to bringing the material onsite.

PART 3 - EXECUTION

3.1 GENERAL

A. Safety Guidelines

1. Personnel working inside and in the general vicinity of the tank shall be trained and thoroughly familiar with the safety precautions, procedures, and equipment required for controlling the potential hazards associated with this work.

2. Personnel shall use proper protection and safety equipment during work in and around the tank as specified in API Publ 2217, API RP 1604, and the contract clauses.

B. Burning and Explosives

1. Use of explosives or burning debris will not be allowed.

3.2 TANK CONTENTS VERICATION

A. Sampling

1. Sampling of tank residues and liquids is not required where the contents of the tank is adequately documented. If contents of the tank are unknown or the records indicating the materials stored are unavailable, the Contractor shall provide sampling and analysis to the extent required by the approved off-site permitted treatment, storage or disposal (TSD) facility receiving the material.

B. Analysis

1. Where tank contents testing is required, the Contractor shall have samples tested for the parameters listed herein. Analyses shall be in accordance with EPA SW-846 and include total recoverable petroleum hydrocarbons (TRPH).

C. Characterization

1. Prior to removing any of the tank contents, the contents shall be characterized to determine if the tank contents must be disposed as a hazardous waste based on local, state, and Federal disposal regulations. The liquid shall be characterized in accordance with CFR 40 Part 261, Subpart C. The waste contents determination and accompanying test results for each phase present in the tank shall be submitted to the Engineer. The Contractor shall be responsible for any additional requirements identified by the disposal facility. The tank contents shall not be removed until approval is given by the Engineer.

3.3 TOPSOIL

A. Uncontaminated topsoil shall be stripped and stockpiled separately for reuse at a location approved the Plainville Public Schools if it meets the requirements of clean fill given in Paragraph BACKFILLING.

3.4 TANK REMOVAL

A. Before excavating, residue, liquids, piping, and ancillary equipment shall be removed from the tank and the tank shall be purged and vented in accordance with API RP 1604 and as specified herein.

1. Removal of Tank Liquid, Residue, and Contaminated Water

a. Tank liquids, residues, and contaminated water shall be contained, and stored onsite, prior to disposal. Contaminated water shall be treated as specified. Residue, liquids and contaminated water, shall be analyzed and segregated to recover reusable products by the Contractor prior to being transported to the approved treatment, storage and disposal (TSD) facility. Tank liquids, residues, and contaminated water shall be removed and disposed of by the Contractor. The Contractor shall be responsible for obtaining all required permits. Usable product shall be the property of the Plainville Public Schools. The Contractor shall provide approved containers, vehicles, equipment, labor, signs, labels and manifests, necessary for accomplishment of the work including materials necessary for cleaning up spills that may occur from tank removal operations.

B. Contaminated Water Disposal

1. General

a. Sampling and analysis shall be performed prior to disposal for every 500 gallons of liquid treated. Analyses for contaminated water to be taken to an off-site treatment facility shall conform to the requirements of the treatment facility with documentation of all analysis performed furnished to the Engineer in accordance with Paragraph Records. Liquids shall be contained, stored onsite, and analyzed prior to being transported to the approved treatment, storage and disposal facility and disposed of by the Contractor in accordance with applicable Federal and state disposal regulations.

b. The Contractor shall provide approved containers, vehicles, equipment, labor, signs, labels and manifests, necessary for accomplishment of the work. Sampling and analyses of contaminated water and treated water and the Contractor and laboratory quality assurance program shall be in accordance with EPA SW-846.

2. Treatment

    a. Contaminated water shall be treated off-site in accordance with all applicable codes. If the tank contents are to be treated onsite, the proposed treatment shall be specified in the Work Plan. Temporary storage and treatment equipment shall be installed in the general vicinity of the tanks. Treated effluent shall be sampled and analyzed and the results approved by the Engineer before discharge to the surface. Treated effluent shall be adjusted to have a pH between 6 and 9.

C. Purging

1. Prior to excavation beyond the top of the tank, flammable and toxic vapors shall be purged from the tank in accordance with API RP 1604 with the exceptions that filling with water shall not be used and if dry ice is employed the Contractor shall use a minimum of 1.8 kg per 500 L (3 pounds per 100 gallons) of tank volume. The tank atmosphere shall be continuously monitored for combustible vapors.

D. Excavation

1. Exploratory Excavations

    a. Exploratory trenches shall be excavated as necessary to determine the tank location, limits and the location of ancillary equipment.

2. Tank Excavation

    a. Excavation around the perimeter of the tank shall be performed in a manner that will limit the amount of potentially contaminated soil that could be mixed with previously uncontaminated soil. Contaminated soil shall be segregated in separate stockpiles.

    b. Surface water shall be diverted to prevent direct entry into the excavation. Dewatering of the excavation will be limited to that necessary to assure adequate access to the tank and piping and to assure a safe excavation. Dewatering may result in the production of contaminated water and/or free product. Free product shall be recovered from the groundwater only as part of necessary dewatering.

3. Open Excavations

    a. Open excavations and stockpile areas shall be secured while awaiting verification test results from the soil beneath the tank. The excavation shall not be backfilled without approval from the Engineer and the code authorities having jurisdiction. The Contractor shall divert surface water around excavations to prevent water from directly entering into the excavation.

4. Stockpiles

    a. Uncontaminated excavated soil shall be stockpiled and used for backfill in the tank excavation prior to using borrow material. Excavated material which is visibly stained and which has an obvious petroleum odor or as required by the State of Connecticut shall be considered contaminated and shall be stockpiled for sampling in accordance with Paragraph Stockpiled Material Sampling. Uncontaminated soil shall be stockpiled separately at a safe distance from the contaminated soil, but adjacent to, the excavation. Contaminated soil shall be placed on an impermeable geomembrane a minimum of 0.762 mm (30 mils) thick, and covered with a 0.254 mm (10 mil) sheet of geomembrane. The geomembrane shall be placed such that the stockpiled soil does not come into contact with surface water run-off. The 0.254 mm (10 mil) geomembrane cover shall prevent rain or surface water from coming into contact with the contaminated soil, as well as limit the escape of the volatile constituents in the stockpile.

E. Removal

1. Tank: The tank shall be removed from the excavation and the exterior cleaned to remove all soil and inspected for signs of corrosion, structural damage, or leakage. All materials coming into contact with the tank, or in the vicinity of the excavation such as shovels, slings and tools shall be of the non-sparking type. After removal from the excavation, the tank shall be placed on a level surface adjacent to the tank excavation and secured with wood blocks to prevent movement.

2. Contaminated Soil: After the tank has been removed from the ground, the adjacent and underlying soil shall be examined for any evidence of leakage. The soil shall be visually inspected for staining and also screened for the presence of contamination using a real time vapor monitoring instrument. Contaminated soil shall be transported off-site for disposal.

F. Tank Cleaning

1. Exterior: Uncontaminated soil shall be removed from the tank exterior to eliminate soil deposition on roadways during transportation to a temporary storage area, ensure markings will adhere to the tank surface, and simplify tank cutting. Soil shall be removed using non-sparking tools. Soil removal shall be accomplished on a geomembrane adjacent to the tank removal site as approved by the Engineer. Uncontaminated Soil removed from the tank exterior shall be recovered and used as backfill in the former tank excavation. Soil believed to be contaminated shall be removed and collected on a 0.762 mm (30 mil) impermeable geomembrane and stockpiled with other contaminated soil removed from the excavation.

2. Temporary Storage

   a. If the tank is stored after the tank exterior is cleaned and ancillary equipment is removed and prior to being cut into sections, the tank shall be labeled as directed in API RP 1604, placed on blocks, and temporarily stored on a flat area adjacent to the excavation.

   b. Prior to cleaning, store the tank on a flat area adjacent to the excavation. Prior to cleaning the tank interior, the tank atmosphere shall be monitored for combustible vapors and purged if combustible vapors are detected.

3. Interior

   a. The tank interior shall be cleaned using a high pressure (greater than 3.45 MPa (500 psi)) low volume (less than 0.13 L/s (2 gpm) water spray or steam cleaned until all loose scale and residue is removed, and contamination in the form of a sheen is no longer visible in the effluent stream. All contaminated water resulting from cleaning operations shall be handled in accordance with Paragraph Contaminated Water Disposal. Cleaning shall be accomplished in a manner that eliminates the need for personnel to enter the tank to the greatest extent possible. Cleaning shall be done using specially designed tank cleaning equipment which allows the tank to be cleaned prior to cutting into sections without requiring personnel to enter the tank or, if less specialized equipment is used, the tank shall be partially dissected to overcome confined space entry hazards by removing the end walls. In either case, the cutting operation shall be accomplished using nonsparking or non-heat producing equipment.

3.5 SOIL EXAMINATION, TESTING, AND ANALYSIS

A. General: After soil excavation is complete, the excavation shall be sampled in accordance with State regulations. Samples may be obtained from the pits using a backhoe with a Shelby tube attached to the bucket. Sample preservation and analytical procedures shall conform to EPA SW-846.

B. Stockpiled Material Sampling: Stockpiled contaminated soil shall be sampled and preserved in accordance with EPA SW-846. Sampling locations, number and specific procedures shall be as required by the State and the disposal facility.

C. Analysis: Soil samples from the excavation and stockpiled material shall be tested in accordance with EPA SW-846 for the following parameters: total recoverable petroleum hydrocarbons (TRPH). Copies of all test results shall be provided to the Engineer. The maximum allowable laboratory detection limits shall be 10 ppm for TRPH. The testing laboratory and Contractor shall adhere to the quality control program, including spikes, blanks, and duplicates, of EPA SW-846.

3.6 BACKFILLING

A. The tank area and any other excavations shall be backfilled only after the soil test results have been approved. The excavation shall be dewatered if necessary. Stockpiled material subjected to chemical confirmation testing shall be used as backfill if it is found to conform to the requirements of clean fill per appropriate state and local regulations ppm of total recoverable petroleum hydrocarbons. The excavation shall be backfilled within 48 hours after the bottom of the tank excavation is determined to have soil contamination levels below the state standards or after being directed to do so by the state inspector. Backfill consisting of clean fill shall be placed in layers with a maximum loose thickness of 200 mm, (8 inches), and compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for cohesionless soils. Density tests shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. A minimum of one density test shall be performed on each lift. Laboratory tests for moisture density relations shall be determined in accordance with **ASTM D 1557, Method B, C, or D or ASTM D 3017**. A mechanical tamper may be used provided that the results are correlated with those obtained by the referenced hand tamper. Field in-place density shall be determined in accordance with **ASTM D 1556, ASTM D 2922, or ASTM D 2167.**

3.7 DISPOSAL REQUIREMENTS

A. General

1. Disposal of hazardous wastes shall be in accordance with all local, State, and Federal solid and hazardous waste laws and regulations, as well as the Resource Conservation and Recovery Act (**RCRA**), and conditions specified herein. These services shall include all necessary personnel, labor, transportation, packaging, detailed analyses (if required for disposal, manifesting or completing waste profile sheets), equipment, and reports.

2. Liquids removed from the tank shall be recycled to the greatest degree practicable. All contaminated soil shall be treated as a hazardous waste. The tanks removed shall be disposed of at a state approved facility.

B. Tank and Ancillary Equipment Disposal

1. After the tank, piping, and ancillary equipment have been removed from the excavation and the tank cleaned, the tank shall be cut into sections with no dimension greater than 1500 mm. (5 feet). Tank and piping sections shall be disposed of in a State approved off-site disposal facility. The tank shall be cut into sections prior to being taken from the tank removal site. The Contractor shall not sell the tank intact. Ancillary equipment shall be disposed of at an approved off-site disposal facility. Piping shall be disconnected from the tank and removed unless otherwise indicated.

C. Transportation of Wastes: Transportation shall be provided in accordance with Department of Transportation (**DOT**) Hazardous Material Regulations and State and local requirements, including obtaining all necessary permits, licenses, and approvals. Evidence that a State licensed waste transporter is being used shall be included in the **SUBMITTALS**.

D. Salvage Rights: The Contractor shall retain the rights to salvage value of wastes, so long as the requirements of CFR 40 Part 266, or the applicable State requirements are met.

E. Records

1. Records shall be maintained of all waste determinations, including appropriate results of analyses performed, substances and sample location, the time of collection, and other pertinent data as required by **CFR 40 Part 280**, **Section 74** and **CFR 40 Part 262 Subpart D**. Transportation, treatment, disposal methods and dates, the quantities of waste, the names and addresses of each transporter and the disposal or reclamation facility, shall also be recorded and available for inspection, as well as copies or originals of the following documents:

    a. Manifests.
    b. Waste analyses or waste profile sheets.
    c. Certifications of final treatment/disposal signed by the responsible disposal facility official. Following contract close out, the records shall become the property of the Government.

F. Hazardous/Special Waste Manifests

1. For hazardous waste the Contractor shall utilize the **U.S. EPA** approved manifest system so that the wastes can be tracked from generation to ultimate disposal. The manifests shall comply with all of the provisions of the transportation and disposal regulations. The Contractor shall be responsible for preparing manifests for each load and obtaining the appropriate identification numbers and signatures. Prior to transportation of the hazardous waste, all of the established pretransport requirements shall be met. The wastes shall be transported by a certified hazardous waste hauler (i.e., the hauler must have a **U.S. EPA** or appropriate state hazardous waste identification number) in approved containers. All transporters must sign the appropriate portions of the manifest and must comply with al of the provisions established in **DOT** and **RCRA** regulations.

G. Documentation of Treatment or Disposal

1. The wastes shall be taken to a treatment, storage, or disposal facility which has **EPA** or appropriate state permits and hazardous waste identification numbers and complies with all of the provisions of the disposal regulations. Documentation of acceptance of special waste by a facility legally permitted to treat or dispose of those materials shall be furnished to the Engineer not later than 5 working days following the delivery of those materials to the facility and a copy included in the Tank Closure Report. A statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept hazardous wastes shall be furnished in the Work Plan. If the Contractor selects a different facility than is identified in the Work Plan, documentation shall be provided for approval to certify that the facility is authorized and meets the standards specified in **CFR 40 Part 264**.

3.8 SPILLS

A. Spill Responsibility: Immediate containment actions shall be taken as necessary to minimize effect of any spill or leak. Cleanup shall be in accordance with applicable Federal, State, and local laws and regulations at no additional cost to the Government.

B. Contractor Reporting Requirements

1. If a spill occurs the Contractor shall immediately notify the Plainville Public Schools and the Engineer. Off the site, the Contractor shall report spills related to project activities to the National Response Center (**NRC**), the Plainville Public Schools, and the Engineer immediately following discovery and shall also comply with applicable State requirements. A written follow-up shall be submitted to the Engineer not later than 7 days after the initial report. The written report shall be in narrative form and as a minimum include the following:

   a. Description of the material spilled (including identity, quantity, and manifest number).

   b. Whether amount spilled is **EPA**/State reportable and when and to whom, it was reported.

   c. Exact time and location of spill, including description of the area involved.

   d. Receiving stream or waters.

   e. Cause of incident and equipment and personnel involved.

   f. Injuries or property damage.

   g. Duration of discharge.

   h. Containment procedures initiated.

   i. Summary of any communications Contractor has with press, agencies, or Government officials other than **COR**.

   j. Description of cleanup procedures employed or to be employed at the site, including disposal location of spill residue.

3.9 TANK CLOSURE REPORT

A. For each **UST** site opened, a Tank Closure Report shall be prepared in a standard three ring binder and submitted within 14 days of completing work at each site. Tank Closure Reports shall include the following information as a minimum:

1. A cover letter signed by a Professional Engineer registered in the State of Connecticut certifying that all services involved have been performed in accordance with the terms and conditions of this specification.

2. A narrative report describing what was encountered at each site, including:

   a. The condition of the **UST**.

   b. Any visible evidence of leaks or stained soils.

   c. Results of vapor monitoring readings.

   d. Actions taken including quantities of materials treated or removed.

   e. Reasons for selecting sample locations.

   f. Sample locations.

   g. Collection data such as time of collection and method of preservation.

   h. Reasons for backfilling site.

   i. Whether or not groundwater was encountered.

   j. Copies of all analyses performed for disposal.

   k. Copies of all waste analyses or waste profile sheets.

   l. Copies of all certifications of final disposal signed by the responsible disposal facility official.

   m. Information on who sampled, analyzed, transported, and accepted all wastes encountered and copies of manifests.

   n. Copies of all analysis performed for verification that underlying soil is not contaminated, with copies of chain-of-custody for each sample. All analysis shall give the identification number of the sample used. Sample identification numbers shall correspond to those provided on the one-line drawings.

   o. Scaled one-line drawings showing tank locations, limits of excavation, limits of contamination, underground utilities within 15 m, (50 feet), sample locations, and sample identification numbers.

END OF SECTION 23131 3

SECTION 235000 HEATING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SCOPE OF WORK:

A. This Contract includes all labor, material, equipment, tests and appliances required to furnish and install all HVAC as shown on drawings, implied and herein specified.

B. The present location of the building will be as shown on drawings. Visit the site and examine the Mechanical trades showing all details of construction before submitting proposal.

C. Connect new boilers and pumps to existing and leave ready to operate. Check all Mechanical and Electrical drawings and coordinate all work accordingly.

D. Refer to Section 230548 for Seismic Restraints.

E. Drawings are diagrammatic and indicate the general arrangement of piping and do not show all minor details and fittings. Such items shall be included, as well as reasonable modification, in the layout as directed to prevent conflict with other trades.

1.3 SUBMITTALS:

A. In accordance with Section 200050, the following items shall be submitted for review.

Pipe and fittings
Boiler

1.4 MOTOR CONTROL:

A. Each electric motor of 3 phase characteristics shall be furnished with an automatic starter as specified in Section 200050, Motor Control.

PART 2 -PRODUCTS

2.1 PIPE AND FITTINGS:

A. Copper Tubing:

1. Type "L", ASTM Specifications B88, shall be used for water lines.
2. Fittings shall be wrought copper or cast brass solder- joint pressure rated type.
3. Type "K" shall be used for underground piping with flared fittings.

B. Steel Piping:

1. Pipe shall be Standard Wall (Sch. 40) black carbon steel, ASTM A-120, Grade B, with threaded ends for sizes 1/2" through 2", for hot water heating piping.
2. Fittings shall be standard weight (125 lbs.), cast iron screwed, ASTM A126, Class A, for sizes 1/2" through 2". Piping 2" and under shall be screwed.
3. Victaulic Grade E couplings, fittings and accessories in conjunction with grooved end schedule 40 piping will be permitted in existing and new construction for hot water heating system.

2.2 PIPE AND FITTINGS:

A. All fittings on welded lines shall be furnished in accordance with ASTM A105 Specification designed for welding. Branch outlets on mains 2-1/2" and smaller to be made with Weldolets or Threadolets. Welding fittings on mains and branches 3" and larger are to be full size of reducing tube designed for welding.
All flanged valves 3" and larger and special equipment connections to be installed with weld neck flanges for welded construction.

B. All nipples shall be extra strong as follows: Pipe size 1/2" to 4" - 6" close. Pipe size 5" - 12" - 12" close and of the same material as the piping they are used with.

C. All copper tubing shall be furnished in Type "L" using sweat fittings unless otherwise noted. Copper tubing shall be furnished in Chase, Anaconda, Bridgeport or Revere.

D. All black steel over 4" or other welded pipe shall have long radius welding ells and tees of the same wall thickness as the pipe. Welding tees will not be required where the mains and branches comply with the following schedule:

Min. Size of Mains	Max. Size of Branch
2 1/2"	3/4"
3"	1 1/4"
4"	2"
5"	3"
6"	4"
8"	6"
10"	8"
12"	10"

E. Welding flanges shall be slip-on or welding neck type, 300 psig forged steel conforming to ANSI Specification B-16.5.

F. All necessary precautions shall be taken when welding in the new building to prevent combustion of structure.

2.3 GROOVE PIPING:

A. Victaulic couplings may be used in lieu of welding, thread or flanging on 2 1/2" through 30" carbon steel pipe, on heating water services from -30 deg. F. to 230 deg. F. within the manufacturer's rated working pressures. Pipe grooving shall be cut grooved and/or rolled grooved as per manufacturer's latest spec. Installation is per manufacturer's latest recommendations. All piping shall be Schedule 40. grooved piping shall be used only in concealed or service areas. Grooved piping will not be accepted in finished areas with no ceiling.

B. Piping Components - Grooved couplings consisting of two or more pieces of ductile or malleable iron. Coupling gaskets will be a synthetic rubber gasket with a central cavity pressure responsive design. Coupling bolts and nuts shall be heat treated carbon steel, track head conforming to physical properties of ASTM-A-183. All grooved couplings shall be as manufactured by Victaulic Co. Style 77, 07 or equal.

C. For piping 2 1/2" and larger, full size branch connections shall be made with manufactured grooved end tees. Branch connections for less than full size shall be made with Victaulic hole cut products. Style 920 or Style 921 branch connections with locating collar engaging into hole or style 72 outlet coupling used to join grooved pipe and to create a branch connection. Gaskets for branch connection shall be Victaulic Grade "E" EPDM Compound with working temperature of -30 deg. F. to 230 deg. F.

D. Flanges - Vic-Flange Style 741 (2-24") for connection to ANSI class 125 and 150 flanged components.

E. Fittings - Fittings shall be full flow cast fittings, steel fittings or segmentally welded fittings with grooves or shoulders designed to accept Victaulic grooved end couplings.

1. Standard Fittings - shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) or malleable iron conforming to ASTM A-47, Grade 32510, painted with a rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153 or zinc electroplated to ASTM B-633, as required.
2. Standard Steel Elbow Fittings - (14" - 24"), shall be forged steel conforming to ASTM A-106 Grade B (0.375" wall), painted with rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153.
3. Standard Segmentally Welded Fittings - shall be factory fabricated, by fitting manufacturer, of carbon steel pipe as follows, 3/4" - 4" conforming to ASTM A-53, Type F; 5" - 6" Sch. 40 conforming to ASTM A-53, Type E or S, Grade B; 8" - 12" Sch. 30 conforming to ASTM A-53, Type E or S, Grade B; 14" - 24" 0.375" wall conforming to ASTM A-53, Type E or S, Grade B, painted with rust inhibiting modified vinyl Alkyd enamel or hot-dip galvanized to ASTM A-153, as required.

F. Victaulic Pipe Hanging (Victaulic Hanging Standard A-130)

1. Style 07 Zero-Flex for rigid piping systems should be supported as per Building Services B31.9 Hanging.
2. Style 77 flexible piping systems are supported as per Victaulic Hanging Standard A-130.

2.4 PIPING JOINTS:

A. Welded Joints shall be fusion welded in accordance with American Standard B31.1, Section 6, except as modified hereinafter. Changes in direction of piping shall be made with welding fittings only. Mitering, notching or direct welding of pipe to the main in order to form tees or ells will not be permitted. Branch connections may be made with welding tees or forced branch outlet fittings, as manufactured by Bonney Forge, either being acceptable without size limitation. Bonney Thredolets shall be used in lieu of Hald couplings when reducing from a welded run to a screwed branch. Outlet fittings where used shall be forged, flared for improved flow where attached to the run, reinforced against external strains and designed to maintain full pipe bursting strength.
Fillet welds shall be used for welding screwed and slip-on steel flanges to pipes. Where lateral connections are to be used, either lateral fittings or Bonney Latrolets are acceptable. Wedded joints shall be used in finished areas with no ceiling.

B. Screwed Joints: The ends of pipes to be threaded shall be cut square and reamed. Pipe threads shall be standard taper, shall be cut straight and clean and to full depth, and shall be free from dirt, chips and burrs when the joint is made. Pipe joint lubricant or compound shall be selected for the pipe line service and shall be applied to male threads only. Screwed joints shall not be caulked.

C. Flanged Joints: This heading covers flanged joints of all types, including those made with flange unions. Flanged joints shall be made with suitable reinforced gaskets. Clean all parts and align the joint before assembling; support pipes or heavy parts independently. Opposite bolts shall be pulled up successively. Screwed steel flanges shall be welded to pipes; slip-on steel flanges shall be welded front and back.

Cast iron flanges shall not be welded to pipes. If raised face flanges are to be bolted against plain face flanges, the raised face shall be removed and a full face gasket used. Where flanged base elbows are installed, the base shall not be used for anchoring the line or otherwise subjected to tension or shear.

D. Soldered Joints in Copper Tubing: Cut the ends of tubes square, remove burrs, clean tube ends and fitting sockets with emery cloth and remove all particles before applying flux and making the joint. Insert tubes to full socket depth. Use the following solders at the given conditions.

95 - 5% Tin-Antimony/all services/high pressure 250 degrees F. Max.
Silver - 35 to 45% alloy-refrigerant piping/high pressure and temperature.

2.5 PIPE HANGERS:

A. Securely hang and anchor pipe as shown and required with proper provision for expansion, contraction and elimination of undue stress and strain on piping.

B. Provide a pipe hanger within two (2) feet of each elbow, tee, wye, valve, strainer and similar device.

C. Secure and support runs at base and at sufficiently close intervals to hold pipe at alignment and to carry safely the weight of piping and contents without undue stress thereon.

D. Except as indicated to the contrary, secure and support all horizontal piping as follows and required to prevent sagging, undue pipe movement and preserve proper alignment in each run.

Piping	Sizes	Maximum Interval
Cast Iron	All sizes	At each hub or joint
Steel	2" & smaller	Six (6) feet
Steel	2 1/2" & larger	Ten (10) feet
Copper Tubing	1 1/4" & smaller	Five (5) feet
Copper Tubing	1 1/2" & larger	Eight (8) feet

E. Hangers up to and including 2" shall be the adjustable band type equal to Empire. Figure 310 for iron pipe and Fig. 310CT for copper tubing.

F. Hangers for piping 2-1/2" and up shall be the clevis type, equal to Empire. Figure 11 for iron pipe and Figure 110CT for copper tubing.

G. Hangers shall be suspended from one of the following devices:

1. "C" clamps.
2. Trapeze hanger assemblies consisting of back-to-back horizontal steel channels with end-type rod hangers.
3. Expansion shield embedded into concrete or masonry.

H. On hot water systems, provide over-sized hangers.

I. Refer to Section 15010 for Seismic Restraints.

2.6 VALVES:

A. This Contractor shall furnish and install valves where shown on plans and also wherever necessary to make the system complete in its operation. All valves shall be as manufactured by Stockham, Jamesbury, Centerline, Appollo, Milwaukee and Victaulic.

Hot Water Heating

2" and smaller	
Ball valves	Apollo 71-100/200
Check valves	Stockham B-310-T
Vertical check valves	Stockham B-310-T
2-1/2" and larger	
Butterfly valves	Stockham - LG712-BS3-B (Lug Style)
Check valves	Centerline - Series 800 S.S. plate and spring, and nypalon seats.

Furnish all valve materials suitable for service intended. No gate valves shall be allowed. Provide all valves with factory installed extension stems.

2.7 UNIONS:

A. All unions shall be furnished in Nibco-633 or equal in Chase, Revere, Jefferson and Anaconda.

2.8 GASKETS:

A. Where flanges occur, they shall be packed with Klinger or approved equivalent high quality non-asbestos material composed of fibers for industrial maintenance service with high chemical stability and heat resistance. Nitrile rubber bonded.

Temperature	750 deg. F. max.
Pressure	1450 psi max.
Compressibility	ASTM F36A
Tensile Strength	ASTM F152

2.9 REAMING OF PIPES:

A. All pipes to be carefully reamed after cutting and threading.

2.10 PIPE ANCHORS:

A. Furnish and install all steel clamps around mains not less than 1/4" thick and welded to pipe and necessary angle braces to substantial construction to meet job conditions. Anchored mains shall be properly guided.

B. Vertical risers, if any, shall be anchored by similar clamps secured to floor, concealed in wall construction.

2.11 HANGERS AND SLEEVES:

A. All horizontal piping shall be supported in a good, firm and substantial manner. No chains, horizontal pieces of pipe or hangers formed by means of perforated steel bands, pipe rings and hooks will be permitted. All hangers shall be oversized

B. All pipes passing through walls or partitions shall be provided with sleeves sized to give a minimum of 1/2" clearance between sleeve and the outside diameter of the pipe or insulation enclosing the pipe.

2.12 SPECIALTIES FOR HOT WATER SYSTEM:

A. Furnish and install all hot water equipment in Bell & Gossett as specified below and as shown on the drawings.

1. Pressure reducing valve for each closed system.
2. B & G Triple Duty flow control valves shall be furnished in either the angle type or straightaway to suit each individual location and full size of each main or branch main.
3. Furnish all pumps as called for in schedule and following paragraph.

B. Furnish and install the following accessories and equipment in make other than Bell & Gossett.

1. Thermometers: Install Ashcroft Fig. 7173T BI-Metal "Every Angle" thermometers where shown and/or called for on plans or in specifications.
2. Thermometers shall have 5" aluminum hermeticism sealed case with stainless steel stem with 1/2" NPT connection. Install in separable well in brass with lagging extension neck. Stem length and dial range shall be 6" and 0 degrees to 250 degrees F., respectively.
3. Furnish and install on non-critical systems, gauges suitable for use on hot water where indicated on drawings or called for in specifications. Gauge shall be Ashcroft Fig. 2070 with silver brazed boudon tube, aluminum back flange type epoxy coated case, chrome ring, 1/4" NPT lower connection, stainless steel movement with 1% accuracy. Pressure range shall be as required. Furnish 1/4" needlepoint valve in Crane #88 for each gauge. Where sharp pressure fluctuations may occur, mount gauge on a 1/4" Fig. 1106B pulsation dampener. Provide compound gauges where required or called for.
4. Furnish and install gauges on all pump discharge and compound gauges on all pump suctions.
5. Furnish and install dielectric fittings.

2.13 IN-LINE MOUNTED CENTRIFUGAL PUMPS:

A. Furnish and install the in-line centrifugal pumps complete with motors and trim meeting the performance, size, electrical requirements as scheduled or otherwise specified in Bell & Gossett Taco or Armstrong. Maximum operating temperature shall be 225 degrees F with a maximum working pressure of 175 PSI.

B. All in-line centrifugal pumps shall be furnished complete with motor and trim suitable for service indicated on plans or otherwise specified. Pump volute shall be of cast iron design. Volute shall include gauge, vent and drain ports. The connection style shall be flanged. The mechanical contractor shall coordinate system connection sizes with trim and pump size and provide all fittings and hardware necessary to connect pump to system piping. . The pump internals shall be capable of being serviced without disturbing piping connections to the pump.

C. Furnish motors for all in-line centrifugal pumps meeting the electrical requirements scheduled and specified in accordance with specification section 15010. All 120 volt motors shall be supplied with built in thermal overload protection.
All three phase motors of 1HP or greater shall be supplied as premium efficiency motors. Motors shall be selected to be non-overloading at any point along the pump curve and shall meet NEMA specifications.

D. Pumps shall be of the maintainable design. Provide owner with complete parts list with service information.

E. Each pump shall be factory tested per Hydraulic Institute standards and name-plated prior to shipment. Impeller shall be both hydraulically and dynamically balanced, keyed to the shaft and secured by a locking cap screw or nut.

F. Each pump shall have a three year warranty from the date of installation.

G. Each pump shall be factory primed and painted to prevent rust and corrosion of the pump exterior surfaces.

H. Provide seismic restraints and vibration isolation for each pump in accordance with specification section 15010.

I. Pump shall be installed, aligned and started in accordance with manufacturer's recommendations

J. Long-Coupled In-Line Pump (B&G Series 60)

1. Long-Coupled In-Line centrifugal pumps shall be horizontal, permanently lubricated and specifically designed and guaranteed for quiet operation. The pump shall be single stage, vertical split case design in cast iron bronze fitted construction
2. The pump shall be composed of three separable components: a motor, bearing assembly and pump end (wet end). The motor shaft shall be connected to the pump via a replaceable flexible coupler. The pump shall have a solid SAE 1144 steel shaft supported by two sealed ball bearings. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal. The pump shall be equipped with an internally flushed mechanical seal assembly. Seal assembly shall have a brass housing, Buna bellows and seal gasket, stainless steel spring, and be of carbon ceramic design with the carbon face rotating against the stationary ceramic face.
3 A flexible-type coupling shall be employed between the pump and motor. To ensure alignment, the motor shall be mounted to the bearing assembly via a bolted motor bracket assembly with a rubber motor mount.
4. The pump shall be designed to allow for true back pull-out access to the pumps working components.

K. Close-Coupled In-Line Pump (B&G Series 80 & 90)

1. Close-Coupled In-Line centrifugal pumps shall be single stage design suitable for installation in vertical or horizontal positions, permanently lubricated and specifically designed and guaranteed for quiet operation.

2. Pump casing shall be Class 30 cast iron, bronze fitted. The impeller shall be cast bronze, closed type
3. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation. A bronze shaft sleeve shall completely cover the wetted area under the seal.

2.14 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
Description:

Standard: ASSE 1079.
Pressure Rating: 150 psig minimum at 180 deg F
End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
Description:

Standard: ASSE 1079.
Factory-fabricated, bolted, companion-flange assembly.
Pressure Rating: 150 psig minimum at 180 deg F
End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
Description:

Nonconducting materials for field assembly of companion flanges.
Pressure Rating: 150 psig. At 180 deg F.
Gasket: Neoprene or phenolic.
Bolt Sleeves: Phenolic or polyethylene.
Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
Description:

Standard: IAPMO PS 66.
Electroplated steel nipple, complying with ASTM F 1545.
Pressure Rating: 300 psig at 225 deg F.
End Connections: Male threaded or grooved.
Lining: Inert and noncorrosive, propylene.

2.15 CONDENSING BOILERS

A. Furnish and install, where shown on the plans, three factory packaged hot water boilers as manufactured by Harsco Industrial/Patterson-Kelley. Each factory "packaged" boiler shall be complete with an *NUROControl System* and all other components required for a complete and operable boiler as specified herein. Each boiler shall be a factory assembled package ready for field wiring and piping. Acceptable substitutions are Aerco Benchmark, Lochinvar or Viessmann.

B. The boiler manufacturer shall be responsible for all parts assembled and furnished by them as components of the boiler regardless of the manufacturer.

C. Boiler specifications

1. The maximum input shall be 4,000,000 BTU per hour. Each boiler shall be capable of operating continuously at its rated capacity while maintaining a CSA certified efficiency of not less than 96 %.

2. Boiler shall comply with ASME Section IV for ____ psig (Max 200º F)

3. Boiler relief valve setting shall be 50 psig.

4. Boiler outlet water temperature shall be a maximum of 200º F.

5. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft Natural gas shall be supplied at a pressure of no less than 4" W.C. at the inlet gas valve. The maximum inlet gas pressure shall not exceed 14" W.C.

6. Power voltage shall be 480VAC, 3-phase, 60 hertz. Control voltage shall be 24 VAC (transformer to be supplied by boiler manufacturer).

D. Boiler design

1. Each hot water boiler shall consist of a horizontal, stainless steel, sectional heat exchanger complete with trim, valve trains, burner, and boiler *NURO Control System*.

2. Each boiler heat exchanger shall be stainless steel, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced water flow through each section.

3. All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.

4. Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. The boiler design shall not employ use of push nipples or gaskets between the sections.

5. Boiler shall be enclosed with a single wall outer casing. The casing shall be airtight for pressurized operation and be fabricated from 16-gauge carbon steel. The front

and top wall shall be secured in place with 1/4" -20 NC machine bolts not sheet metal screws. The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.

6. An observation port shall be provided on the boiler to allow full observation of the burner flame pattern.

7. The flue gas outlet and combustion air intake shall be located at the boiler rear. Boiler shall be CSA certified for Category IV venting (stack) as defined in NFPA 54 (ANSI Z221), latest edition.

8. All venting material shall be certified for installation on a Category IV appliance. Copies of a computer design and detailed drawing of the venting system shall be submitted for review and approval.

E. Coiler Connections

1. Each boiler shall be provided with the following connections:
   One (1) 4 "-Victaulic water-inlet. (A companion fitting to be supplied by contractor)
   One (1) 4 "-Victaulic water-outlet. (A companion fitting to be supplied by contractor)
   One (1) relief valve outlet
   One (1) flue gas vent outlet,
   One (1) 1" FPT, fuel-gas inlet.

F. Boiler Trim

1. Each boiler shall be provided with the following trim compliant with CSD-1:
   a. Pressure relief valve sized to comply with both ASME and local codes.
   b. Water pressure and temperature gauge.
   c. Primary low water flow fuel cutoff, probe type with manual reset.
   d. High water temperature limit control to stop burner at 200° F. with manual reset.
   e. Operating temperature control to control the sequential operation of the burner.
   f. Separate inlet and outlet water temperature sensors capable of monitoring flow
   g. Exhaust temperature sensor
   h. Outdoor reset control as required for single boiler installation.

G. Boiler Fuel Burning System

1. Each boiler shall be supplied with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner shall be fully coordinate for interaction of its elements with the boiler heat exchanger and the boiler control system to provide the required capacities, efficiencies, and performance as specified.

2. Each burner shall be provided with an integral gas firing combustion head.

3. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

4. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the firing rate to provide air for stoichiometric combustion plus required excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall be a maximum of 300 watts and operate at 7000 RPM maximum without vibration or noise and shall be designed and constructed for exposure to temperatures in its normal location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.

5. Each burner shall of the down-fired type and constructed of steel with a horizontal, stainless steel inner and stainless steel mesh outer screen.

6. Each boiler shall be provided with a “Full Modulating” firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

7. Each boiler shall have *NURO Control System* control to determine the firing rate and have all the following capabilities allowing all inputs and reporting in text base English:

    a. Maintain single set point
    b. Reset the set point based on outdoor air temperature.
    c. Boiler shutdown based on outdoor air temperature
    d. Internal dual set point program with an integral switchover to night setback.
    e. Alarm relay for any manual reset alarm function including blocked flue and frost protection.
    f. Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation.
    g. LED Display showing current supply and return temperatures, current set points as well as differential set points. It shall also display any faults whether automatically reset or manually reset

and report all errors in text base English.

h. Provide local Manual Operation in low or high fire for start up and testing and retain a record of the number of hours of operation at high, low and mid-fire hours.

i. The *NURO Control System* boiler control shall be capable of accepting input and output signals to a building management system via MODBUS RS-485 protocol or 10 VDC analog signals to control boiler operation by Gateway for BACnet, LonWorks or Metasys N2.

j. On board Domestic Hot Water Priority capable of changing from the heating pump to the DHW pump as well as temporarily changing the boiler set point from a heating temperature to a higher set point temperature to satisfy the DHW system and then returning to the heating mode.

k. The *NUROControl System* shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve, which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.

l. The *NUROControl System* shall be capable of cascading and controlling all functions of up to a total of 24 boilers while rotating the lead boiler to even load distribution overall system boilers.

l. The *NUROControl System* shall control the two way isolation valve furnished by the boiler manufacturer.

m. The *NUROControl System* shall control the in-line primary pump associated with esch individual boiler.

H. Main Gas Valve Train

1. Each boiler shall be provided with an integral main gas train, factory assembled, piped, and wired. The gas valve train shall include at least the following:
   a. One (1) manual shutoff valve at gas train inlet connection.
   b. Two (2) safety shutoff valves equipped with dual solenoids for independently energizing for leak testing.
   c. Air - Gas ratio control (maximum inlet pressure 14" W.C.)
   d. One (1) low gas pressure switch (manual reset).
   e. One (1) high gas pressure switch (manual reset).
   f. Two (2) pressure test ports

I. Ignition System

1. Each boiler shall be equipped for direct spark ignition

J. Burner Control System

1. The control system shall be supplied with a 24 VAC transformer to reduce the 120 VAC, single phase, 60 hertz primary. The 120/1/60 power supply to each boiler shall be protected by a 15 amp fused disconnect switch supplied by the electrical contractor..

2. The boiler must include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod, rectification system.

3. Each boiler shall be provided with all necessary controls, all required programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safety devices.

4. Each boiler control system shall provide a timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

K. Boiler Control Panel

1. The boiler manufacturer shall provide each boiler with an integral, factory pre-wired control panel. The control panel shall contain at least the following components, all pre-wired to a numbered terminal strip:

   a. One (1) - Burner "on-off" switch.
   b. One (1) - Electronic combination temperature control, flame safeguard and system control.
   c. One (1) - Control circuit breaker, 5 amp
   d. All necessary control switches, pushbuttons, relays, timers and terminal strips.
   e. LED Display Panel to adjust set points and control operating parameters. LED displays to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, sensor values including inlet and outlet flue gas and outdoor air temperature.
   f. Isolation valve position

L. Factory Testing - Hydrostatic

1. Each boiler shall be a complete factory packaged, hydrostatically tested and bear the ASME - “H” stamp.

M. Factory Testing – Fire testing

1. Each boiler shall be factory fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

N. Warranties

1. The boiler manufacturer shall warranty each boiler, including boiler trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of eighteen (18) months after the Owner took beneficial use of the installation. The heat exchanger and burner shall be warranted for a period of five (5) years from date of shipment.

O Installation

1. Contractor shall install boilers in strict compliance with manufacturer's written Installation and Owner's Manual.
2. Contractor shall install boilers in strict compliance with all state and local codes.
3. Contractor shall maintain manufacturer's designated clearances around all sides and top of boilers.
4. Contractor shall install boiler components that may have been removed for shipping purposes.
5. Contractor shall install boiler components that were furnished loose for field installation.
6. Electric contractor shall provide all electrical control and power interconnect wiring.
7. The control contractor shall provide all interconnections between boilers and to the building management system.
8. Contractor shall provide all fuel gas vent and service piping.
9. Contractor shall provide all boiler piping connections.
10. Contractor shall install all combustion air intake and exhaust venting as specified.

P. Field Testing

1. The boiler manufacturer representative shall test the *NUROControl System*, burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. for proper function. Any malfunctioning component shall be replaced.
2. All adjustments to the *NURO Control System* and other boiler components shall be performed by the boiler manufacturer's local representative.

R. Start-up, Instructions and Warranty Service

1. The boiler manufacturer's representative shall provide start-up and (18) months warranty of parts and service after the Owner took beneficial use of the installation.

PART 3 -EXECUTION

3.1 INSTALLATION:

A. Furnish and install the hot water piping as shown on plans and required for a complete installation. Furnish and install all control valves, flow valves, air vents, gate valves and/or balancing valves and drain valves.

B. All piping work shall be installed with proper provision to allow for expansion and contraction of lines so as to prevent any undue strains on pipe and fittings, any trapping of lines or lifting or dislocating of any appliances.

Rectify without cost to the Town any conditions of noisy circulation due to trapped or air bound lines, including the expense of cutting and repairing of the building structure incident to making such alterations.

C. Install the work to conform to space conditions and the work of other trades. The drawings indicate generally the runs and sizes of piping and, although the size must not be decreased, nor the drawings deviated from, except as unforeseen space conditions may require, the right is reversed to make minor changes in the arrangement of the work to meet conditions arising during construction.

D. Whenever the documents indicate for new piping to connect to an existing piping system, the contractor shall install a temporary corrosion inhibitor system to treat the existing piping. The system shall consist of an injector, piping modifications, and the applicable chemicals required to treat the existing system for a minimum of three weeks prior to any new connections. Upon the installation of the new piping system, the entire system (new and existing) shall be flushed with a chemical cleansing agent."

3.2 TESTING:

A. All flow piping shall be tested and made tight.

B. All piping, including hot water piping, shall be tested and made tight at 100 psi or 50 psi above the city pressure before any piping is concealed or approved.

C. After the system is thoroughly cleaned, it shall be put into operation by this Contractor. All parts of the system shall be thoroughly tested and this Contractor shall carefully instruct the Town's authorized representative as to the proper operation and are of the entire system.

D. All low pressure piping shall be tested and made tight at 100 lbs. per square inch hydrostatic pressure before any piping is concealed or covered.

3.3 BALANCING AND VENTING OF HOT WATER SYSTEM:

A. Contractor shall provide all labor and materials as required to assist the Balancing Contractor in proper balancing of the water systems. Contractor shall return to the job and shall make necessary adjustments and corrections to the systems as required by the Balancing Contractor in order to achieve satisfactory system performance in accordance with design parameters.

B. Contractor shall carefully vent the system when filling same and return to the job during the eighteen months guarantee period as required to assure the Town of a proper operating system.

C. System shall be slowly filled with cold water to purge air and shall maintain 4 psig on a gauge located conveniently near the top of the system.

END OF SECTION 235000

SECTION 235133 - BREECHINGS, CHIMNEY, AND STACKS FOR CONDENSING APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. The General Requirements in Section 200050 shall also govern the work under this Section.

C. Examine all drawings and data and coordinate the work of this Section with all related and adjoining work.

1.2 SUMMARY

A. Section Includes:
   1. Venting for the removal of products of combustion for Category II, III, IV gas burning appliances

1.3 REFERENCES

A. Underwriters Laboratories (UL):
   1. UL1738

B. National Fire Protection Association (NFPA):
   1. NFPA 54 – National Fuel Gas Code
   2. NFPA 211 – Standard for Chimneys, fireplaces, Vents, and Solid Fuel-Burning Appliances.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 54
B. Must install duct in accordance to manufacturer's listings and installation instructions.
C. Components coming in contact with the products of combustion shall carry the appropriate UL or CUL listing, mark or label.

1.5 WARRANTY

A. Condensing Appliance vent listed to UL1738 shall have a limited lifetime warranty to begin at the date of installation. Any portion of the vent repaired or replaced under warranty shall be warranted for the remainder of the original warranty period.

PART 2- PRODUCTS

2.1 AVAILABLE MANUFACTURERS

A. Listed Double-Wall vent for condensing appliances, Model FCS as manufactured by Metal-Fab, Inc.

2.2 LISTED VENTING FOR CONDENSING APPLIANCES

A. The condensing appliance vent shall be double-wall for use with Category II natural draft appliances and Category III or IV positive pressure appliances.

B. Maximum temperature shall not exceed 550˚ F (288˚ C).

C. Vent shall be listed for an internal static pressure of 15" inch w.c. and tested to 37.5 inch w.c. for diameters 3 inch - 36 inch.

D. Vent shall be constructed of UNS S44735 AL29-4C material tested to UL1738, .015 thickness for 6 inch - 12 inch diameters, .024 thickness for 14 inch to 24 inch diameters, and .035 thickness for 26 inch to 36 inch diameters.

E. Outer casing shall be type 430, stainless steel of .018 inch thickness for 3 inch to 12 inch diameters, .024 inch thickness for 14 inch to 24 inch diameters, and .035 thickness for 26 inch to 36 inch diameters.

F. Joint assembly utilizes flanged mating surfaces, with a 1" long self-guiding sleeve for diameters 6 inch – 24 inch. P077 sealant will be used on the flange surface and in the vee band. Flanges are joined with a vee band secured by tightening draw bolts. Chimney shall be Metal Fab Model FCS.

PART 3 - EXECUTION

3.1 STORAGE AND CONSTRUCTION

A. Protect materials from accidental damage.

B. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings required to install the vent system shall be included.

C. Joint assembly utilizes flanged mating surfaces with a factory supplied gaskets for diameters 6" through 24", for diameters 26" to 36" P070 sealant will be used on the flange surface. Flanges are joined with a vee band secured by tightening draw bolts. Diameters 3-5 inch utilize a snap-lock, gasketed connection.

D. Where exposed to weather, the outer closure band shall be sealed to prevent moisture from entering the space between the walls.

E. All parts exposed to the weather shall be protected by one (1) coat of corrosion and heat resistant base primer and one (1) coat of heat resistant paint unless constructed of 430, 304 or 316 stainless steel.

F. Vent shall terminate in accordance with installation instructions and local codes.

G. Installation shall conform to manufacturers installation instructions.

END OF SECTION 235133

SECTION 260000 GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the work specified in this Section.

B. Section 260000, General Electrical, shall govern the work under all Sections of Division 26.

1.2 DESCRIPTION:

A. Work Included: The electrical work shall consist of all labor, equipment and services required to complete, ready for correct operation, all of the work called for by the accompanying drawings and these specifications.

B. The work shall include, but is not limited to:

1. Demolition.
2. Raceways and Boxes.
3. Branch Circuit Wiring.
4. Wiring Devices.
5. Circuit Breakers.

1.3 SITE CONDITIONS:

A. Prior to submitting bid, visit the site and identify existing conditions and difficulties that will affect work called for by the Contract Documents.

B. No compensation will be granted for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observers. Include in the bid amount all demolition work required.

C. The Contractor shall verify and obtain all necessary dimensions at the site.

1.4 DEFINITIONS:

A. Furnish: The word "furnish" is used to mean "supply and deliver the referenced item to the project site, ready for unloading, unpacking, assembly, and installation".

B. Install: The word "install" is used to describe operations at the project site involving the referenced item including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

C. Normally Occupied: The words "normally occupied" are used to mean "all rooms within a building except for crawlspaces, underground tunnels, attic spaces, mechanical rooms, telephone rooms, data distribution rooms, and electrical rooms".

D. Or Approved Equal: The words "or approved equal" are used to mean "any product which in the opinion of the Engineer is essentially equal in quality, size, arrangement, appearance, construction, and performance to that product specified or shown on the drawings".

E. Provide: The word "provide" means "to furnish and install the referenced item, complete and ready for the intended use".

F. Remove: The word "remove" means "to disconnect from its present position, remove from the project site, and to dispose of in a legal manner".

1.5 QUALITY ASSURANCE:

A. Codes and Standards

1. All work under this section shall comply with the applicable requirements of the National Electrical Code, local electrical and other codes, laws, regulations and standards including those of all state authorities. Where references are made in laws codes regulation and standards, these documents, including the latest revisions and amendments in effect as of the date of bid opening, shall form part of these specifications. Upon completion of the work, the contractor shall furnish Certificates of Approval from the local inspection authorities having jurisdiction for approving materials, equipment, installation pertaining to the electrical work as may be required by the local and/or state authority for the issuance of a permanent Certificate of Occupancy. All expenses arising from the procurement of these Certifications shall be paid by the contractor and shall be included in the lump sum contract price.

2. In addition to complying with the specified requirements, comply with all Federal, State and Local Codes wherever applicable including the following: 2022 Connecticut State Building Code, 2021 IBC, 2021 Connecticut Fire Safety Code , 2021 International Fire Code, 2019 NFPA 72 National Fire Alarm Code, 2020 NFPA 70 National Electrical Code as amended by the State Building Code , 2021 International Energy Conservation Code, ICC/ANSI A117.1-2009 Accessible and Usable Buildings and Facilities, and ADA.
3. Comply with the requirements of the Local Authority Having Jurisdiction.
4. Materials and equipment shall be UL listed where standard has been established.
5. Perform tests required by specifications, Engineer's instructions, laws, ordinances or public authorities, approvals, and give Owner timely notice. Notify the Owner of dates for inspection by other authorities.
6. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
7. Reference made to codes and standards shall be interpreted as minimum requirements. Provide and perform work in excess of codes and standards as indicated by drawings or specifications.

B. Submittals

1. The contractor shall submit for approval a complete list of materials, fixtures and equipment to be incorporated in the work. The list shall include manufacturer's names

and catalog numbers, descriptive data, manufacturer's ratings and application recommendations, cuts, diagrams, performance curves and such other information as may be required by the Owner to judge compliance with the requirements of the contract and suitability to the application. Items on the list shall be clearly identified as to proposed application. Approval of materials and equipment will be based on manufacturer's published ratings. Submittal procedures shall be in accordance with Division 1 of these specifications.

2. When directed by the Owner, the contractor shall submit in approved form for record, a Certificate of Compliance with a cited code or standard for the designated materials and equipment; such certificates may be accepted in lieu of samples. Any materials or equipment submitted for approval, which are not in accordance with the specifications requirements may be rejected.

3. As part of the coordination work required of the contractor, installation drawings shall be prepared by the contractor as necessary. It is intended that these drawings be used to coordinate the work of the various trades and to clarify details of proposed assembly, erection and installation. Installation drawings shall be prepared when indicated in these specifications or on the electrical drawings, or when directed by the Owner for comment or approval when an installation condition or problem arises which the contractor wishes the Owner to review. All installation drawings submitted for review will be considered and treated as shop drawings and the requirements pertaining to shop drawings shall govern.

C. Equipment alternates, substitutions, and deviations:

1. Wherever more than one manufacturer is mentioned in the specifications or on the drawings, any of those named shall be considered equally acceptable to that on upon which design was based, and providing all aspects of the specification are met insofar as quality, construction, performance, space requirements, noise levels and special accessories or materials, any of those named may be included in Contractor's bid.

2. Bidders wishing to obtain approval on brands other than those specified by name shall submit their request to the Engineer not less than ten (10) business days before the date fixed for opening of bids. Approval by the Engineer will be in the form of an Addendum to the specifications issued to all prospective bidders, indicating that the additional brand or brands are approved as equal to those specified so far as the requirements of the project are concerned.

3. Wherever a single manufacturer is used in the specifications or on the drawings and is followed by the words "or approved equal" the Contractor must use the item named or he may apply for an alternate equipment deviation.

4. Alternate equipment to that specified or shown on the drawings, as proposed to be provided by the contractor, must be essentially equal in quality, size, construction, and performance to that item specified or shown on the drawings.

5. Submittals for alternate equipment shall list all deviations and differences from the specified equipment. Failure to submit this list will result in rejection of the submittal.

Any deviations and differences not listed but discovered after installation shall be rectified as directed by the Engineer at the Contractor's cost.

6. Furnish samples of alternate equipment proposed to be provided when so requested by the Engineer.

7. Where the Contractor proposes to use an item of equipment which differs from that upon which design was based, which requires any redesign of the structure, partitions, foundations, piping, wiring or of any other part of Mechanical, Electrical Layout, all such redesign, new drawings or detailing required shall be prepared by Contractor at his own expense for approval of the Engineer.

8. Where approved substitutions or deviations require a different quantity, size or arrangement of structural supports, wiring, conduit, piping, ductwork, and equipment from that upon which design was based, all additional items required by the systems shall, with the approval of the Engineer, be furnished by Contractor at no additional cost to Owner.

D. Allow sufficient time so that the delivery and installation of equipment will not be delayed as a result of the time required to review, process and transmit submittals, including resubmittals. Failure by the Contractor to transmit submittals to the Engineer in ample time for review and processing shall not entitle him to an extension of the Contract Time and no claim for an extension of time by reason of such default will be allowed.

E. Submittals, shop drawings, and samples will be reviewed with reasonable promptness and will be stamped indicating appropriate action as follows:

1. "No Exceptions Taken" means that fabrication, manufacture, or construction may proceed providing submittal complies with contract documents.
2. "Amend as Noted" means that fabrication, manufacture, or construction may proceed, providing the submittal complies with Engineer's notations and contract documents.
3. "Resubmit" means that submittal, or equipment proposed to be provided, does not comply fully with the contract documents and that fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the Engineer's notations and contract documents.
4. "Rejected" means that submittal does not comply with contract documents, or that equipment proposed to be provided does not comply with the specified requirements or is not equal or better in quality and performance than that item specified. Fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the contract documents and specified requirements.

F. If material or equipment is installed prior to review, or without review, it shall be removed and replaced at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment is not in compliance with the Contract Documents.

G. Record Drawings

1. The contractor shall maintain an accurate record of all deviations in work as actually installed from work as indicated. This record shall be kept current and shall be kept available at the site for inspection. Upon completion of the work, and before final payment

is authorized, marked prints with signed certifications of accuracy shall be delivered to the engineer.

H. Manuals

1. The contractor shall furnish to the Owner operating and maintenance instructions for each piece of equipment and each device.

2. The instructions shall provide detailed descriptions of the operation and maintenance of the equipment or device and shall include manufacturer's literature, detailed wiring diagrams, device internal wiring diagrams, characteristics curves and graphs, data sheets and descriptive literature. The instructions shall be furnished to the Owner 30 days prior to the completion of the building work.

I. Product Handling

1. All work, materials and equipment, whether incorporated into the building or not, shall be protected from damage due to moisture, dirt, plaster, concrete, or from carelessness.
2. All material and equipment which is damaged, including installed work, shall be repaired or replaced to the satisfaction of the Owner.

3. After work is complete, all equipment, including switchboards, transformers, panelboards, lighting fixtures and lamps, shall be cleaned of all construction dirt.

1.6 INTENT OF SPECIFICATIONS:

A. It is the intent of these Specifications each subcontractor or equipment suppliers to furnish all equipment complete with all motors, drives and magnetic starters throughout for all equipment furnished under these specifications. The above shall also apply to any additions to this Contract, either as covered by and Addenda or Change Orders.

B. The Electrical Contractor shall provide overload and short circuit protection for all motors unless provided by equipment supplier for packaged type equipment.

1.7 GUARANTEE FOR EQUIPMENT AND SYSTEMS:

A. Refer to Specifications.

B. The entire Electrical System included under this Section of the Specifications shall be guaranteed by this Contractor against original defects of equipment and workmanship for a period of 18 months from date of acceptance, unless otherwise specified.

1.8 CUTTING AND PATCHING:

A. Cutting and patching for all electrical work inside building shall be done in accordance with Division 1.

1.9 SLEEVES AND OPENINGS:

A. This Electrical Contractor shall furnish and install all necessary sleeves and openings as required to permit the installation of the electrical systems.

1.10 ACCESS PANELS:

A. Provide access panels to make all junction and pull boxes accessible as required by The National Electrical Code.

1.11 PAINTING:

A. All painting of electrical work will be done in accordance with Division 9 unless otherwise specified.

1.12 RUBBISH AND CLEANING:

A. This Contractor shall be responsible for removal of all rubbish and trash created by the installation of the electrical systems and equipment from the job site. Contractor shall sweep clean all areas.

1.14 INSTRUCTIONS:

A. The Superintendent of the electrical work for this particular project shall spend all necessary time required to instruct the custodians of the building, together with representatives from the Maintenance Department, in the installation including all special controls and devices installed or connected under this contract.

1.15 POWER SHUTDOWNS:

A. Any power shutdown required for the completion of the electrical work shall be scheduled with the owner at least ten working days in advance and shall be done at owner's convenience.

1.17 SEISMIC:

A. Provide seismic restraining devices on all required items of electrical equipment in accordance with ICC Chapter 16. Refer to specification Section 200050 and details on mechanical drawings.

END OF SECTION 260000

SECTION 260500 BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Bidding Requirements, Contract Forms and Conditions of the Contract, including General Conditions of the Contract for Construction, and Division 1 - General Requirements, apply to the work specified in this Section.

B. Section 260000, General Electrical, shall also govern the work under this Section.

C. This Section includes requirements that are binding on other Sections of Division 26.

1.2 SCOPE:

A. Scope of work consists of installation of materials to be furnished under this Section, and without limiting generality thereof consists of furnishing labor, materials, equipment, hoisting, plant, transportation, rigging, staging, appurtenances, and services necessary and/or incidental to properly complete all electrical work as shown on the drawings, as described in these specifications or as reasonably inferred from either as being required in opinion of the Owner.

B. Work Included: Provide complete electrical services where shown on the drawings, as specified herein and as needed for a complete and proper installation including but not necessarily limited to:

1. General
2. Conduits & Raceways
3. Identification
4. Wire and Cables
5. Wiring Devices
6. Outlet Boxes, Junction Boxes, Pull Boxes
7. Supporting Devices
8. Disconnect Switches
9. Grounding.
10. Circuit Breakers.

1.3 QUALITY ASSURANCE:

A. Refer to Section 260000.

1.4 SUBMITTALS:

A. Shop Drawings: Submit for all items listed in Paragraph 1.2.B.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide only materials that are new and of type and quality specified, or approved equal. Where Underwriters' Laboratories, Inc. has established standards for such materials, provide only materials bearing the UL label.

B. Provide materials and equipment necessary to make installation complete in every detail, and to conform to manufacturers' latest installation instructions, under this contract whether or not specifically shown on drawings or specified herein.

2.2 TEMPORARY FACILITIES:

A. Refer to the requirements of Division 1 regarding temporary facilities.

B. Scaffolding and other temporary construction shall be rigidly built in accordance with Local and State requirements. Remove from premises upon completion of work.

C. Provide temporary construction required for electrical work as directed by the Owner.

2.3 RACEWAYS:

A. Electrical Metallic Tubing:

1. Shall be manufactured from high grade mild strip steel, shall be hot dipped galvanized, and shall be chromated and lacquered to form additional protective layer. EMT conduit shall conform to UL 797 and ANSI C80.3 and shall be as manufactured by Allied Tube and Conduit, or approved equal.
2. Connectors and couplings shall be galvanized steel set screw type. Provide gland compression type couplings and connectors for exposed work in wet locations.
3. Shall be used all branch circuit wiring.

B. Flexible Steel Conduit:

1. Shall be manufactured from high grade strip steel and shall be hot dipped in a molten zinc bath. The steel strip shall be formed into interlocking convolutions that are continuously joined, metal to metal, assuring continuous grounding contact. Flexible steel conduit shall be UL listed and shall be as manufactured by AFC Cable Systems, or approved equal.
2. May be used in short lengths where EMT cannot be installed due to interferences and obstacles.
3. Provide for final connections to motor driven equipment or where subject to vibration.

C. Liquid tight Flexible Steel Conduit:

1. Shall be similar to flexible steel conduit, but with pressure-extruded moisture and oil-proof outer jacket of gray polyvinyl chloride plastic. Liquid tight flexible steel conduit shall be UL listed (UL 360) and shall be as manufactured by AFC Cable Systems, or approved equal.

2. Fittings, couplings and connectors shall be hot dipped galvanized and threaded, liquid tight type.
3. Provide where located outdoors or in damp or wet areas for final connections to motor driven equipment or where subject to vibration.

2.4 IDENTIFICATION:

A. Identify all junction boxes and pull boxes installed above ceilings and in unfinished spaces with branch circuit designations. Identification shall be done with black felt tip permanent marker in a neat and readily legible manner.

2.5 SAFETY SWITCHES:

A. Furnish and install disconnect switches where shown on the drawings..

2.6 CONDUCTORS:

A. All branch circuit conductors shall be copper rated 600 volts, 90 deg. C., Type THWN-2.

B. Grounding electrode conductors and bonding conductors shall be soft drawn copper, ASTM B3 solid bare copper for sizes smaller than #8AWG, ASTM B8 stranded bare copper for sizes #8AWG and larger.

C. Minimum gauge conductors for power and lighting shall be #12 AWG. Increase to #10 AWG for runs exceeding 75'-0", and #8AWG for runs exceeding 150'-0".

D. Wire Size #8 AWG and larger shall be stranded. Wire of size smaller than #8 AWG shall be solid.

E. Wire and cable conductors shall be soft drawn copper with conductivity of not less than 98 percent of ANSI Standard for annealed copper. Aluminum conductors shall not be used.

2.7 OUTLET, JUNCTION AND PULL BOXES:

A. Provide outlet boxes as required for a complete installation.

B. Outlet boxes shall be code gauge galvanized steel and shall be of shapes and sizes to suit their respective locations and installations, and shall be provided with covers to suite their function and installation. Outlet boxes shall be equipped with fixture stud or straps where required.

C. The minimum box size for all wall outlet boxes shall be nominal 4” square x 2 1/8” deep (2-gang). Provide larger size outlet boxes, or gangable type boxes where required for the installation.

D. For exposed work in normally unoccupied (unfinished) areas, provide pressed steel boxes with galvanized or cadmium plated steel covers with rounded corners. Provide cast boxes for work exposed to wet locations and where called for on the drawings.

E. For above ground pull boxes, provide galvanized code-gauge sheet steel units with screwed on covers, of size and shape required to accommodate wires without crowding, and to suit the location. Provide pull boxes as specified herein, as required for job conditions, and as follows:

1. Indoors: NEMA Type 1.
2. Outdoors or Damp or Wet Locations: NEMA Type 3R.
3. Hosedown and Splashing Water Locations: NEMA Type 4.

H. Wireways shall be code gauge galvanized steel, manufactured standard sections and fittings, with hinged and/or screw covers, indoors NEMA Type 1/Outdoors NEMA Type 3R. Wireways shall be sized to code conductor fill requirements and shall be provided as required for job conditions.

2.8 WIRING DEVICES:

A. All devices shall be furnished in Hubbell or approved equal in Pass & Seymour, or Leviton. Devices specified herein are based on Hubbell unless otherwise noted.

B. Lighting Switches:

1. Toggle Type: Institutional Heavy Duty specification grade, flush mounting, quiet operation AC type with abuse resistant colored nylon toggle operator, heat resistant composition plastic housing, silver cadmium oxide contacts and copper alloy spring contact arm. Rated at 120-277 VAC, capable of full capacity on tungsten or fluorescent lamp load. Designed for side or back wiring with up to No. 10 wire, and with #8 brass terminal screws.

	20 AMP	30 AMP
Single Pole	#HBL1221	#HBL3031
Two Pole	#HBL1222	#HBL3032
Three way	#HBL1223	#HBL3033
Four way	#HBL1224	-

C. Receptacles:

1. Duplex convenience receptacles shall be heavy duty specification grade, 2 pole, 3 wire grounding, NEMA 5-20R, rated 20AMP at 125 Volts AC.

2. Receptacles shall have a one-piece nickel plated brass wrap around mounting strap with integral ground contacts and ground tension retaining clips, tandem bypass contact, heat resistant thermoplastic rynite base, and high impact thermoplastic polyester face. Receptacles shall be back and side wired, shall have a back wired green ground terminal, automatic ground clip, and threaded bronze square head center rivet assembly. Duplex Receptacle #HBL5362

3. Ground Fault Duplex convenience receptacles shall be heavy duty specification grade, 2 pole, 3 wire grounding, NEMA 5-20R, rated 20AMP at 125 volts AC. Receptacles shall have a solid brass wrap around mounting strap with pre-tensioned ground contacts, tandem modified bypass contacts, all glass circuit board with conformal coating for superior moisture immunity, 7 noise filtering capacitors, heat resistant thermoplastic base and high impact nylon face. Receptacles shall be side wired and shall have a green ground terminal. Duplex GFCI Receptacle #GF5362.

D. Cover Plates:

1. Cover plates shall be specification grade non-magnetic Type 302 stainless steel, brushed finish. Where multiple devices are ganged together they shall be mounted under a common cover plate. Provide switch and receptacle combination plates where switches and receptacles are located together. Cover plates shall be furnished in same Manufacturer as devices.

2.9 CIRCUIT BREAKERS:

A. Provide circuit breakers as noted on the drawings.

2.10 ACCESS PANELS:

A. Provide access panels for electrical equipment and wiring splices which are not readily accessible. This includes electrical equipment and wiring splices installed above hung ceilings which are not readily removable, within walls, inside chases, or inside dead cavity spaces.

B. Access panels shall be prime painted steel, with screwdriver lock, shall bear the same fire rating as the wall or ceiling in which they are installed, and shall be of sufficient size for wiring splice access or electrical equipment removal and replacement.

Access panels shall be provided in Milcor manufacture, or approved equal. Provide Milcor Type A in acoustical tile surfaces, Type K for plastered surfaces, and Type M for masonry construction.

2.11 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor subject to the approval of the engineer.

PART 3 - EXECUTION

3.1 GENERAL:

A. Unless specifically noted or shown otherwise, install all equipment and material specified herein or shown on drawings whether or not specifically itemized herein. PART 3 covers particular installation methods and requirements peculiar to certain items and classes of materials and equipment.

B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.

C. The electrical drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other trades will permit. Where deviations are required to conform with actual construction and the work of the other trades, make such deviations without additional cost to the Owner.

D. Data indicated on the drawings and in theses specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels and other conditions will be governed by actual construction and the drawings and specifications should be used only for guidance in such regard.

E. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the drawings and actual measurements at the site of construction.

F. Do not scale drawings. Scale indicated on drawings is for establishing reference points only. Actual field conditions shall govern all dimensions.

G. Coordinate:

1. Coordinate as necessary with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section.
2. Coordinate delivery of electrical equipment to project prior to installation. Equipment stored for an extended period of time prior to installation may be subject to rejection by Engineer.
3. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total work.
4. Where electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
5. Prior to roughing, the contractor shall obtain exact fixture and device locations from the Engineer. Outlet and fixture locations shown on the drawings are to be used for general reference only. Roughing of fixtures and outlets shall not proceed until exact locations, heights, and orientations of fixtures and outlets have been agreed upon with the Engineer and Owner.
6. Arrange installation to provide access to equipment for easy maintenance and repair.

3.2 INSTALLATION OF RACEWAYS AND FITTINGS:

A. Install wire and cable in approved raceways as specified and as approved by authorities having jurisdiction.

B. All conduits shall be concealed from view above ceilings, in chases, and in walls. Conduits may only be installed exposed to view in mechanical and electrical rooms and where run overhead in rooms without ceilings.

C. Run conduit and cable parallel to or at right angles with lines of the building, to present a neat appearance.

1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
2. Make bends free from dents and flattening.

D. Provide code sized conduit unless a larger size is shown on the drawings or specified herein. Minimum size shall be ¾".

E. Securely and rigidly support conduit throughout the work with approved conduit clips and hangers all in conformance with code seismic requirements.

1. Do not use mechanics wire for supporting conduit.
2. Do not support conduits on hung ceilings or from mechanical or electrical equipment.

3. Steel supports and racks shall be galvanized steel channel and fittings, unistrut or approved equal.
4. Provide clamps and support rods as required.
5. Steel support rods or support bolts for conduits shall be 1/8 inch diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than ¼" in diameter.
6. Horizontal and vertical conduit supports shall not be more than 10' apart or more than 1' from any fitting.

F. Do not install conduit runs exposed on the building exterior.

G. Maintain at least 3" clearance between conduits and heating pipes when running parallel to these pipes, and at least 1" clearance when running perpendicular to these pipes.

H. Provide double locknuts on all conduits terminating in sheet metal enclosures.

I. Provide expansion couplings for rigid metallic and non-metallic conduits where such conduits are subject to thermal expansion and contraction.

J. Provide full wall steel flexible conduit for all conduit penetrations through fire walls. Full wall steel flexible conduit shall be 3-hour through penetration fire wall rated and shall be as manufactured by AFC Cable Systems, or approved equal.

K. Provide necessary sleeves and chases where conduits and cables pass through floors, walls, ceilings, and roofs, and provide other necessary openings and spaces, all arranged for in proper time to prevent unnecessary cutting. Perform cutting and patching in accordance with the provisions for the original work.

L. Provide offsets prior to entrance into outlet boxes and other electrical equipment for proper adjustment to finished building surfaces.

M. Seal around all conduit and cable penetrations through fire rated walls and ceilings with 3M Brand CP25N/S fire barrier caulking.

N. Carefully clean and dry all conduit before installation of conductors. Plug conduit ends to exclude dust, moisture, plaster, or mortar while building is under construction. Lubricants or cleaning agents which might have deleterious effect on conductor coverings shall not be used for drawing conductors into raceways.

O. All wiring shall be installed in electrical metallic tubing unless otherwise specified herein or called for on the drawings.

3.3 SLEEVES:

A. Provide EMT sleeves for each conduit and cable passing through walls, partitions, and floors.

1. Set pipe sleeves in place before wall, floor, or partition is finished. Seal between sleeves and wall, partition, or floor.
2. Support conduit and cable free from sleeves.

3. Provide sleeves two pipe sizes larger than the conduit or cable passing through, or provide a minimum of ½" clearance.

B. Caulk the space between sleeve and conduit or cable using 3M Brand OP25N/S fire barrier caulking.

C. Fireproof all penetrations made in fire rated walls or floors with UL approved materials to prevent passage of fire and smoke and maintain original fire rating of floors or walls.

D. Provide chrome plated escutcheon plates for each sleeve where exposed to view in finished areas.

3.4 CONDUCTOR INSTALLATION:

A. General:

1. The interior of all conduits shall be cleared of burrs, moisture, dirt and obstructions before wires are pulled.

2. Lubricant for pulling wires shall be inert to cable and conduit, shall not in any way restrict ease of pulling through conduit with passage of time, and shall be special lubricant designed specifically for cable pulling and shall be chemically compatible with cable.

B. Color Coding:

1. Consistent phase identification of all conductors shall be maintained as follows:

	120/208V
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral Wire	White

Provide colored plastic tape of specified color code identification for large size conductors available only in black. Wrap tape three complete turns around conductor, at ends and at connections and splices. Provide same color coding for switch legs as corresponding phase conductor.

C. Minimum Conductor Sizes:

1. The minimum branch circuit conductor size shall be #12AWG. Provide #10AWG conductors for branch circuits where the conductor run exceeds 75 feet, and #8AWG conductors where the conductor run exceeds 150 feet.

D. Provide the number of conductors required for a given branch circuit, or as required for circuitry, whether indicated on the drawings or not.

E. Neutral Conductors:

1. All branch circuits shall be installed with a separate neutral conductor. Shared neutrals for groups of branch circuits shall not be permitted.

F. Provide each circuit with a dedicated ground wire. Use #12 minimum size.

G. Identify conductors passing through pull boxes, junction boxes, and wireways to indicate circuit designation. Identify pull boxes and junction boxes as specified herein.

H. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops, circuit ampacities and other considerations.

1. Install the wiring with circuits arranged as shown on the drawings, except as otherwise approved in advance by the Engineer.

2. Do not make changes and rearrange circuits without prior approval.

3. If more than 3 current carrying conductors are installed in one conduit they shall be derated in accordance with the National Electric Code.

4. Do not install more than three 30 Amp single phase or four 20 Amp single phase circuits in the same conduit. Do not run emergency and normal power wiring in the same conduit.

I. Splices and Connections:

1. Makes splices electrically and mechanically secure with pressure-type connectors.

a. For wires size #8AWG and smaller, provide solderless, screw-on connectors, "Scotch-Lock" or equal, 600V rating, of size and type to manufacturer's recommendation, with temperature ratings equal to the conductor insulation.
b. Make splices and terminations to conductors #6AWG and larger with corrosion-resistant, high conductivity, pressure indent, hex screw or bolt clamp connectors, with or without tongues, designed specifically for intended service.

2. Insulate splices with a minimum of two layers of scotch brand No. 33 vinyl-plastic electrical tape where insulation is required.

3. Tape joints as required with rubber tape 1 ½ times the thickness of the conductor insulation, then cover with the vinyl-plastic electrical tape specified above.

4. Provide high conductivity copper alloy bolt-on lugs with pressure plate and socket set screw or hex head screw to attach wire and cable to disconnect switches, transformers, and other electrical equipment as required.

3.5 OUTLET BOXES:

A. All outlet boxes in finished areas shall be concealed from view above hung ceilings or recessed (flush) in walls and floors. Outlet boxes may only be exposed to view or surface mount type in mechanical and electrical rooms, or for feeding items overhead in rooms without ceilings.

C. Install outlet boxes at uniform heights and straight and true with reference to walls, floors, ceilings and casework.

D. Provide knockout plugs in boxes with unused openings.

E. Secure all outlet boxes to building structure with metal straps, rods, or bolts independently of entering conduits or cables.

F. Provide bar hanger outlets in hollow framed partitions with bar hanger secured to partition studs with self-threading screws, or drill through hangers with Caddy or equal clips.

G. Provide horizontal separation for outlet boxes mounted on opposite sides of common wall. Back to back or thru-wall boxes will not be permitted.

3.6 PULL BOXES AND JUNCTION BOXES:

A. Provide pull boxes and junction boxes where shown on the plans and where required to facilitate proper pulling of wires and cables. Install pull boxes or pull fittings no less than one every 100 ft. of straight horizontal conduit run, or three 90 degree bends, unless otherwise noted.

3.7 WIRING DEVICES:

A. Wherever possible install switches directly adjacent to the strike side of door. Check drawings for door swing.

B. Device mounting heights indicated below are general. Refer to drawings for special cases. Mounting heights are to centerline of device whether shown on plans or indicated below.

Receptacles	1'-6" AFF
Switches	4'-0" AFF

C. Where receptacles and outlets are shown over counters, refer to drawings for mounting heights.

D. Install receptacles vertically with grounding posts at top of device, except locate grounding post to left for horizontal mounting.

3.8 WIRING DEVICE PLATES:

A. Set plates so that all edges are in contact with mounting surface. Provide common device plate for multi-device locations.

B. Provide electric outlet and switch sealers for all receptacles, switches and technology outlets installed at exterior walls.

C. Align all wall plate screws with screw slots aligned in the vertical position.

3.9 MOTOR POWER AND CONTROL WIRING:

A. Contractor shall provide and be responsible for the complete power wiring of all motors and motorized equipment.

B. Furnish proper overload and short circuit protection for all new motors. Provide a combination thermal overload and disconnect for switch all equipment using fractional horsepower motors.

C. Check electrical connections and sizing of motor circuit protection and prevent damage to motor and equipment from incorrect direction of rotation.

D. Provide mounting for motor and equipment disconnect switches adjacent to motor and supported independent of motor.

E. Connections to miscellaneous building equipment:

1. Wire to and connect to, all items of building equipment not specifically described in this Section but to which electrical power is required.

2. Coordinate as necessary with other trades and suppliers to verify types, numbers and locations of equipment.

3.10 GROUNDING SYSTEM:

A. Provide a complete grounding system which will thoroughly ground the non-current carrying metal parts of every piece of installed equipment, as described herein and as indicated on the drawings.

B. System shall be mechanically and electrically connected to provide an independent return path to the grounding sources.

C. Each grounding conductor shall have a minimum capacity of 25 percent of the rated capacity of the equipment it grounds, unless otherwise indicated.

D. The minimum size of grounding conductors shall be No. 12 AWG copper. Insulation color of grounding conductors shall be green.

E. Provide a separate green ground conductor for each branch circuit.

3.11 SPECIAL REQUIREMENTS:

A. Wiring shall be bundle tied where passing through pull boxes, wireways, and panelboards in neat and orderly manner with plastic cable ties. Cable ties shall be Ty-Raps as manufactured by Thomas & Betts, or equal.

B. Provide miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws, and other such items, with galvanized or cadmium plated finish, or other approved rust inhibiting coatings.

C. Unload electrical equipment and materials delivered to site. Pay cost for rigging, hoisting, lowering and moving electrical equipment on site, in building or on roof. During construction provide additional protection against moisture, dust accumulation and physical damage of electrical equipment. Provide temporary heaters within units, as approved to evaporate excessive moisture and provide ventilation as required.

3.12 TESTING AND INSPECTION:

A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

C. Perform all required adjustments and settings. Verify and correct deficiencies as necessary including voltages, tap settings, trip settings and phasing of equipment from distribution system to point of use.

D. Provide all necessary testing equipment.

E. In the Owner's Presence:

1. Test all parts of the electrical system and prove that all such items provided under this Section function electrically in the required manner.

3.13 PROJECT COMPLETION:

A. Upon completion of the work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

B. Equipment with damage to painted finish shall be repaired to satisfaction of the Engineer.

C. On the first day the facility is in operation, for at least eight hours, at a time directed by the Engineer, provide a qualified foreman and crew to perform such electrical work as may be required by the Engineer.

E. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under these Specifications.

3.14 EQUIPMENT SPECIFIED:

A. Contractor shall furnish equipment or systems in manufacturers specified or named herein or on the drawings. No other manufacturers shall be considered.

END OF SECTION 260500

PLAINVILLE HIGH SCHOOL

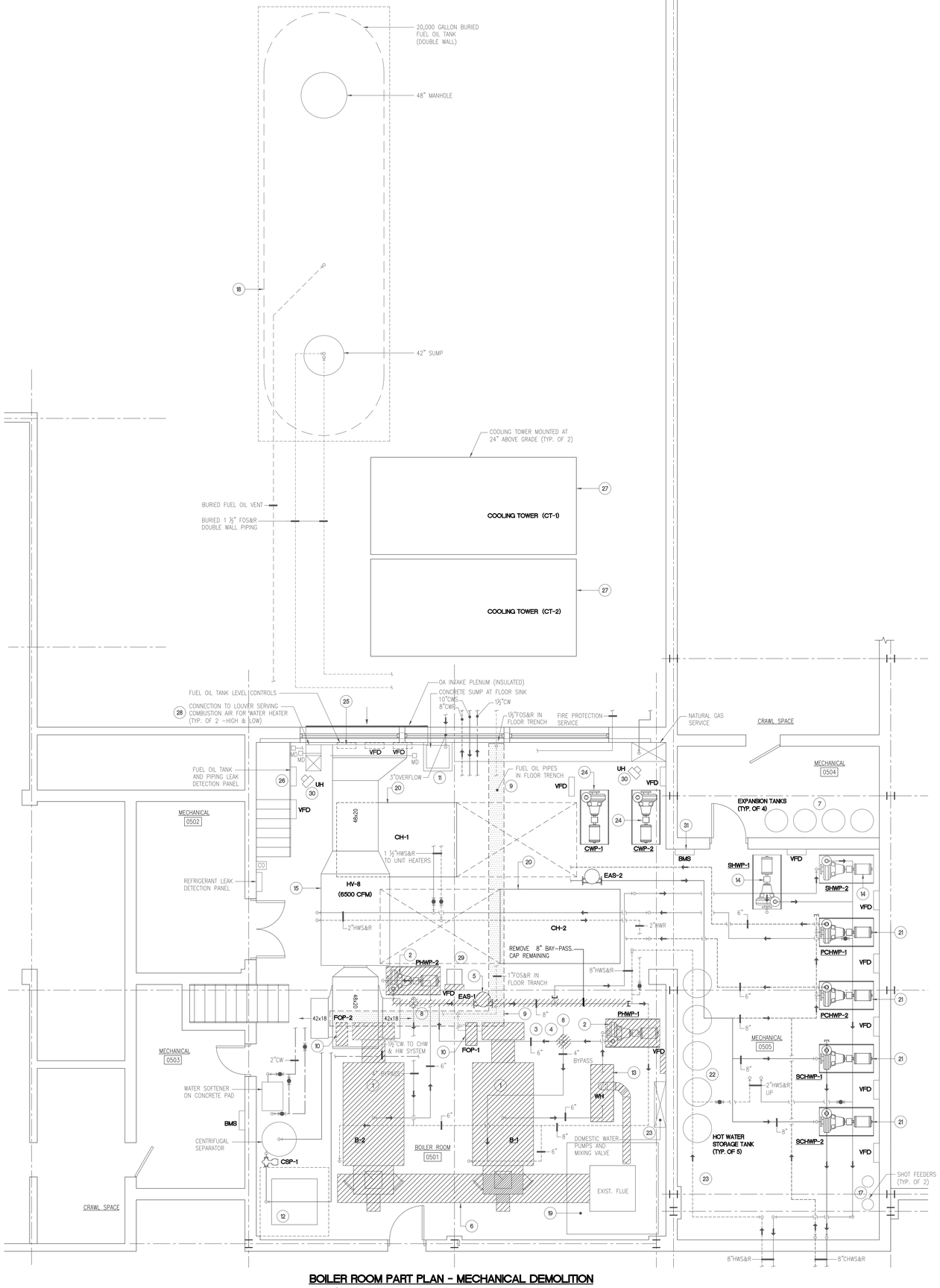
BOILER REPLACEMENT

47 ROBERT HOLCOMB
PLAINVILLE, CONNECTICUT 06062

M/E/P ENGINEER
BEMIS ASSOCIATES LLC
185 MAIN STREET
FARMINGTON,CONNECTICUT
Phone: 860-667-3233
Fax: 860-321-7070

LIST OF DRAWINGS

MAY 30, 2023



BOILER ROOM PART PLAN - MECHANICAL DEMOLITION

SCALE: 1/4"=1'-0"

GENERAL DEMOLITION NOTES

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL EXISTING UTILITY LINES INCLUDING ELECTRICAL, SEWER, WATER, GAS, TELEPHONE, ETC. THE DRAWINGS SHOW DIAGRAMMATICALLY THE APPROXIMATE LOCATION OF UTILITIES WHERE INFORMATION IS AVAILABLE, BUT THE DRAWINGS ARE NOT EXACT AS TO THE QUANTITY, EXTENT OR LOCATION. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION DURING ALL PHASES OF THE WORK TO LOCATE, IDENTIFY, AND PROTECT EXISTING UTILITIES. THE CONTRACTOR SHALL RECORD LOCATION OF AND REPAIR DAMAGE TO EXISTING UTILITIES WHICH ARE ENCOUNTERED AS A RESULT OF WORK UNDER THIS CONTRACT.

ANY EQUIPMENT REMOVED DURING DEMOLITION WORK MAY BE RETAINED BY THE OWNER AT HIS OPTION. ANY SUCH MATERIAL SHALL BE STORED IN THE BUILDING AT A LOCATION DESIGNATED BY THE OWNER. REMOVAL OF SUCH MATERIAL FROM THE JOB SITE SHALL BE THE OWNER'S RESPONSIBILITY.

CONTRACTOR SHALL MEASURE, RECORD AND SUBMIT REPORT FOR ALL THE EXISTING HOT WATER PUMPS PRIOR TO ANY DEMOLITION. MEASURE AND RECORD FLOW AND PRESSURE.

GENERAL MECHANICAL DEMOLITION WORK NOTES

1 – PRIOR TO SUBMITTING BID, VISIT THE SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY CONSTRUED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.

2 – THE DEMOLITION DRAWINGS ARE INTENDED ONLY TO DEFINE THE GENERAL SCOPE OF DEMOLITION WORK AND TO ASSIST THE CONTRACTOR DURING BIDDING. THE DEMOLITION DRAWINGS MAY NOT SHOW EVERY ITEM WHICH MUST BE DISCONNECTED, REMOVED, OR RELOCATED IN ORDER TO FACILITATE NEW WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION WORK REQUIRED WHETHER OR NOT SHOWN ON THE PLANS.

3 – COORDINATE AND SCHEDULE ALL WORK WITH THE OWNER TO MINIMIZE INCONVENIENCE TO THE BUILDING OCCUPANTS. ALL SERVICES AND SYSTEMS SERVING OCCUPIED AREAS OF THE BUILDING SHALL BE MAINTAINED IN OPERATION DURING WORKING SHIFTS.

4 – CONTRACTOR IS RESPONSIBLE FOR ANY TEMPORARY WORK REQUIRED TO KEEP THE BUILDING OCCUPIED DURING CONSTRUCTION, INCLUDING (BUT NOT ONLY) TEMPORARY DOMESTIC WATER HEATER.

5 – REMOVE AND/OR RELOCATE ALL EXISTING MECHANICAL WORK AS NECESSARY FOR THE PERFORMANCE OF THE WORK OF THIS CONTRACT.

6 – REMOVE ALL DEMOLITION MATERIAL FROM THE JOB SITE UNLESS NOTED DIFFERENTLY.

7 – CONTRACTOR SHALL FIELD VERIFY LOCATION AND SIZE OF ALL EXISTING PIPING IN THE BOILER ROOM PRIOR TO ANY DEMOLITION

8 – CONTRACTOR SHALL REMOVE AND REPLACE EXISTING BOILERS AND DOMESTIC WATER HEATER

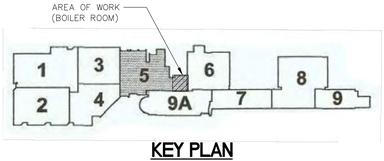
9 – CONTRACTOR SHALL MEASURE AND RECORD EXISTING HW FLOWS PRIIOR TO ANY DEMOLITION. WHEN STARTING THE NEW BOILER, CONTRACTOR SHALL RESTORE THE HW FLOWS TO THE RECORDED VALUES

10 – CONTRACTOR SHALL REPLACE ANY PIPE AND DUCT INSULATION THAT WAS DAMAGED AS A RESULT OF WORK UNDER THIS CONTRACT.

11 – CHILLED WATER PLANT SHALL REMAIN OPERATIONAL DURING WORK UNDER THIS CONTRACT. THIS CONTRACTOR IS RESPONSIBLE FOR ANY TEMPORARY WORK REQUIRED TO ACHIEVE THIS REQUIREMENT.

- MECHANICAL DEMOLITION WORK SYMBOLS -

TAG	ACTION
(1)	EXISTING HEATING BOILER AND ASSOCIATED BURNER, PIPES, VALVES & ACCESSORIES SHALL BE REMOVED. CAP REMAINING GAS, HOT WATER SUPPLY CW MAKE-UP & RETURN PIPING FOR FUTURE CONNECTION. EXISTING BOILER CONCRETE PAD SHALL BE REMOVED. PATCH, PAINT TO MATCH FLOOR.
(2)	EXISTING PRIMARY CIRC. PUMP, ASSOCIATED ACCESSORIES, INCLUDING VFD AND CONCRETE PAD SHALL BE REMOVED. CAP REMAINING PIPE AT MAIN. MAKE SAFE. PATCH AND PAINT TO MATCH FLOOR.
(3)	EXISTING BOILER CONTROLS AND ASSOCIATED ACCESSORIES SHALL BE REMOVED.
(4)	EXISTING COLD WATER MAKE-UP PIPE SHALL REMAIN
(5)	EXISTING AIR SEPARATOR WITH ASSOCIATED PIPING SHALL BE REPLACED IN KIND. CONTRACTOR SHALL FIELD VERIFY SIZE AND MODEL.
(6)	EXISTING BOILER BREECHING SHALL BE REMOVED. PATCH REMAINING CHIMNEY OPENING TO MATCH EXISTING. CONTRACTOR SHALL CLEAN THE INTERIOR OF THE EXISTING CHIMNEY. PROVIDE NEW STAINLESS STEEL CAP AT THE TOP OF CHIMNEY TO CONTROL OPENING.
(7)	EXISTING VERTICAL EXPANSION TANKS SHALL REMAIN.
(8)	EXISTING 3-WAY MIXING VALVE SHALL BE REMOVED.
(9)	EXISTING TRENCH COVERS SHALL BE REMOVED AND TRENCH SHALL BE FILLED WITH 4000psi CONCRETE TO MATCH EXISTING FLOOR. PROVIDE NEW FLOOR DRAIN AND PIPE AND EXTEND TO FINISH FLOOR. PAINT TO MATCH FLOOR. EXISTING OIL PIPES SHALL BE REMOVED. (EXISTING TRENCH IS 2'-0" ± DEEP) CONTRACTOR SHALL FIELD VERIFY.
(10)	EXISTING OIL TRANSFER PUMP, ASSOCIATED CONTROLS AND OIL PIPING SHALL BE REMOVED. CAP AND SEAL PIPES AT WALL PENETRATION. DISPOSE OF REMAINING OIL IN ACCORDANCE WITH LOCAL STATE AND FEDERAL REGULATIONS.
(11)	EXISTING FLOOR DRAIN SHALL REMAIN.
(12)	EXISTING SUMP PUMP SHALL REMAIN.
(13)	EXISTING DOMESTIC WATER HEATER ASSOCIATED PIPING, PUMP AND FLUE SHALL BE REMOVED AND REPLACED. REMOVE CONCRETE PAD. PATCH, PAINT TO MACH FLOOR. PATCH TO MATCH CHIMNEY
(14)	EXISTING BASE MOUNTED HOT WATER CIRCULATING PUMP AND TRIPLE DUTY VALVE SHALL REMAIN. REBALANCE TO DESIGN FLOW.
(15)	EXISTING COMBUSTION AIR UNIT SHALL REMAIN. BRING TO PROPER WORKING CONDITION; LUBRICATE AND REPLACE FILTERS. INTEGRATE OPERATION WITH NEW BOILER CONTROLS
(16)	EXISTING VARIABLE FREQUENCY DRIVE SHALL REMAIN.
(17)	EXISTING SHOT FEEDERS SHALL REMAIN. PROVIDE NEW FILTERS (typ. of 2).
(18)	EXISTING 20,000 GAL. UNDERGROUND FUEL OIL STORAGE TANK, ACCESSORIES AND CONCRETE PADS SHALL BE REMOVED. RESTORE SITE TO ORIGINAL CONDITION. PROVIDE NEW PAVEMENT TO MATCH EXISTING. CONTRACTOR SHALL PROVIDE SOIL SAMPLE FROM UNDERSIDE OF THIS TANK FOR TESTING AT CERTIFIED LAB. DISPOSE OF REMAINING OIL IN ACCORDANCE WITH LOCAL STATE AND FEDERAL REGULATIONS. (ADD ALTERNATE #1)
(19)	REMOVE EXISTING CHIMNEY DOWN TO FOUR FEET ABOVE ROOF. PROVIDE NEW STAINLESS STEEL COVER. SECURE TO CHIMNEY. REPAIR REMAINING PORTION OF THE CHIMNEY. (ADD ALTERNATE #2)
(20)	EXISTING CHILLER SHALL REMAIN. CHILLER SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
(21)	EXISTING CHILLED WATER CIRCULATING PUMPS AND ASSOCIATED VFD SHALL REMAIN.
(22)	EXISTING DOMESTIC HOT WATER STORAGE TANKS SHALL REMAIN. (TYP. OF 5)
(23)	EXISTING THERMOSTATIC MIXING VALVES AND DOMESTIC WATER RE-CIRCULATING PUMPS SHALL REMAIN.
(24)	EXISTING CONDENSER WATER PUMPS AND ASSOCIATED VFD SHALL REMAIN.
(25)	EXISTING OIL STORAGE TANK LEVEL CONTROL SHALL BE REMOVED. PATCH AND PAINT WALL TO MATCH.
(26)	EXISTING OIL STORAGE TANK AND OIL PIPING LEAK DETECTOR SHALL BE REMOVED. PATCH AND PAINT WALL TO MATCH.
(27)	EXISTING COOLING TOWER SHALL REMAIN.
(28)	EXISTING COMBUSTION AIR LOUVERS ASSOCIATED WITH THE EXISTING DOMESTIC WATER HEATER SHALL REMAIN. REMOVE DAMPERS, DUCTS AND CONTROLS. PATCH REMAINING OPENING AND INSULATE INSIDE WITH FOIL FACED INSULATION TO MATCH EXISTING.
(29)	REMOVE AND REPLACE EXISTING BOILER MAKE-UP WATER. PROVIDE NEW ASSEMBLY (INCLUDING BACKFLOW PREVENTER AND PRESSURE REDUCING VALVE WITH STRAINER) INSTALLED MAX. 5'-0"A.F.F.
(30)	EXISTING UNIT HEATERS AND ASSOCIATED THERMOSTATS SHALL REMAIN
(31)	EXISTING BMS (TRANE) SHALL REMAIN. THIS CONTRACTOR SHALL COORDINATE WITH TCC FOR CONTROL OF THE NEW BOILERS AND PUMPS AND INTEGRATION WITH THE EXISTING COMBUSTION AIR UNIT.



KEY PLAN

NORTH

REVISIONS

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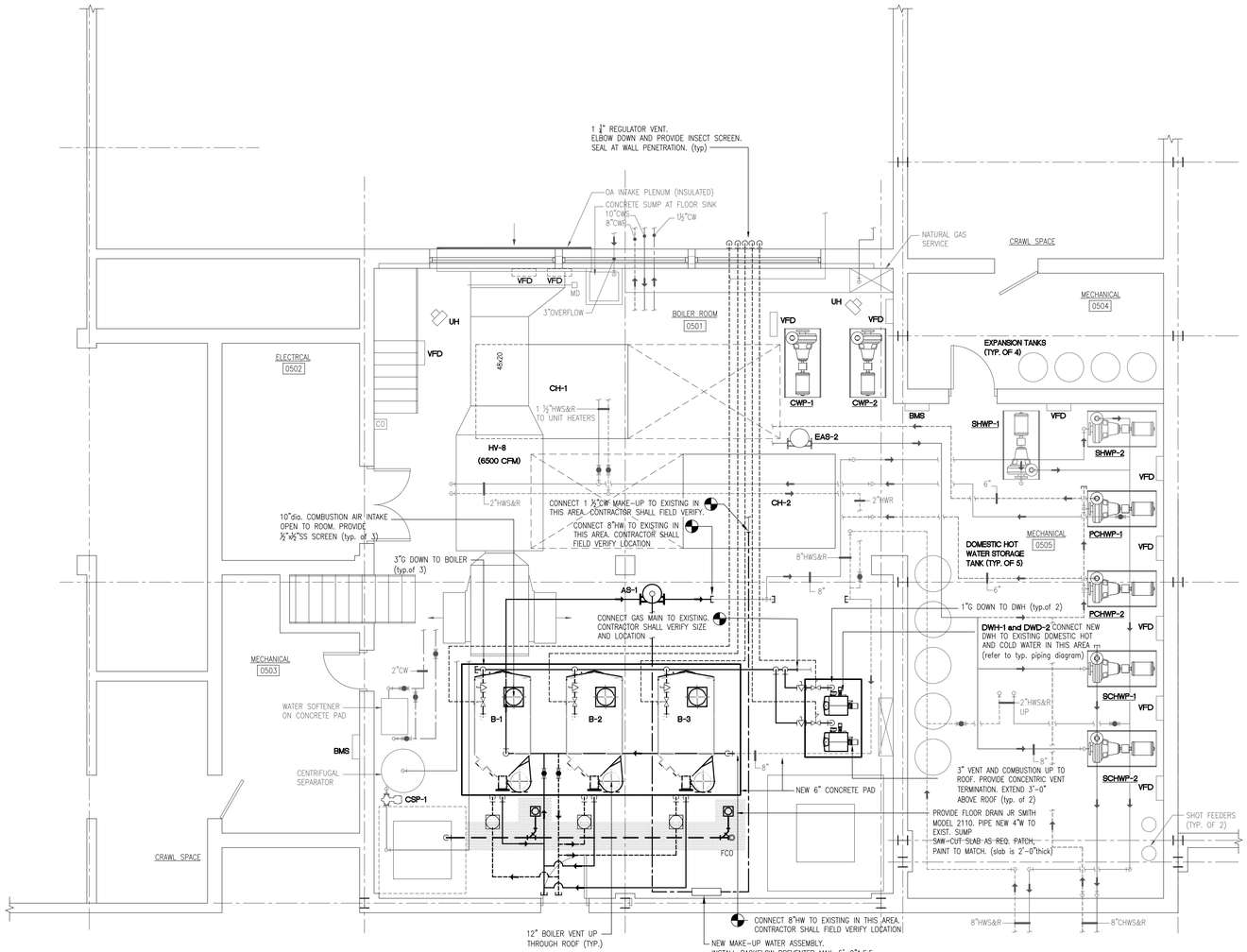
TITLE
BOILER ROOM PART PLAN - MECHANICAL DEMOLITION

DATE MAY 30, 2023

DWG. NO.
MD1.1



BOILER ROOM PART PLAN - MECHANICAL NEW WORK

SCALE: 1/4"=1'-0"

GAS FIRED, HOT WATER BOILER SCHEDULE

(NATURAL GAS min. PRESSURE 4"w.c.)

TAG	LOCATION	MANUF.	MODEL	MAX/ABSOLUTE MIN. FLOW RATE (GPM)	BOILER WATER CONTENT (GAL)	FUEL	GAS			ELECTRICAL				OUTPUT (HIGH FIRE/ /LOW FIRE) (MBH)	EWT	LWT	GPM	VENT SIZE (DIA)	AIR INTAKE (DIA)	REMARKS
							INPUT (MBH)	PRESSURE (MIN/MAX)	THERMAL EFFICIENCY	VOLTAGE	PHASE	FLA	MCA							
B-1	BOILER RM. 0501	PATTERSON-KELLEY	P-K SONIC Model SC-4000	384/96	35	GAS	4,000	4"WC MIN/ 14"WC MAX	96.0%	480	3	5	20	3,840/768	150	190	266	10"	12"	1,2,3,4,5
B-2	BOILER RM. 0501	PATTERSON-KELLEY	P-K SONIC Model SC-4000	384/96	35	GAS			96.0%	480	3	5	20	3,840/768	150	190	266	10"	12"	1,2,3,4,5
B-3	BOILER RM. 0501	PATTERSON-KELLEY	P-K SONIC Model SC-4000	384/96	35	GAS			96.0%	480	3	5	20	3,840/768	150	190	266	10"	12"	1,2,3,4,5

REMARKS:
1. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
2. POWER WIRING AND RACEWAY BY DIVISION 26
3. DISCONNECT, MOTOR STARTERS AND CONTROLS BY DIVISION 23
4. BOILER MANUFACTURER SHALL SELECT, FURNISHED AND INSTALL HI/LOW GAS PRESSURE SWITCH, LOW WATER CUT OFF-MANUAL RESET, HIGH LIMIT-MANUAL RESET, CIRCULATING PUMP, LOCKUP GAS PRESSURE REGULATOR AND CONDENSATE NEUTRALIZATION KIT
4. BOILER MANUFACTURER TO PROVIDE 208V-120V TRANSFORMER FOR CIRCULATING PUMP
5. BOILER MANUFACTURER SHALL PROVIDE MOTORIZED ISOLATION VALVE, BMS GATEWAY FOR FULL INTEGRATION WITH EXISTING EMS (COORD. WITH TCC – TRANE), ASME 75psi RELIEF VALVE, BOILER CONTROLS

GAS FIRED, DOMESTIC WATER HEATER SCHEDULE

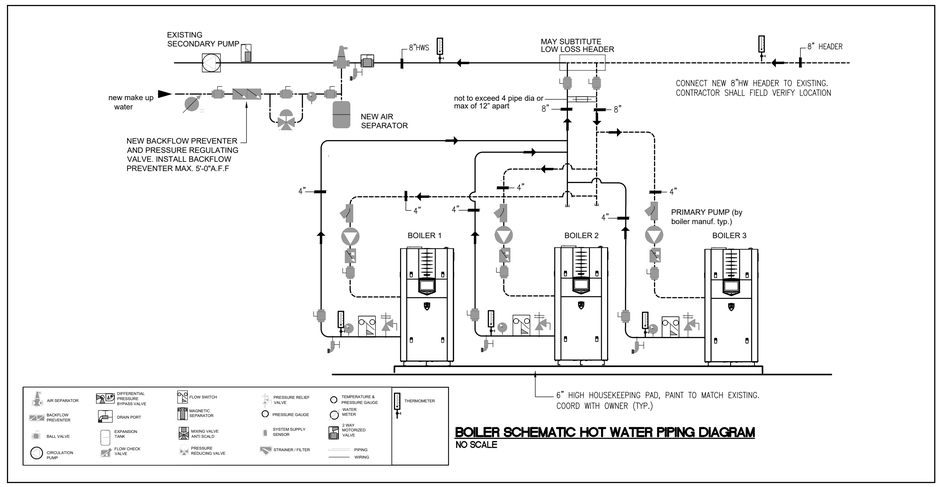
(NATURAL GAS min. PRESSURE 4"w.c.)

TAG	LOCATION	MANUF.	MODEL	STORAGE TANK CAP. (GAL)	RECOVERY @ 100deg F, 40-140deg F (GPH)	FUEL	GAS			ELECTRICAL			VENT SIZE (DIA)	AIR INTAKE (DIA)	REMARKS
							INPUT (MBH)	PRESSURE (MIN/MAX)	THERMAL EFFICIENCY	VOLTAGE	PHASE	FLA			
DWH-1	BOILER RM. 0501	LOCHINVAR	ARMOR AWN200PM	–	232	NAT. GAS	199	4"WC / 14"WC	96%	120	1	3	3"	3"	1,2,3,4,5
DWH-2	BOILER RM. 0501	LOCHINVAR	ARMOR AWN200PM	–	232	NAT. GAS	199	4"WC / 14"WC	96%	120	1	3	3"	3"	1,2,3,4,5

1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS
2. POWER WIRING AND RACEWAY BY DIVISION 26
3. DISCONNECT, MOTOR STARTERS AND CONTROLS BY DIVISION 23
4. UNIT MANUFACTURER SHALL PROVIDE CONDENSATE NEUTRALIZATION KITM, BACnet COMMUNICATION, FLOW SWITCH, LOW WATER CUT-OFF SWITCH KIT, MODBUS COMMUNICATION, CONCENTRIC VENT TERMVATION, CIRCULATING PUMPS
5. UNIT MANUFACTURER SHALL PROVIDE LOCK-UP STYLE REGULATOR INDEPENDENTLY VENTED TO OUTSIDE.

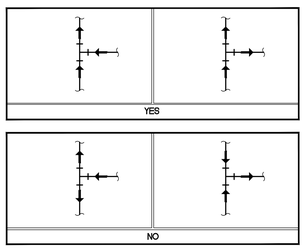
PUMP SCHEDULE (for reference only)

	UNIT No.	LOCATION	AREA SERVED	TYPE	MANUFACTURER	MODEL	GPM	HEAD (FEET)	RPM	BHP	HP	VOLTS	PH	Pump Efficiency %	REMARKS
(2)	PHWP-1	BOILER ROOM 0501	BOILER 1	BASE MOUNTED			660	45		9.5	15	480	3	79	PRIMARY PUMP (REMOVED)
(2)	PHWP-2	BOILER ROOM 0501	BOILER 2	BASE MOUNTED			660	45		9.5	15	480	3	79	PRIMARY PUMP (REMOVED)
(14)	SHWP-1	BOILER ROOM 0501	ENTIRE BUILDING	BASE MOUNTED			1,800	130		70	75	480	3	85	SECONDARY LEAD PUMP
(14)	SHWP-2	BOILER ROOM 0501	ENTIRE BUILDING	BASE MOUNTED			1,800	130		70	75	480	3	85	SECONDARY STAND-BY PUMP



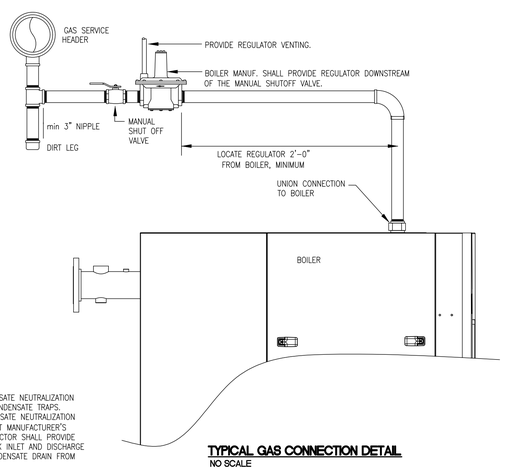
BOILER SCHEMATIC HOT WATER PIPING DIAGRAM

NO SCALE



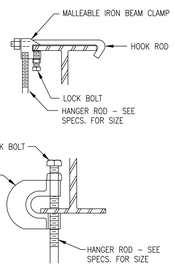
ALLOWABLE FLOW CONFIGURATIONS IN PIPING TEES-HVAC SYSTEMS

NO SCALE



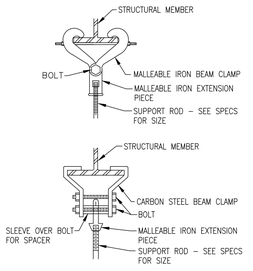
TYPICAL GAS CONNECTION DETAIL

NO SCALE



TYP. SIDE BEAM CLAMPS FOR EQUIPMENT OR PIPE SUPPORT

NO SCALE



TYP. BEAM CLAMPS FOR PIPE OR EQUIPMENT SUPPORT

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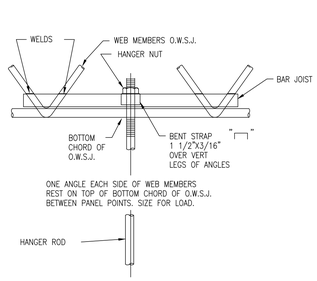
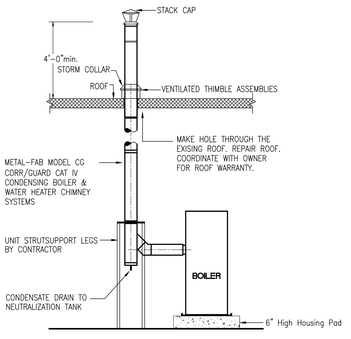


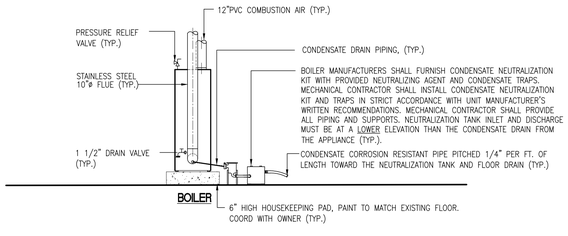
TYP. STEEL BAR JOIST PIPE SUPPORT

NO SCALE



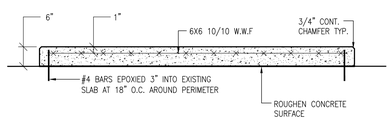
TYPICAL BOILER STACK DETAIL

NO SCALE



TYPICAL GAS FIRED BOILER VENTING AND CONDENSATE DETAIL

NO SCALE



TYPICAL EQUIPMENT PAD DETAIL

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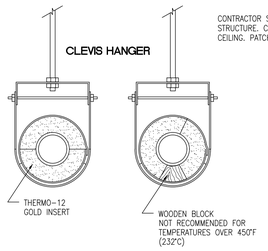
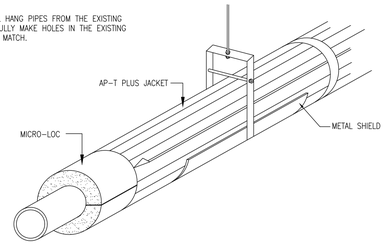
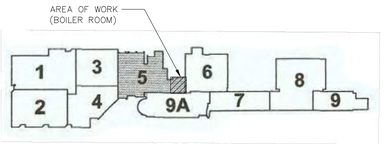


TYPICAL HOT WATER PIPING INSULATION

NO SCALE





KEY PLAN

NORTH

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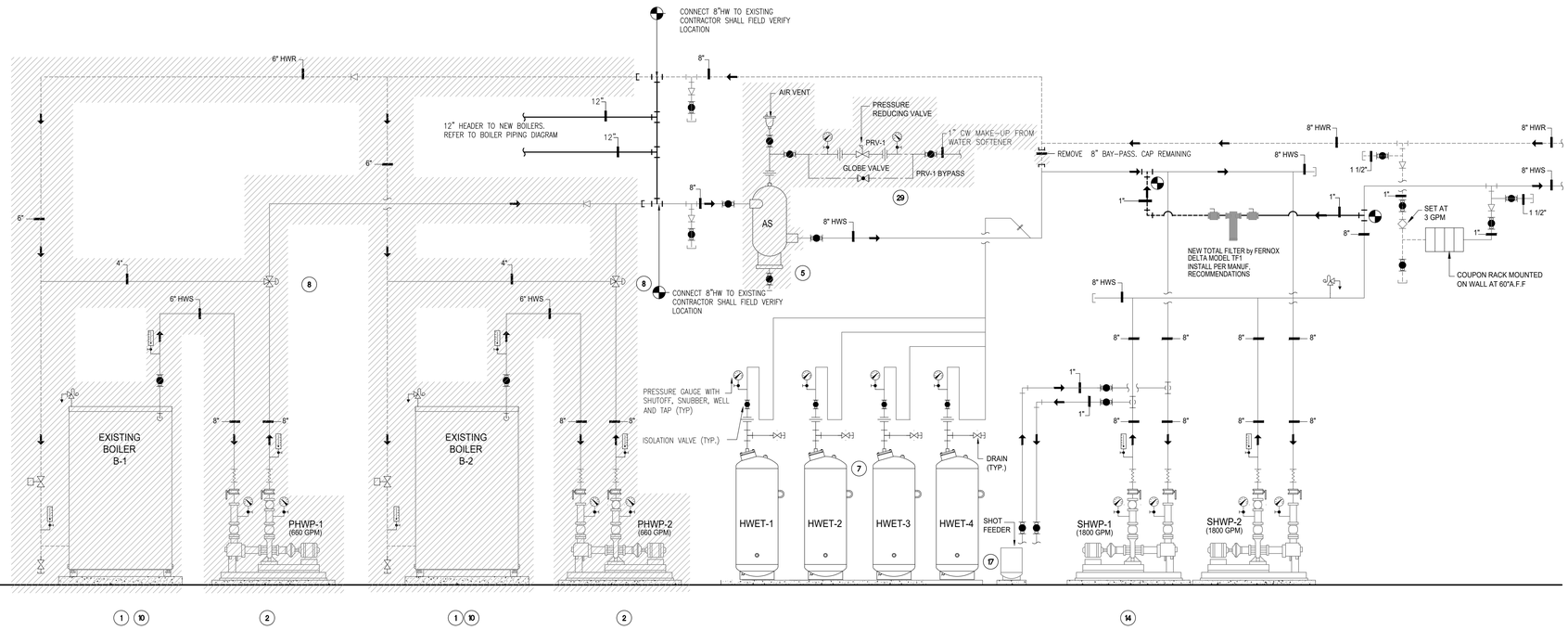
TITLE
BOILER ROOM PART PLAN - MECHANICAL NEW WORK

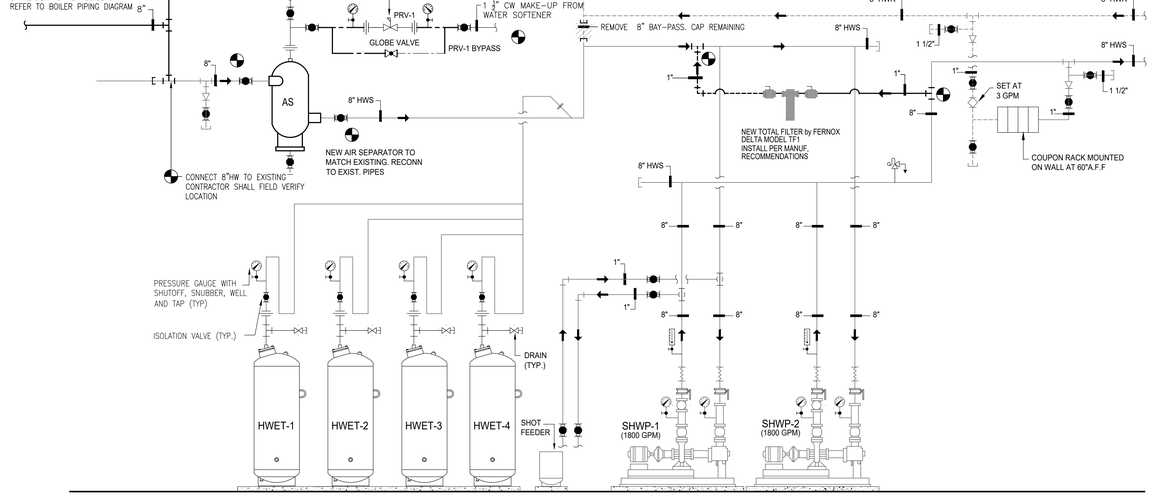
DATE MAY 30, 2023

DWG. NO.
M1.1



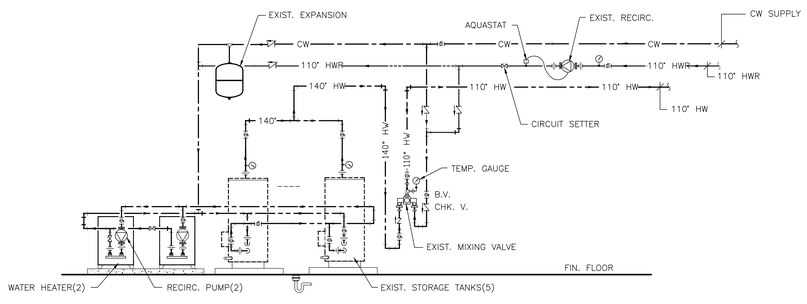
HOT WATER PIPING DIAGRAM - EXISTING

NO SCALE



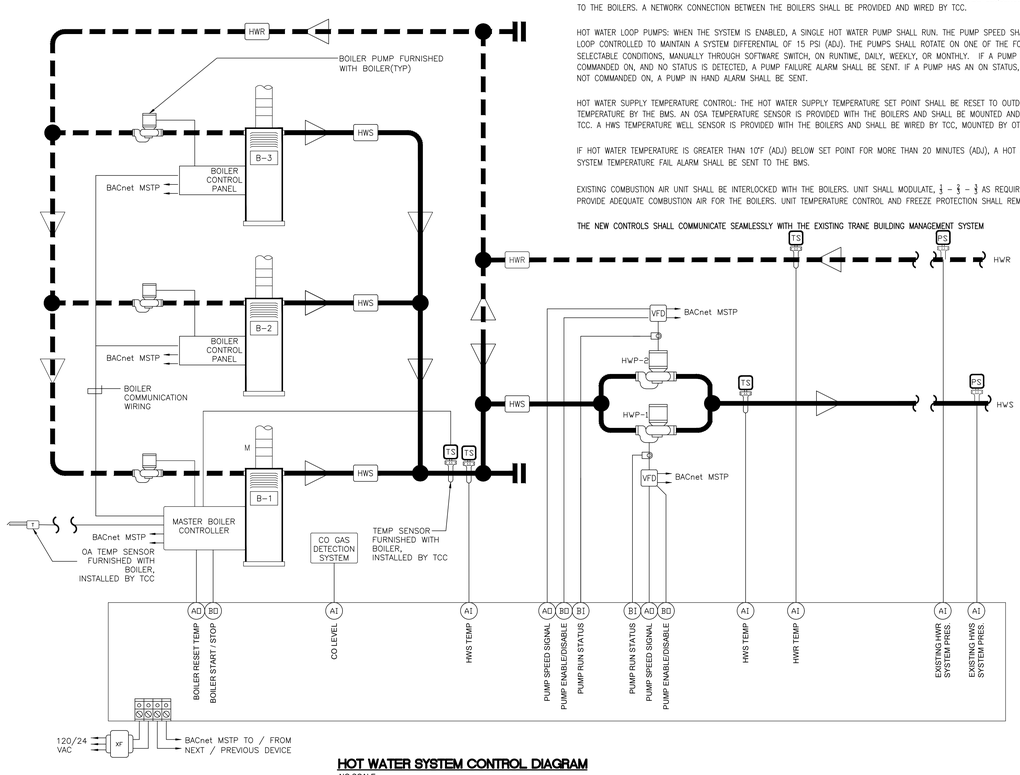
HOT WATER PIPING DIAGRAM - EXISTING

NO SCALE



TWO HEATERS / FIVE TANKS, SINGLE TEMPERATURE

NO SCALE



HOT WATER SYSTEM CONTROL DIAGRAM

NO SCALE

GENERAL NEW WORK NOTES :

1. DRAWINGS ARE DIAGRAMMATIC AND SHOW GENERAL INTENT OF WORK, ALL CONTRACTORS MUST COORDINATE WITH OTHER TRADES OTHER TRADES BEFORE PROCEEDING WITH ANY WORK.
2. THE CONTRACTOR SHALL COORDINATE THE ROUTING AND INSTALLATION OF ALL SYSTEMS TO AVOID CONFLICTS.
3. THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS PRIOR TO SUBMITTING HIS BID.
4. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING PIPE LOCATIONS AND SIZES.
5. INSTALL PIPES TO ALLOW EASY ACCESS TO VALVES.
6. BRANCH TAKE-OFFS FOR FLUE AND COMBUSTION AIR SHALL BE AT 45° ANGLES.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY TEMPORARY WORK REQUIRED TO KEEP THE BUILDING OCCUPIED DURING THE CONSTRUCTION.
8. INSULATE ALL NEW HOT WATER HEATING SUPPLY AND RETURN PIPING.

MECHANICAL SYMBOL LIST

SYMBOL	ABBREV.	DESCRIPTION
	HWS	HOT WATER HEATING SUPPLY
	HWR	HOT WATER HEATING RETURN
	CW	COLD WATER
	G	NATURAL GAS
	EG	EXISTING NATURAL GAS
	CND	CONDENSATE DRAIN
		SHUTOFF VALVE
		GAS SHUTOFF VALVE
		RISER DOWN
		RISER UP
		RISE OR DROP
		BRANCH-TOP CONNECTION
	FD	FLOOR DRAIN
	POC	POINT OF CONNECTION

GENERAL TEMPERATURE CONTROL NOTES:

1. ALL ELECTRIC WIRING, CONNECTIONS, DEVICES, RACEWAY AND HARDWARE REQUIRED FOR THE INSTALLATION OF THE TEMPERATURE CONTROL SYSTEM AS SPECIFIED AND SHOWN ON THE DRAWINGS SHALL BE PROVIDED BY THE TEMPERATURE CONTROLS CONTRACTOR (TCC).
2. ALL CONTROL WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE CONTROL SYSTEM MANUFACTURER'S REQUIREMENTS AND CURRENT CODES.
3. ALL LOW VOLTAGE CONTROL WIRING SHALL BE PLENUM RATED CABLE OF TYPES AND SIZES REQUIRED BY THE CONTROL SYSTEM MANUFACTURER. PROVIDE MINIMUM OF 3/4" EMT CONDUIT FOR ALL WIRING EXPOSED TO VIEW AND FOR WIRING DROPS AND RUNS WITHIN WALLS. EMT FITTINGS AND CONNECTORS SHALL BE STEEL SET SCREW TYPE.
4. ALL CONDUITS SHALL TERMINATE WITH JUNCTION BOXES OR OUTLET BOXES. PROVIDE BUSHINGS FOR ALL WIRING ENTRIES INTO THE CONDUIT SYSTEM.
5. ALL TEMPERATURE CONTROL WIRING SHALL BE NEATLY INSTALLED WITH CABLE RUNS INSTALLED PARALLEL TO OR AT RIGHT ANGLES TO THE LINES OF THE BUILDING. ALL WIRING IN NORMALLY OCCUPIED AREAS OF THE BUILDING SHALL BE CONCEALED FROM VIEW. OPEN CABLE RUNS ABOVE CEILINGS SHALL BE BUNDLE TIED WITH PLASTIC CABLE TIES AND SHALL BE SUPPORTED FREE FROM THE CEILING AND MECHANICAL/ELECTRICAL EQUIPMENT USING APPROVED CABLE HANGERS AND CABLE CLIPS.
6. THE TEMPERATURE CONTROL CONTRACTOR SHALL COORDINATE POWER SUPPLY REQUIREMENTS OF THE CONTROL SYSTEM WITH DIVISION 26.
7. REFER TO SPECIFICATION FOR ADDITIONAL CONTROLS REQUIREMENTS AND THE EQUIPMENT SEQUENCE OF OPERATIONS.
8. ALL CONTROLS DEVICES AND ELECTRONICS SHALL BE INSTALLED WITHIN A NEMA-1 ENCLOSURE LOCATED WITHIN PROXIMITY TO THE EQUIPMENT SERVED.

9

HOT WATER SYSTEM, VFD SINGLE LOOP PUMPS

RUN CONDITIONS: THE HOT WATER SYSTEM SHALL BE ENABLED WHEN OUTDOOR AIR TEMPERATURE IS LESS THAN 60°F (ADJ) AND AVERAGE ZONE LOAD IS GREATER THAN 10%. FOR FREEZE PROTECTION THE HOT WATER SYSTEM SHALL REMAIN ENABLED WHEN OUTDOOR AIR TEMPERATURE IS LESS THAN 35°F (ADJ). WHEN ENABLED THE HOT WATER SYSTEM SHALL RUN FOR A MINIMUM OF 20 MINUTES (ADJ).

BOILER CONTROL: THE BOILERS ARE SUBJECT TO THEIR HARDWIRED SAFETIES. WHEN THE SYSTEM IS ENABLED THE LEAD BOILER AND LEAD HOT WATER LOOP PUMP SHALL RUN. THE BOILERS SHALL BE CONFIGURED BY AN LOCHINVAR FACTORY QUALIFIED TECHNICIAN TO RUN IN CASCADE MODE. THE ROTATION AND STAGING OF THE BOILERS SHALL BE CONTROLLED BY THE CASCADE SEQUENCE INTEGRAL TO THE BOILERS. A NETWORK CONNECTION BETWEEN THE BOILERS SHALL BE PROVIDED AND WIRED BY TCC.

HOT WATER LOOP PUMPS: WHEN THE SYSTEM IS ENABLED, A SINGLE HOT WATER PUMP SHALL RUN. THE PUMP SPEED SHALL BE PID LOOP CONTROLLED TO MAINTAIN A SYSTEM DIFFERENTIAL OF 15 PSI (ADJ). THE PUMPS SHALL ROTATE ON ONE OF THE FOLLOWING SELECTABLE CONDITIONS, MANUALLY THROUGH SOFTWARE SWITCH, ON RUNTIME, DAILY, WEEKLY, OR MONTHLY. IF A PUMP IS COMMANDED ON, AND NO STATUS IS DETECTED, A PUMP FAILURE ALARM SHALL BE SENT. IF A PUMP HAS AN ON STATUS, AND IS NOT COMMANDED ON, A PUMP IN HAND ALARM SHALL BE SENT.

HOT WATER SUPPLY TEMPERATURE CONTROL: THE HOT WATER SUPPLY TEMPERATURE SET POINT SHALL BE RESET TO OUTDOOR AIR TEMPERATURE BY THE BMS. AN OSA TEMPERATURE SENSOR IS PROVIDED WITH THE BOILERS AND SHALL BE MOUNTED AND WIRED BY TCC. A HWS TEMPERATURE WELL SENSOR IS PROVIDED WITH THE BOILERS AND SHALL BE WIRED BY TCC, MOUNTED BY OTHERS.

IF HOT WATER TEMPERATURE IS GREATER THAN 10°F (ADJ) BELOW SET POINT FOR MORE THAN 20 MINUTES (ADJ), A HOT WATER SYSTEM TEMPERATURE FAIL ALARM SHALL BE SENT TO THE BMS.

EXISTING COMBUSTION AIR UNIT SHALL BE INTERLOCKED WITH THE BOILERS. UNIT SHALL MODULATE, $\frac{1}{3} - \frac{2}{3} - \frac{3}{3}$ AS REQUIRED TO PROVIDE ADEQUATE COMBUSTION AIR FOR THE BOILERS. UNIT TEMPERATURE CONTROL AND FREEZE PROTECTION SHALL REMAIN AS IS.

THE NEW CONTROLS SHALL COMMUNICATE SEAMLESSLY WITH THE EXISTING TRANE BUILDING MANAGEMENT SYSTEM

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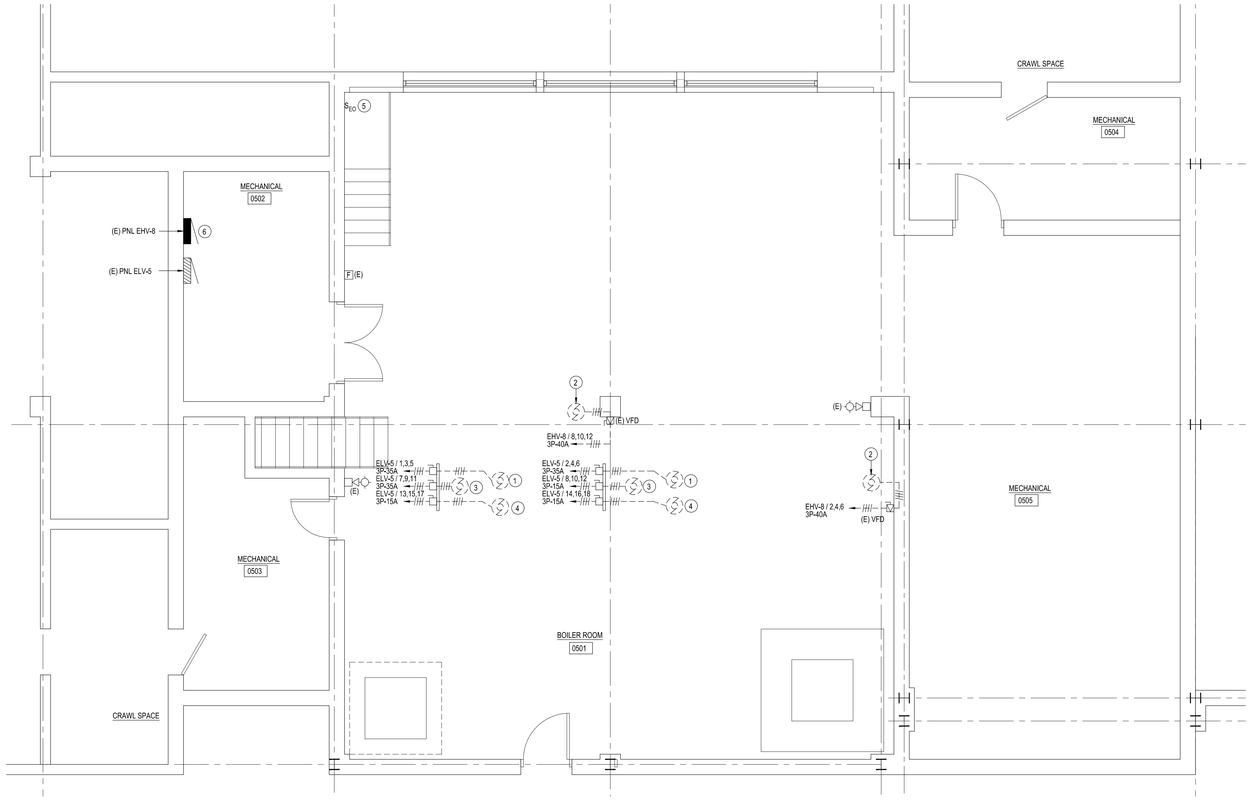
TITLE
EXISTING HOT WATER PIPING DIAGRAM

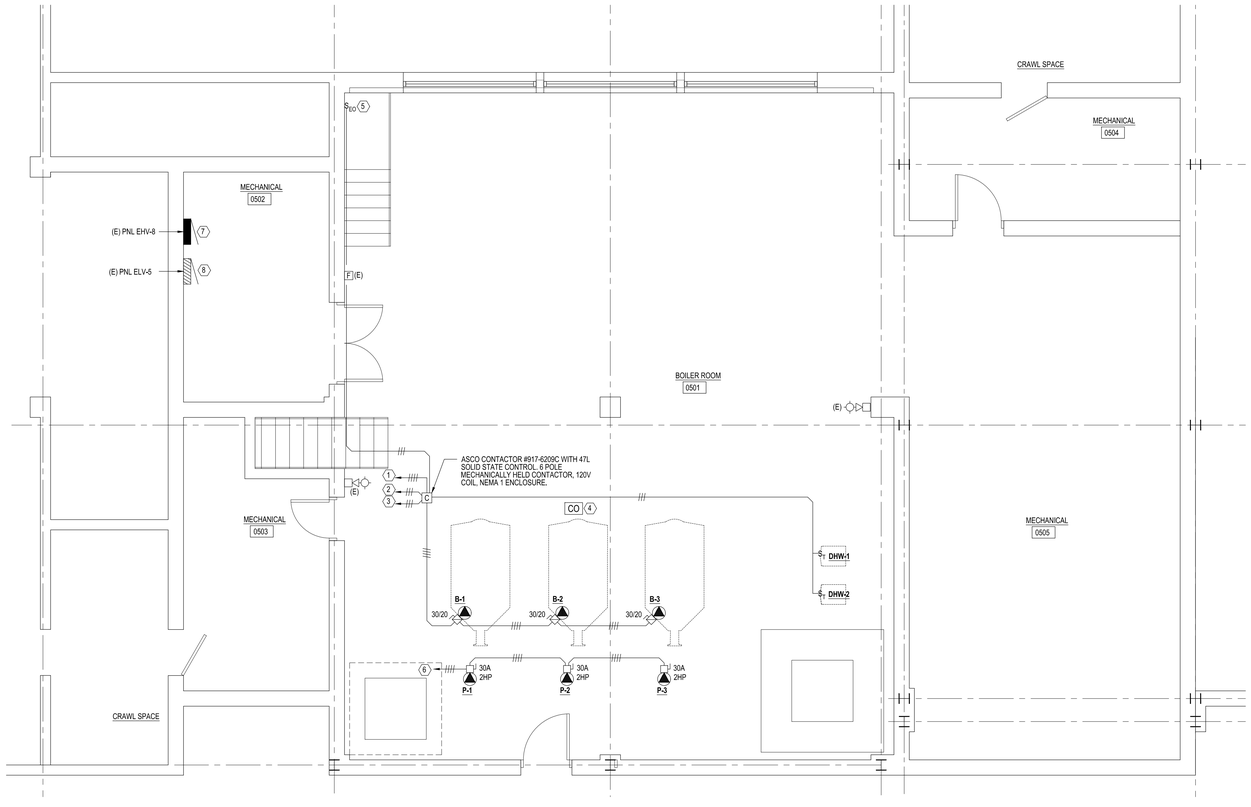
DATE MAY 30, 2023

DWG. NO.
M2.0



BOILER ROOM PART PLAN - ELECTRICAL DEMOLITION

SCALE: 1/4"=1'-0"



BOILER ROOM PART PLAN - ELECTRICAL NEW WORK

SCALE: 1/4"=1'-0"

ELECTRICAL DEMOLITION WORK NOTES

1 - PRIOR TO SUBMITTING BID, VISIT THE SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY CONSTRUED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.

2 - THE DEMOLITION DRAWINGS ARE INTENDED ONLY TO DEFINE THE GENERAL SCOPE OF DEMOLITION WORK AND TO ASSIST THE CONTRACTOR DURING BIDDING. THE DEMOLITION DRAWINGS MAY NOT SHOW EVERY ITEM WHICH MUST BE DISCONNECTED, REMOVED, OR RELOCATED IN ORDER TO FACILITATE NEW WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION WORK REQUIRED WHETHER OR NOT SHOWN ON THE PLANS.

3 - REMOVE AND/OR RELOCATE ALL EXISTING ELECTRICAL WORK AS NECESSARY FOR THE PERFORMANCE OF THE WORK OF THIS CONTRACT.

4 - EXISTING ELECTRICAL EQUIPMENT, WIRING, AND RACEWAYS SHALL NOT BE REUSED UNLESS SPECIFICALLY NOTED OTHERWISE.

5 - REMOVE ALL DEMOLITION MATERIAL FROM THE JOB SITE UNLESS NOTED DIFFERENTLY. MATERIAL REQUESTED BY THE OWNER FOR SALVAGE SHALL BE DELIVERED TO THE OWNER'S DESIGNATED MATERIAL STORAGE AREA.

6 - PROVIDE WIRING AS REQUIRED AND RECONNECT EXISTING FIXTURES, DEVICES, OR EQUIPMENT THAT ARE TO REMAIN ACTIVE, BUT HAVE BEEN DISCONNECTED DURING DEMOLITION OF OTHER FIXTURES, DEVICES, OR EQUIPMENT.

- ELECTRICAL DEMOLITION WORK SYMBOLS -

TAG	ACTION
1	DISCONNECT AND REMOVE EXISTING BOILER BRANCH CIRCUIT WIRING AND CONDUIT BACK TO DISCONNECT SWITCH.
2	DISCONNECT AND REMOVE EXISTING PUMP ELECTRICAL.
3	DISCONNECT AND REMOVE EXISTING FUEL OIL TRANSFER PUMP ELECTRICAL.
4	DISCONNECT AND REMOVE EXISTING BOILER FAN ELECTRICAL.
5	DISCONNECT AND REMOVE EXISTING BOILER & WATER HEATER EMERGENCY OFF SWITCH (VERIFY EXACT LOCATION IN FIELD) AND ALL ASSOCIATED WIRING MADE OBSOLETE BY REMOVAL.
6	REMOVE (2) EXISTING 3P-40A CIRCUIT BREAKERS MADE OBSOLETE BY REMOVAL OF EXISTING PUMPS.

- ELECTRICAL NEW WORK SYMBOLS -

TAG	ACTION
1	EXTEND 3#12, 1#12G IN 3/4" EMT CONDUIT FROM NEW BOILERS TO NEW 3P-20A CIRCUIT BREAKER (THRU NEW EMERGENCY OFF CONTACTOR) IN EXISTING 480Y/277V-3Ø-4W ELECTRICAL PANEL "EHV-8" AND CONNECT AS REQUIRED.
2	EXTEND 2#12, 1#12G IN 3/4" EMT CONDUIT FROM NEW GAS WATER HEATERS TO NEW 1P-20A CIRCUIT BREAKER (THRU NEW EMERGENCY OFF CONTACTOR) IN EXISTING 208Y/120V-3Ø-4W ELECTRICAL PANEL "ELV-5" AND CONNECT AS REQUIRED.
3	EXTEND 2#12, 1#12G IN 3/4" EMT CONDUIT FROM NEW EMERGENCY OFF CONTACTOR TO NEW 1P-20A CIRCUIT BREAKER IN EXISTING 208Y/120V-3Ø-4W ELECTRICAL PANEL "ELV-5" AND CONNECT AS REQUIRED.
4	PROVIDE A NEW CARBON MONOXIDE DETECTOR. PROVIDE WIRING AND CONNECTIONS AS REQUIRED AND CONNECT TO LOCAL FIRE ALARM INITIATION CIRCUIT. PROVIDE MONITOR MODULE AND 24 VDC POWER WIRING FROM EXISTING FIRE ALARM CONTROL PANEL IF REQUIRED
5	PROVIDE A NEW EMERGENCY OFF SWITCH AT EXISTING LOCATION. WIRE AS REQUIRED TO DISCONNECT NEW BOILERS & NEW GAS WATER HEATERS.
6	EXTEND 3#12, 1#12G IN 3/4" EMT CONDUIT FROM NEW BOILER PUMPS TO NEW 3P-20A CIRCUIT BREAKER IN EXISTING 480Y/277V-3Ø-4W PANEL "EHV-8" AND CONNECT AS REQUIRED.
7	PROVIDE (2) NEW 3P-20A CIRCUIT BREAKERS IN EXISTING 480Y/277V-3Ø-4W PANEL "EHV-8". NEW BREAKERS SHALL MATCH EXISTING PANEL MANUFACTURER (GE) AND AIC RATING (COORDINATE). INSTALL NEW CIRCUIT BREAKERS IN SPACES MADE AVAILABLE BY REMOVAL OF EXISTING PUMP C/B'S. PROVIDE NEW TYPEWRITTEN PANELBOARD DIRECTORY INDICATING NEW CONDITIONS.
8	PROVIDE (2) NEW 1P-20A CIRCUIT BREAKERS IN EXISTING208Y/120V-3Ø-4W PANEL "ELV-4". NEW BREAKERS SHALL MATCH EXISTING PANEL MANUFACTURER (GE) AND AIC RATING (COORDINATE). INSTALL NEW CIRCUIT BREAKERS IN EXISTING BLANK SPACE. PROVIDE NEW TYPEWRITTEN PANELBOARD DIRECTORY INDICATING NEW CONDITIONS.

GENERAL SPECIFICATION NOTES - POWER

1 - THE CONTRACTOR SHALL VERIFY AND OBTAIN ALL NECESSARY DIMENSIONS AT THE BUILDING.

2 - FINISHED WORK: THE INTENT OF THE SPECIFICATIONS AND DRAWINGS IS TO CALL FOR FINISHED WORK, COMPLETED, TESTED AND READY FOR OPERATION.

3 - GOOD PRACTICE: IT IS NOT INTENDED THAT THE DRAWINGS SHOW EVERY CONDUIT, JUNCTION BOX, FITTING OR MINOR DETAIL AND IT IS UNDERSTOOD THAT WHILE THE DRAWINGS MUST BE FOLLOWED AS CLOSELY AS CIRCUMSTANCES WILL PERMIT, THE SYSTEMS SHALL BE INSTALLED ACCORDING TO THE INTENT AND MEANING OF THE CONTRACT DOCUMENTS AND IN ACCORDANCE WITH GOOD PRACTICE.

4 - ANY APPARATUS, APPLIANCE, MATERIAL OR WORK NOT SHOWN ON DRAWINGS BUT MENTIONED IN SPECIFICATIONS OR VICE VERSA, OR ANY INCIDENTAL ACCESSORIES NECESSARY TO MAKE THE WORK COMPLETE AND PERFECT IN ALL RESPECTS AND READY FOR OPERATION, EVEN IF NOT PARTICULARLY SPECIFIED, SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR AT NO ADDITIONAL COST TO OWNER.

5. CODES AND STANDARDS - COMPLY WITH ALL FEDERAL, STATE AND LOCAL CODES AND STANDARDS WHEREVER APPLICABLE INCLUDING THE FOLLOWING:
2022 CONNECTICUT STATE BUILDING CODE, (2021 IBC WITH AMENDMENTS).
2022 CONNECTICUT FIRE SAFETY CODE, (2021 IFC WITH AMENDMENTS).
2022 CONNECTICUT STATE FIRE PREVENTION CODE (2021 NFPA 1 WITH AMENDMENTS).
2021 INTERNATIONAL ENERGY CONSERVATION CODE WITH AMENDMENTS,
2021 INTERNATIONAL PLUMBING CODE WITH AMENDMENTS,
2021 INTERNATIONAL MECHANICAL CODE WITH AMENDMENTS,
2020 NFPA 70 NATIONAL ELECTRICAL CODE WITH AMENDMENTS,
2019 NFPA 72 NATIONAL FIRE ALARM CODE,
ICC A117.1-2017 ACCESSIBLE AND USABLE BUILDINGS,
ADA,
NFPA,
UNDERWRITERS LABORATORIES,
FACTORY MUTUAL INSURANCE COMPANY,
NEMA STANDARDS.

6 - NOTE THAT THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF THE ELECTRICAL EQUIPMENT AND SYSTEMS, WITHOUT SHOWING EVERY DETAIL AND FITTING.

7 - RACEWAYS: PROVIDE EMT CONDUIT FOR ALL WIRING. EMT CONNECTORS AND COUPLINGS SHALL BE GALVANIZED STEEL SET-SCREW TYPE. PROVIDE GLAND COMPRESSION CONNECTORS AND COUPLINGS WHERE LOCATED IN DAMP AND WET LOCATIONS. PROVIDE FLEXIBLE STEEL CONDUIT FOR FINAL CONNECTIONS TO MOTOR DRIVEN EQUIPMENT.

8 - BRANCH CIRCUIT CONDUCTORS SHALL BE COPPER, RATED 600 VOLTS, 90 DEG.C., COLOR CODED, TYPE XHHW-2.

9 - WIRE SIZE #6 AWG AND LARGER SHALL BE STRANDED. WIRE OF SIZE SMALLER THAN #8 AWG SHALL BE SOLID.

10 - MINIMUM SIZE CONDUCTORS FOR POWER AND LIGHTING SHALL BE #12 AWG. PROVIDE MINIMUM #10 AWG SIZE FOR RUNS EXCEEDING 75' IN CONDUCTOR LENGTH, AND #8 AWG SIZE FOR RUNS EXCEEDING 150' IN CONDUCTOR LENGTH. PROVIDE LARGER SIZE CONDUCTORS AS SCHEDULED OR AS NOTED ON THE DRAWINGS.

11 - THE NUMBER OF WIRES IN A CONDUIT RUN IS INDICATED ON THE DRAWINGS BY CROSS LINES ON THE CONDUIT RUNS. PROVIDE CODE-SIZED CONDUIT FOR THE NUMBER AND SIZE OF WIRES UNLESS A LARGER SIZE IS SHOWN ON THE DRAWINGS. MINIMUM CONDUIT SIZE SHALL BE 3/4".

12 - RACEWAYS SHALL BE CONCEALED WHEREVER POSSIBLE IN ALL FINISHED AREAS.

13 - RACEWAYS SHALL BE RUN PARALLEL TO OR AT RIGHT ANGLES TO WALL LINES.

14 - RACEWAYS SHALL BE SUPPORTED FROM THE STRUCTURE BY STRAP HANGERS, ROD HANGERS, OR RACK MOUNTED, OR OTHER APPROVED ELECTRICAL MOUNTING.

15 - PROVIDE FIRE STOPPING AT ALL FIRE AND/OR SMOKE RATED WALL OR CEILING PENETRATIONS IN ORDER TO MAINTAIN ITS ORIGINAL INTEGRITY.

16 - OUTLET BOXES SHALL BE CODE GAUGE GALVANIZED STEEL AND SHALL BE OF SHAPES AND SIZES TO SUIT THEIR RESPECTIVE LOCATIONS AND INSTALLATIONS, AND SHALL BE PROVIDED WITH COVERS TO SUIT THEIR FUNCTION AND INSTALLATION. MINIMUM BOX SIZE SHALL BE 4" SQ. X 2 1/8" DEEP (2-GANG). PROVIDE CAST BOXES FOR OUTDOOR WORK.

17 - OUTLET BOXES SHALL BE EQUIPPED WITH FIXTURE STUD OR STRAPS WHERE REQUIRED.

18 - INSTALL BOXES IN ACCESSIBLE LOCATIONS AND AT UNIFORM HEIGHTS.

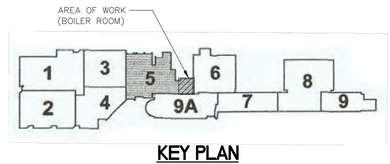
19 - SET BOXES AND COVERS SQUARE AND TRUE WITH BUILDING FINISH.

20 - BRANCH CIRCUIT WIRING AND ARRANGEMENT OF HOME RUNS HAS BEEN DESIGNED FOR MAXIMUM ECONOMY CONSISTENT WITH ADEQUATE SIZING FOR VOLTAGE DROPS, CIRCUIT AMPACITIES, AND OTHER CONSIDERATIONS. INSTALL THE WIRING WITH CIRCUITS ARRANGED AS SHOWN ON THE DRAWINGS, EXCEPT AS APPROVED IN ADVANCE BY THE ARCHITECT AND ENGINEER. DO NOT MAKE CHANGES WITHOUT PRIOR APPROVAL.

21 - PROVIDE A SEPARATE NEUTRAL CONDUCTOR FOR EACH 120V SINGLE PHASE CIRCUIT. DO NOT USE A COMMON NEUTRAL FOR GROUPS OF CIRCUITS. PROVIDE A SEPARATE GROUND WIRE FOR EACH CIRCUIT BACK TO THE RESPECTIVE PANEL GROUND. IF MORE THAN 3 CURRENT CARRYING CONDUCTORS ARE INSTALLED IN ONE CONDUIT THEY SHALL BE DE-RATED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE. DO NOT INSTALL MORE THAN THREE 30 AMP SINGLE PHASE OR FOUR 20 AMP SINGLE PHASE CIRCUITS IN THE SAME CONDUIT.

LEGEND

SYMBOL/ABBREVIATION	DESCRIPTION
	SPECIAL EQUIPMENT POWER CONNECTION. EQUIPMENT AS DESIGNATED.
	MOTOR POWER CONNECTION. EQUIPMENT AS DESIGNATED.
	DISCONNECT SWITCH.
30/20	FUSED DISCONNECT SWITCH (DISCONNECT SIZE / FUSE SIZE)
	COMBINATION VARIABLE FREQUENCY DRIVE AND DISCONNECT SWITCH.
	CONDUCTORS IN CONDUIT, CROSS LINES INDICATE NUMBER OF CONDUCTORS.
	BRANCH CIRCUIT HOMERUN IN CONDUIT. CROSS LINES INDICATE NUMBER OF CONDUCTORS.
S_T	THERMAL OVERLOAD SWITCH.
S_{EO}	EMERGENCY SHUT OFF SWITCH, 60" AFF.
S_3	THREE-WAY TOGGLE SWITCH, 48" AFF.
	480Y/277V-3Ø-4W PANELBOARD
	208Y/120V-3Ø-4W PANELBOARD
F	EXISTING MANUAL PULL STATION TO REMAIN.
CO	CARBON MONOXIDE DETECTOR.
	EXISTING HORN/STROBE TO REMAIN.
C	CONTACTOR
A	AMPS.
AFF	ABOVE FINISHED FLOOR.
C	CONDUIT.
C/B	CIRCUIT BREAKER.
(E)	EXISTING.
GND.	GROUND.
P	POLE.
PNL	PANELBOARD.



KEY PLAN

NORTH

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TITLE
ELECTRICAL DEMOLITION and NEW WORK PART PLANS

DATE MAY 30, 2023

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E1.1