

STANDARD SPECIFICATION
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DIVISION 15

SECTION 15A HEATING AND VENTILATING

15A.01 GENERAL:

- A. All work under this Section is subject to the Contract Documents, Contract Drawings and the "General Conditions Governing all Contracts," all of which form a part of this Section as if written out in full herein.
- B. The contractor for work under this specification is referred to the General Conditions, Special Conditions and all Contract Documents, all of which are hereby made part of this specification.
- C. Perform all necessary removals, cuttings, repairs, replacement etc., for the completion of this work and provide all materials, labor, tools and equipment required to perform the work as specified herein.
- D. Contractor must carefully examine the site of the proposed work, as well as its adjacent area, and seek other usual sources of information for they will be conclusively presumed to have full knowledge of any and all conditions on, about, or above the site relating to, or affecting in anyway, the performance of the work to be done under this contract which were or should have been indicated to a reasonably prudent bidder.

NOTE: NOTIFY ARCHITECT/ENGINEER BEFORE STARTING WORK. ALL WORK TO BE DONE UNDER THE DIRECTION OF THE ARCHITECT/ENGINEER. NO WORK TO BE PERFORMED ON WEEKENDS WITHOUT PRIOR APPROVAL FROM THE ARCHITECT/ENGINEER.

- E. *All HVAC work shall be performed by a Licensed Master Plumber, as specified by NYC Building Department in a neat manner and in accordance with best practices. All work shall comply with all local, state and Federal rules and regulations. The Contractor shall obtain and complete all necessary applications, approvals and pay all fees required to obtain all trade related permits and final sign offs from all agencies having jurisdiction.*
- F. The Contractor shall perform all necessary removal, cutting, repair, replacement, etc. for the completion of this work, and provide all labor, materials, tools and equipment required to perform the work as specified herein and to comply with the New York City Code. Rubbish and debris shall be expeditiously removed from the premises.
- G. The Contractor shall obtain prior approval from Architect/Engineer for changes, additions or modifications to the "Scope of Work", specifications, and drawings.
- H. Notify Architect/Engineer before starting work. All work is to be done under the supervision and as directed by Architect/Engineer. Prior to completion of Contract,

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Architect/Engineer shall coordinate with the Management Group a single authorized punch-list for issuance to the Contractor.

I. Tenants in occupancy (If applicable):

1. It is understood and agreed that the existing tenants in the building may remain in occupancy during the work. The Contractor shall, at all times, be responsible for minimizing inconvenience to the tenants, protecting life and property of tenants, and maintaining the work area in a clean and habitable condition.
2. If the work requires substantial disruption, the Contractor shall be responsible for informing Architect/Engineer of the time and extent of the disruption at least two days in advance and shall obtain approval from Architect/Engineer to proceed with the work.
3. Temporary heat and hot water services should be provided during construction especially during the heating season and hot water should be available year round. There will be no shut off of heat and/or hot water longer than 48 hours without proper notification and scheduling with tenants.

J. The Contractor shall fully familiarize himself with the job and field conditions before submitting his bid.

K. Substitutions:

1. Reference in the Contract Document to materials, form of construction, products, and equipment by proprietary name, make and catalogue number shall be interpreted as establishing a standard of quality of manufacture, performance, or appearance, and shall not be construed as limited competition.
2. Should the Contractor desire to substitute any item of brand or manufacture other than that specified, he/she shall submit to Architect/Engineer a written request for approval of the substitutions he proposes and wishes to make. Such requests shall be accompanied by descriptive literature, drawings, samples or such information as the Architect/Engineer will investigate all such requests and render decisions thereon as promptly as is reasonably possible, and such decisions shall be final.
3. Any substitution of material specified shall be equal in quality and value, or credit is due Owner.

L. Immediately upon award of this contract, this contractor shall confer with Architect/Engineer to prepare a work program schedule. This schedule shall be revised as may be required by Architect/Engineer and when approved, shall establish the order in which the work shall proceed, and the dates when the various parts shall be installed or completed.

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- M. Provide for all work for a complete and working HVAC system. Any items or services not indicated in the contract documents and necessary for completion of the system, or required by all codes and must be brought to Architect's/Engineer's attention. This contractor is responsible for all items or services necessary for a complete installation of the heating and ventilation systems.

15B.02 WORK INCLUDED

- A. **Refer to "Supplement of Requirements for Adaptable Apartments, "Division 1, Section 1E and/or Requirements for Public Areas" Division 1 Section 1F. for Handicapped if Applicable and provide systems as indicated in all A.D.A adaptable apartments and public areas.**
- B. Provide all labor, materials and equipment necessary or incidental to perform the work of this Section and related work as indicated in the Contract Documents. Refer to "Division Scope of Work" section: 15A for complete scope of work for this section, which form a part of the contract specifications.

15B.03 WORK EXCLUDED

- A. Electric wiring for all controllers and motors, by Section 16A.
- B. Painting, except as noted herein.
- C. Removal of friable asbestos insulation.

15A.04 SUBMISSION REQUIREMENTS

- A. Before Work Commences Architect's/Engineer's Approval is Required
1. Catalog cuts for boiler, domestic water heater, burner(s), boiler controls, burner controls, pumps, baseboards, convectors, expansion tanks, exhaust fans, valves and any other items requested by Architect/Engineer. All catalog cuts are to include manufacturers name, model numbers, capacities, BSA/MEA number and all other relevant information.

NOTE: REMOVAL OF ANY EXISTING FRIABLE ASBESTOS INSULATION ON HEATING LINES OR BOILER WILL BE DONE BY OTHERS PRIOR TO THE COMMENCEMENT OF THIS CONTRACT. REFER TO SPECIFIC REQUIREMENTS SECTION 1A.

- B. Must Accompany Final Payment Request

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1. New York City Department of Buildings Final Sign-off for all work under this section.
2. Registration/Certificate of Operation from Bureau of Environmental Compliance.
3. Operation and service manuals, and warrantee information for all equipment and devices installed.

15A.05 SCOPE OF WORK

- A. This contractor must only refer to the appropriate sections of the specification as requested in the Scope of Work and/or contract drawings.
- B. Provide complete heating and ventilation systems in accordance with New York City Mechanical and Fuel Gas Codes including heating and ventilation equipment, piping, ductwork, heating controls, wiring, burner controls, breaching for each boiler, burner, burner controls, wiring etc.

15A.06 CODES, RULES AND CERTIFICATES

- A. The complete installation of the heating system, boiler, burner, ventilation, controls and all other items of the work shall be in strict accordance with all laws and with latest rules and regulations of all Municipal and other Public Agencies, and the National Board of Fire Underwriters. Should there be a conflict between any items or requirements, specified herein and/or shown on the contract drawings, all pertinent rules, regulations and legal requirements shall apply.
- B. This contractor is responsible to complete all necessary applications, pay all fees, give all notices, file all drawings (if required) and obtain all permits and final sign-offs from The Department of Buildings for work under this contract. This contractor is responsible for filing the boiler Registration/Certificate of Operation with Bureau of Environmental Compliance. Adhere to controlled inspection requirements and furnish Certificates of Inspection by all Agencies requiring them.

15A.07 CONTRACT DRAWINGS

- A. The contract drawings show the approximate location of all required equipment and the diagrammatic arrangement of piping. Piping runs have been shown with the intention of most clearly indicating the routing. Actual runs may differ if kept within the requirements and provisions of these specifications, and providing that all modifications have been shown in the shop drawings. Exact location of all equipment will be determined in the field and the contractor must secure exact dimensional data before laying out any work.
- B. This contractor must submit shop drawings only if the final field installation will differ from Architect's/Engineer's proposed drawings.

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1. Five (5) copies of each drawing shall be submitted to Architect/Engineer before any work begins.
2. Drawing shall be 1/4" = 1' - 0" scale blueprint indicating exact location and size of all equipment and piping. Plans to include cellar layout, first floor layout, typical floor layout, riser diagram, schematic of boiler room indicating all equipment valves and piping, electrical schematic indicating all high and low voltage wiring and any drawings Architect/Engineer may request. Drawings will not be accepted unless a complete list of deviations from Architect's/Engineer's proposed plans is included.

15A.08 REMOVAL OF RUBBISH AND CLEANING

- A. This contractor shall remove at all times from the building, waste materials or rubbish accumulated resulting from this work. Upon completion of the work, clean all heating materials and equipment to the satisfaction of Architect/Engineer.

15A.09 CUTTING AND PATCHING

- A. The contractor shall be responsible for all cutting, patching and drilling for expansion bolts and supports necessary to be done for installation of this work.

15B.10 ACCESSIBILITY

- A. Ascertain that all equipment, such as boiler, pumps and such other apparatus as may be necessary to be reached from time to time for operation and maintenance, is made easily accessible.
- B. The location of equipment may conflict with the building construction and may disclose the fact that the location for this work does not make its position easily and quickly accessible. In such cases, call Architect's/Engineer's attention to this fact before installing this work and contractor shall be guided by Architect's/Engineer's instructions.

15A.11 REQUIREMENTS AND PROCEDURES

- A. General
 1. The hydronic heating system shall be gas fired, two pipe forced hot water reverse return system with reverse return risers installed to operate as a self balanced system. See drawings for exact system to be used. Systems shall operate rapidly, noiselessly and efficiently throughout.
 2. The size of the heating plant(s) required was based on maintaining 70 F inside temperature when outside conditions of 5 F and 15 winds MPH exists; and for domestic hot water production through an indirect-fired water heater.

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3. Domestic hot water shall be provided from an indirect-fired water heating tank with an immersed coil. The domestic water heater load was based on a 90deg. F temperature rise.

B. Coordination of Work and Trades

1. As per N.E.C., all heating piping and equipment installed under this contract shall be 6'-0" minimum from all electrical equipment.
2. All piping and ductwork shall be concealed in wall chases, recesses, shafts, and hung ceilings where same are provided. Refer to, and carefully check Architectural, Structural, Electrical and Plumbing Drawings and details for locations where walls, partitions, ceilings, beams, columns and other surfaces are furred, locations of shafts and conflicts with work of other trades.
3. Obtain maximum possible headroom to the bottom of exposed ductwork piping or covering. In no case shall headroom be less than seven (7) foot six (6) inches above finished floor.
4. The Contractor shall provide offsets as may be required to maintain pitch, elevation or to accommodate routing around obstacles.
5. Should any work installed require subsequent modification to avoid interference, as determined by the Architect/Engineer such changes shall be made without cost to Owner. Architect's/Engineer's decision where interference or other conditions require the changing of work installed shall be final.
6. Where the work of the Contractor is concealed, the contractor is responsible for its proper installation to assure that it does not project beyond the finished lines of floors, ceilings or walls.

15A.12 EXCAVATION AND BACKFILL

- A. Perform all excavation, backfilling, pumping and sheathing required for installation of all work described herein. Backfilling shall be carefully done and thoroughly compacted. For excavation below 8'-0", fill shall be made in layers not more than one foot deep and each layer tamped. Fill around piping shall be flushed in with water. No large stone or boulders shall be used. All backfill shall be installed as per requirements of Bureau Highways Operations and New York Paving.
- B. Contractor is required to obtain a permit from the Department of Highways prior to proceeding with any pavement excavation.

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- C. All backfill for pavement shall be tested and inspected by an approved testing laboratory and Professional Engineer provided by the contractor in accordance with Bureau of Highways Operations and New York paving requirements.

15A.13 MATERIALS AND INSTALLATION

All equipment must have M.E.A. approval and conform to all state and city codes, regulations and to be installed as per manufacturer's instructions.

- NOTE:
1. ALL BOILERS MUST HAVE A CERTIFIED A.F.U.E. OF 85% TO 86% (non-condensing).
 2. Boilers shall be Energy Star approved and labeled. Where installation of Energy Star boiler is not applicable, boilers must meet the minimum product performance standards in the high performance specifications.
 3. **This contractor must obtain a comprehensive wiring schematic from the boiler manufacture or manufacture's representative before any boiler plant wiring is started.**
 4. **Boiler(s) shall be started up in accordance with manufacturer's checklist; boiler start-up must be performed by a factory-trained and certified start-up contractor. Start-up shall include control panel programming. A complete copy of the final list of control panel settings shall be provided by the installing contractor. A documented sign-off shall be provided by this contractor indicating that the boiler has been set-up, installed, wired, programmed and started in compliance with the manufacture's guidelines and building parameters.**

- A. Building Hydronic Heating Boiler(s)

1. Boilers (76 to 600MBH Gross Heating Capacity)

This boiler must meet the performance specification of Viessmann boiler, Vitogas 100 series or approved equal.

a. General:

- 1) The hydronic heating boiler shall be an atmospheric, sectional cast iron, single stage, natural gas fired boiler. The heat exchanger must be made of high-grade grey cast iron with lamellar graphite. There must be low thermal load on the heat exchanger surface to increase lifespan and efficiency. The boiler shall be of a lightweight and compact design in order to permit easy transport to the installation location. Venting system options shall consist of a Category I natural draft chimney design or side-

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wall (if applicable) vent system using an external power vent motor and termination as supplied by the boiler manufacturer. Both venting systems shall utilize Type B venting materials. Control packages shall come pre-wired for direct connection to the boiler ignition system.

- 2) Maximum boiler operating pressure: 60 psig; maximum boiler water temperature: 248°F.

b. Construction:

- 1) Each heating boiler shall consist of individual high mass cast-iron sections, assembled with push nipples and tie rods. The assembled cast-iron heat exchanger block shall be equipped on the return flange with a steel return flow injection tube to ensure equal water flow through all cast-iron sections.
- 2) Individual gas burner tubes shall be of a fully pre-mixed superstoichiometric design for reduced emissions and quiet operation. Individual gas burner tubes shall be constructed of high grade AISI 430 stainless steel for universal use of natural gas or propane gas. Main burner ignition shall be by intermittent pilot electronic ignition system.
- 3) Boiler enclosure panels shall be electrostatically powder-coated and encase the boiler shell outside with 3" mineral wool insulation wrap-around blanket complete with nylon backing. Water and gas connections to be on the boiler's left rear side. Wire and cable entry to boiler shall be facilitated by strain relief lids to reduce wear and to protect wires.
- 4) Boiler shall have a low profile, horizontal-to-vertical draft hood.
- 5) The boiler electrical requirements shall be 120 VAC, 60 Hz, less than 12 A. The electrical wiring shall have a plug in system, male and female, for easy servicing and connection of accessories. This contractor must obtain a comprehensive wiring schematic from the boiler manufacture or manufacture's representative before any boiler plant wiring is started.
- 6) Standard equipment not mentioned above shall include the following items:
- Cast iron safety header equipped with 60 psig pressure relief valve
 - Pressure gauge and air vent
 - Blocked vent and roll out switches
 - Automatic factory pre-wired flue damper assembly
 - Flue brush
- 7) Boiler(s) shall be started up in accordance with manufacturer's checklist by factory-trained start up contractor. Start up shall include control panel

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programming. A copy of the final list of control settings shall be provided to the installing contractor.

c. Boiler Certifications:

- 1) All individual components must be certified as part of the system under the governing body having jurisdiction. Field approval must not be required for any component. Boiler shall be CSA approved and shall be built in accordance with ASME Section IV, carrying the "H" stamp
- 2) The boiler must have the following approvals and listings:
- CSA, CRN (K1558.5613247890YTN), ASME, I=B=R, NY City approval (MEA#), MA State approval

d. Controls:

- 1) The control on each boiler must be factory tested to ensure proper operation. The Vitotronic 200 control on boiler #1 shall include the following hardware as standard equipment: boiler control with boiler temperature sensor, capillary for adjustable high limit (AHL), capillary for fixed manual reset temperature high limit (FHL), DHW tank temperature sensor, and outdoor temperature sensor. The Vitotronic 100 control on boiler #2 (if provided) shall include the following hardware as standard equipment: boiler control with boiler temperature sensor, capillary for adjustable high limit (AHL), and capillary for fixed manual reset temperature high limit (FHL). Both controls shall be factory tested and approved by CSA as part of a package with the compatible boiler.
- 2) Each control shall consist of a single housing for mounting on a compatible boiler.
- 3) A digital display located on the face of the boiler control shall be used to indicate time, weekday, outdoor temperature, boiler water temperature, and DHW temperature, so as to assist in set-back programming and diagnostics.
- 4) A burner status indicator shall be located prominently on the face of the boiler control and indicate when burners are in operation.
- 5) The AHL shall govern the maximum boiler water temperature; it shall be tamper proof, lock in design and be located behind a flip-down cover.
- 6) The FHL shall shut down the boiler in the event of boiler or system deficiencies, and shall have the following tamper-proof features:

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-A locking mechanism which allows for lower temperature adjustments only. Once a lower setting is adjusted, the limit cannot revert back to a higher temperature setting.

- 7) A TUV test switch shall enable the user to override the AHL to test proper operation of the FHL. The TUV test switch shall be located behind a flip-down cover to discourage tampering.
- 8) Boiler water temperature shall be modulated by a weather responsive control. The control shall be capable of managing two independent heating curves: one for constant high temperature, and one for a weather responsive temperature driven through the actions of a 4-way mixing valve. In addition, the control shall be capable of managing the production of DHW is necessary. If DHW is incorporated into any system with a mixing valve, a check valve shall be provided for installation on the return to the boiler.
- 9) Programmable energy saving features shall include 7-day, 4 event per setback programming for space heating and DHW production. An integrated failure diagnostic shall aid the heating contractor in determining the correct course of action in the event of system faults. The control logic shall be equipped to protect the heating system from freeze-up if left powered during the off-season.
- 10) The controls on each boiler shall be pre-wired with a low voltage plug-in and play system for complete system integration.
- 11) Boiler manufacturer or local representation shall provide recommended control settings for each boiler application for review and implementation to system start up entities.

e. Control Certifications:

- 1) All individual components must be certified as part of the system under the governing body having jurisdiction. All submittals must be submitted to HPD for approval, field approval is not acceptable for any component.
- 2) The equipment shall meet the Standard for Controls and Safety Devices for Automatically Fired Boilers ASME CSD-1 (latest edition).
- 3) All electrical wiring is to be done in accordance with the latest editions of: ANSI/NFPA 70 National Electrical Code.

2. Boilers (400MBH and Larger Gross Heating Capacity)

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This boiler must meet the performance specification of Lochinvar Copper-Fin II series boiler or Laars Pennant series boiler, or approved equal.

a. General:

- 1) The hydronic heating boiler shall be an atmospheric, copper fin heat exchanger, multi-staged (if applicable) natural gas fired boiler. The heat exchanger must be made of high-grade copper. There must be low thermal load on the heat exchanger surface to increase lifespan and efficiency. The boiler shall be of a lightweight and compact design in order to permit easy transport to the installation location. Venting system options shall consist of a Category I natural draft chimney design or side-wall (if applicable) vent system using an external power vent motor and termination as supplied by the boiler manufacturer. Both venting systems shall utilize Type B venting materials. Control packages shall come pre-wired for direct connection to the boiler ignition system.

b. Construction:

- 1) The water tube heat exchanger shall be a straight tube design with integral finned copper tubes. The tubes shall be rolled directly into glass-lined cast iron headers, rated for 160 psi (1103 kPa) working pressure. The heat exchanger shall be a low water volume design. All gaskets shall be non-metallic, outside the jacket, and separated from the combustion chamber to eliminate deterioration from heat. Headers shall have covers permitting visual inspection and cleaning of all internal surfaces. The heat exchanger shall have a ten year warranty.
- 2) The piping side header shall have removable flanges, and the boiler design shall permit removal of the complete heat exchanger for service from either the front or top, to facilitate maintenance.
- 3) The units shall use a proved hot surface ignition with a 15 second pre-purge cycle to clean out the combustion chamber. Upon a call for heat, if a flame is not detected, the ignition module shall lock-out and shall require manual reset. If there is a loss of flame signal during a call for heat, the ignition control shall attempt one re-ignition cycle before locking out. The control circuit shall be 24V. Unit shall be 120V, single phase, less than 12 Amps.
- 4) Burners shall be multi-port design, and shall be constructed of high temperature stainless steel. The burners shall be designed to mix air and gas, and burn cleanly with NO_x emissions not exceeding 10ppm. Burners shall be in easily-removable burner tray assemblies with no more than 4 burners per tray.

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- 5) The combustion chamber shall be lined with lightweight, ceramic fiberboard insulation to retain heat, and shall be approved for service temperatures of not less than 2000°F (1093°C). The outer jacket shall be a unitized shell finished with acrylic thermo-set paint baked at not less than 325°F (163°C). The frame shall be constructed of galvanized steel for strength and protection. Chamber shall include a sight glass for viewing flame.
- 6) Boilers shall have a forced draft design and shall meet a minimum 85% to 86% steady state combustion efficiency. The unit shall be designed for vertical venting with standard B-vent as a fan-assisted Category I appliance and for horizontal venting as a Category III appliance (if applicable) and shall not require an external draft hood. The unit shall accept ducted combustion air, or shall be able to pull combustion air from the boiler room. Vent and ducted combustion air shall each be able to be piped to either the top or the back of the unit, in any combination. Changing from top-to-back or from back-to-top piping orientation shall be easily accomplished in the field.
- 7) Units shall be multi-stage firing with multiple gas trains as required based on needed output. Each gas train shall have a gas shutoff valve and main gas valve with built-in redundant valve seats and gas regulator. Unions shall be used before and after each main gas valve, to permit easy removal of the each gas valve, gas train and burner tray assembly from the front of the unit.
- 8) Units shall come complete with a volute-mounted secondary flow pump sized to provide the correct heater flow rate for the heater and 30 feet of full-sized piping. Each unit shall have a pump time delay. The pump time delay shall be adjustable from 20 seconds to 10 minutes for continued pump circulation after the call for heat has been satisfied, to remove residual heat from the unit's combustion chamber.
- 9) The boiler shall be provided with an integral, washable combustion air filter. The air filter shall provide 83% arrestance to protect the burners and blower(s) from debris. The air filter shall be constructed out of open-cell polyurethane foam.
- 10) Boiler shall include as standard equipment the following controls and trim:
 - ASME 160 psi working pressure heat exchanger
 - ASME "H" stamp
 - Flanged water connections
 - Glass-lined cast iron headers
 - External header gaskets
 - 75 psi (517 kPa) ASME rated pressure relief valve

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- Flow switch
- Temperature and pressure gauge
- Multiple operating gas valve/pressure regulators
- Manual "A" gas valve
- Intake air filter
- Multiple, removable burner trays
- Stainless steel burners
- Built-in draft fan(s) for Category I or III venting
- Air pressure switch
- Burner site glass
- 24V control system
- 115/24VAC 75VA power from class 2 transformer
- Manual reset high limit
- Automatic reset high limit
- Electronic PID staging control with LCD and touchpad
- PC board for electrical connections
- External controller connections with selector switch
- Hot surface ignition
- On/Off toggle switch
- Pump time delay
- Diagnostic lights

11) This contractor must obtain a comprehensive wiring schematic from the boiler manufacture or manufacture's representative before any boiler plant wiring is started.

12) Boiler(s) shall be started up in accordance with manufacturer's checklist by factory-trained start up contractor. Start up shall include control panel programming. A copy of the final list of control settings shall be provided to the installing contractor.

c. Boiler Certifications:

1) The unit(s) shall be design certified to comply with the current edition of the Harmonized ANSI Z21.13 / CSA 4.9 Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers, and shall be design certified for both indoor and outdoor use. The unit(s) shall be designed and constructed in accordance with the ASME Boiler & Pressure Vessel Code, Section IV requirements for 160 psi (1103 kPa) working pressure, and shall bear the ASME "H" Stamp. The unit(s) shall be constructed to comply with the efficiency requirements of the latest edition of ASHRAE Standard 90.1 The standard unit shall meet the requirements of the latest edition of the ASME CSD-1 (Controls and Safety Devices for Automatically Fired Boilers) Standard.

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d. Heating/Boiler Controller (For Use with Laars or Lochinvar Boilers Only)

1) Hydronic Heating System: - Multiple Dwelling Systems

- a) Provide a heating system/boiler A Tekmar model# 274 or approved equal controller. Unit shall monitor and control up to four boiler on/off stages, hydronic heating pump sequencing and indirect domestic hot water (DHW) production with separate zone pump.
- b) This control panel shall be wired and programmed to be the system lead controller with the factory installed boiler mounted controller acting as a slave controller.

The lead controller shall:

- monitor outdoor temperatures
- adjust boiler output water temperatures based on indoor and outdoor temperatures (Outdoor Reset)
- stage boiler burners based on required demand load
- operate night time setback
- sequence main system pumps
- monitor and control domestic hot water production with separate zone pump
- operate boiler room combustion air damper
- monitor indoor temperature sensors placed throughout building (if required in Scope of Work)

The factory installed boiler mounted slave controller shall:

- monitor water flow with in boiler and operate secondary pump
- control blower purge functions
- control ignition of burners
- monitor low water cutoff
- operate main gas valve(s)
- monitor high and low limits
- monitor all boiler safety features

- c) The building heating control system shall vary the supply water temperature to the heating system proportionately with changes in outside temperatures (Outdoor Reset). An outdoor sensing element shall continuously adjust the boiler supply water temperatures in accordance with outside temperatures.

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- d) Outdoor sensing devices shall be located where recommended by manufacturer of the heating control system except that equipment required heating control system should not be installed within apartments, public halls or entrances. Devices shall be a type that is sensitive to changes in the outdoor dry bulb temperature. This sensor must be extending a minimum of 12 inches away from building structure, mounted out of direct sunlight (solar radiation) and installed a minimum of 10 feet above grade to avoid false readings. Outdoor sensing devices shall be mounted to be inconspicuous and not mar the appearance of the buildings. Wiring to outdoor devices shall be run in metal conduit, and must be concealed. Sensors and/or mounting conduits can only be located in rear or side courtyards, units cannot be located at any street facade. Tekmar Control Systems, model# 070 or approved equal.

- e) Provide a night time setback timer panel for automatic operation of the control system with the following features:
 - 1. Automatic heat up in the morning by setting the maximum temperature of the hot water supply from boilers for a period of time depending on the outside temperature, and as determined by the control system manufacturer.

 - 2. Automatic daytime (6:00am to 10:00pm) operation of the heat-up period shall be achieved by turning the controls to automatic to maintain proper daytime temperatures. System shall provide indoor heating temperature of 68deg. and higher if outside temperature below 55deg.

 - 3. Automatic night time (10:00pm to 6:00am) setback operation heating system shall maintain an indoor heating temperature of 55deg. and higher if outside temperature is below 40deg.

- f) This Contractor shall provide for all power wiring and conduits from boiler room breaker panel, any device and wiring required for the heating control system, all relays, transformers, fuses, switches, connections, etc. required for complete operation of heating system. Main boiler room breaker panel shall be provided by electrical contractor.

- g) Start-up programming for control panel must conform all buildings parameters such as type of heating elements (Fin-Tube Convactor), boiler mass, outdoor and indoor temperature settings, Warm Weather Shut Down (WWSD) setting, etc.

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- h) Provide for boiler start up in accordance with manufacturer's checklist; boiler start-up must be performed by a factory-trained and certified start-up contractor. Start-up shall include control panel programming. A complete copy of the final list of control panel settings shall be provided by the installing contractor. A documented sign-off shall be provided by this contractor indicating that the boiler has been set-up, installed, wired, programmed and started in compliance with the manufacture's guidelines and building parameters.
- i) If indicated on the drawings and/or in the Scope of Work, this panel shall be provided with indoor temperature monitoring devices/sensors positioned throughout building where indicated on drawings. Sensors shall be wired to an average temperature panel prior to connections to main control panel. Tekmar Control Systems, model# 077 or approved equal
- j) Heating system/boiler main controller shall be as manufactured by Tekmar Control Systems, model# 274 or approved equal.

B. Indirect-Fired Domestic Hot Water Heating

NOTE: Domestic indirect water heating shall be accomplished by circulating boiler water through a copper tube transfer coil which is mounted internally within a water heater storage tank.

1. The DHW tank shall have a storage capacity as indicated on drawings.
2. The tank shall be suitable for domestic hot water production in combination with the building hot water hydronic heating system.
3. Tank operating conditions - maximum operating pressure 150 psig at 150°F (65.6°C)
4. Heat exchanger coil operating conditions - maximum hot water operating pressure 150 psig at 230°F (110°C)
5. Each hot water storage tank shall have a corrosion protected steel tank shell with two coat enamel finish. A magnesium or Aluminum anode rod shall provide additional cathodic tank protection.
6. The 1" or 1¼" (32mm) diameter internal tubular heat exchanger shall be designed with a large surface coil area in the lower portion of the tank to allow rapid and uniform heating of the water in the tank with a low pressure drop through the heat exchanger coil. The coil shall be designed so as to be both self-draining and self-venting, be non-finned with space between passes, and be tapered to allow full

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output from all passes of the coil.

7. The tank shall be equipped with a sensor well.
 8. Tank enclosure panels shall encase the tank with wrap-around foam insulation (HCFC-free). Brass NPT adaptors, for attachment of each threaded nipple to boiler water or domestic water piping, shall be factory supplied.
 9. Each tank shall have a front-mounted inspection / clean-out port, and be equipped with a thermometer registering tank water temperature.
 10. Four leveling feet shall be provided on the tank base to allow for easy adjustment.
 11. For applications requiring larger quantities of hot water, multiple vertical tanks shall be capable of combining via headers to form tank batteries.
 12. All water connections shall be accessible once the tank is installed, for ease of service.
 13. A 3/4" pressure and temperature relief valve shall be factory supplied and field installed to meet local U.S. codes. The maximum pressure relief setting shall be 150psi at 210°F (99°C).
 14. Thermal expansion tank shall include as standard equipment the following controls and trim:
 - A circulation pump, with bronze casing, between boiler and hot water tank.
 - Inlet, outlet and storage tank thermometers.
 - Temperature and pressure relief valves. Approved manufacturers include Wilkins, Watts or Taco.
 - High limit and operating aquastat (Immersion Type), Honeywell-Model #L4006 and L6006 or approved equals, set to 140deg. F.
 - All piping and fittings between tank and boiler shall be type "L" copper tubing or brass.
 - Thermal Expansion Tank, Amtrol Therm-X-Trol Series or approved equal.
 15. An all bronze temperature regulating valve (domestic hot water mixing valve) shall be provided on the outlet from the storage tank. Unit as manufactured by Holby Valve Company or HPD approved equal.
 16. Approved manufacturers include Viessmann Vitocell-V100, Lochinvar EGS Series, or HPD approved equal.
- C. Thermal Expansion Tank for Building Heating System:

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1. Provide expansion tanks of size and arrangement, in accordance with details on the drawings.
 2. Tanks shall be fabricated of steel with welded construction. Tanks shall be built in accordance with the ASME Code for Unfired Pressure Vessels, and shall be designed for the same working and test pressures as the boilers, and shall bear the ASME label.
 3. Tanks shall be provided with all necessary tapping, including vent, drain, and gauge glass. Provide each with a shut off valve, and drain and vessel valves and other accessories in accordance with the details on the Drawings.
 4. Expansion tanks may be suspended from the ceiling.
 5. Tanks shall be pre-pressurized diaphragm type and suitable for a maximum working pressure of 125 psi with an ASME stamp. They shall have a sealed-in elastomer diaphragm suitable an operating temperature of 240 F.
 6. Expansion tanks may be floor mounted on saddles furnished with units as required by the sizes specified or required.
 7. Expansion tanks shall be covered with 1-inch thick fiber glass insulation, having density of not less than 6 pounds per cubic foot, cut and mitered to fit curvature of the tank, and form a smooth exterior surface. The insulation shall be securely fastened with welded pins and washer, or copper plated steel wire. After all insulation is in place, the entire surface shall be given a brush coat of lagging adhesive and 6 ounce canvas embedded in the wet coating, smoother and overlapping at least 4 inches at all canvas seams. The entire canvas surface shall then be finished with a brush coat of the same material.
 8. All diaphragm tanks shall have high capacity air eliminator installed before tank.
 9. Expansion tank shall be as manufactured by Taco Inc., "PAX" series, Amtrol-Therm-X-Trol series, Arrow Industries BackStop series or approved equal.
- D. Hydronic Distribution Hot Water Circulating Pumps:
1. Provide single stage, end section inline type hot water circulating pumps and accessories as specified or as described on the drawings. Two pumps shall be provided; one to be primary pump and one to be stand-by pump (see drawings for sizes). A pump sequencer shall be provided to alternate between primary and stand-by pumps.

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2. Pumps shall be single stage, cast iron housing. Impeller shall be cast bronze ASTM B584 dynamically balanced enclosed centrifugal type. Shaft shall be steel SAE 1144. Pumps shall be designed for working pressures.
3. Pump bearing housing assembly shall have heavy-duty greased ball bearings, replaceable without disturbing piping connections and have foot support at end.
4. Motor shall meet NEMA premium specifications and shall be of size and voltage called for on plans pump and motor shall be factory aligned, and shall be realigned after installation by contractor. Each unit shall be checked by contractor and regulated for proper differential pressure voltage and amperage draw.
5. See drawings for pump sizes and type.
6. Approved manufactures include Taco, Federal, Bell And Gosset And Alyan.

E. Boiler Breeching

1. Gas system - Breeching and connectors shall be constructed of No. 20 gauge galvanized steel. The joints connections shall be made with #10x1/2" sheet metal screws on 4" centers. Breeching shall be hung from the ceiling beams with galvanized straps at not more than 6-foot intervals.
2. Draft hood supplied is to be A.G.A. Certified Design.(Gas system)
3. The contractor shall breach the new boiler to new exterior or interior venting system as indicated on drawings The breeching shall be supported on approved type hangers at every change of direction. This contractor to be responsible for all necessary adjustments and changes to the vent system and breeching to meet Bureau of Environmental Compliance requirements. The breeching shall conform to Building Code.
4. Provide spill switch with automatic reset on draft hood.(Gas system)
5. Breeching shall have a positive pitch of no less than 1/2 " per foot.

F. Distribution System Piping

1. Distribution system piping shall include supply and return mains, risers, and all branch work to and from heating elements.
2. Pipe Schedule
 - a. Hydronic system - Type "M" copper tubing and fittings.

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- b. Fresh water make-up/domestic - type "L" copper tubing and fittings.
 - c. All copper piping must comply with ASTM B88 requirements.
3. Pipe Connections
- a. All tubing and fittings shall be soldered using 95-5 Tin Antimony Solder
 - b. All tube ends shall be reamed and all burrs removed before being joined to fittings.
 - c. All solder connections must comply with ASTM B32 requirements.
4. Pipe Installation
- a. All pipe delivered to the job for use under these specifications shall be of mill random lengths and shall be installed as continuous tubes. Piping built up of short lengths shall not be used, but short lengths of pipe may be used as filler-pieces where structural conditions interfere.
 - b. Approved flanges (screwed or welded) shall be installed at apparatus and appurtenances and wherever else required to permit easy connection and disconnection. Screwed unions with steel faces can be used on piping one inch or less.
 - c. Piping connections to equipment shall be made with offset provided with screwed or welded bolted flanges so arranged that the equipment can be serviced or removed without dismantling the piping.
 - d. Pitch water piping in direction of flow to insure adequate flow without air binding and to prevent noise and water hammer. Branch connections to mains are to be made in such a manner as to prevent air trapping and permit free passage of air. To meet job conditions mains shall be set up to maintain headroom and clear other trades.
5. Hydronic Supply and Return Mains
- a. Mains shall be pitched not less than 1 inch in 40 feet in direction of flow.
 - b. Where mains are reduced in size, eccentric reducing couplings shall be used with pipe flush at the top.
 - c. Run-outs to heating risers shall be taken off top of the main and shall pitch 1 inch in 4 feet.
 - d. All high points shall be vented.

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- e. Supply and return mains shall be installed a minimum of (4) feet away from outside walls.
 - f. Supply and return mains shall be graded and vented to ensure adequate venting and drainage.
 - g. Where hot water lines are reduced in size, eccentric reducing couplings or fittings shall be used with pipes flush on the top. Bushings are not acceptable.
 - h. Automatic air vents of the float operated type shall be provided at all points where rises and drops in elevation create pockets where air may become entrapped and at all other points as required.
 - i. At the base of each supply and return riser, at all low points of supply and return mains, and at all other point required, a bronze 150 psi service 3/4 inch hose end valve and gate valve shall be provided. Hose end threads shall be standard hose threads.
 - j. Test tees shall be provided in supply and return mains where required to permit testing of separate circuits.
6. Convector/Baseboard Connections to Risers
- a. Radiator run-outs shall be of size shown on the schedule on the Drawings. No run-outs shall be less than 3/4 inch.
 - b. All Supply run-outs shall be pitched downward toward the riser with a pitch of 1 inch in 4 feet of run, return connections from radiator traps to risers shall be pitched not less than 1/8 inch to the foot. Run-outs over 8 feet long shall be not less than 1 inch.
 - c. All hot water run-outs shall be pitched a minimum amount as required to ensure adequate venting through heating element.
7. Expansion of Pipes
- a. All piping within the buildings shall be installed so as to avoid serious strain or distortion from expansion and contraction. In all cases, expansion and contraction shall be provided for by mean of swing joints, bends or offsets of proper length.
 - b. Expansion of underground pipes shall be compensated for by means of anchors and expansion loops. Expansion loops shall be of ample size so

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as not to cause fatigue of piping. Expansion loops in underground piping in conduit shall be not less than the conduit manufacturer's standards.

- c. Expansion joints for risers shall be installed 18" above the floor and in accordance with the manufacturer's instruction.
- d. Expansion loops shall be provided on all horizontal and vertical hot water piping with a straight run of 50 linear feet or more.
- e. See detail sheet.

8. Pipe Welding

- a. Welded joints for steel pipe shall be of the open V-type; following approved welding procedures for metallic arc or oxyacetylene carbon steel welded pipe joints. Pipe shall be mill-beveled or machine beveled by this trade. All scale and oxide must be removed with hammer, chisel or file and the bevel left smooth and clean.
- b. Weld metal shall be thoroughly fused with base metal at all sections of weld and penetration of weld shall include unbeveled portion and shall extend to inside wall of pipe.
- c. With the exception of pipe welded end-to-end, all welded joints shall be made with the use of one welding neck flanges, weld-o-lets, nozzles, elbows, tees, etc., as manufactured by Tube-Turn, Grinnell Ladish, Taylor-Forge, or as approved.

9. Protection of Piping

- a. All concealed copper piping and tubing must be protected with shield plates as required under NYC Mechanical Code section 305.5.

G. Hangers and Support:

- 1. All piping shall be rigidly supported from the building structure by approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place, and shall be arranged to provide for expansion and contraction of piping.
- 2. Hangers for horizontal piping shall be of the adjustable "Clevis" type or Trapeze type. Hanger rods shall have machine threads, and shall be furnished with two (2) nuts at each end. Trapeze hangers shall be made up of angles, or channels with two or more suspension rods.

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3. The spacing of the hangers for piping shall prevent sagging, and be not greater than the following:

Horizontal Piping:

- a. Copper tubing 1 ¼" and smaller - 6 feet on center.
- b. Copper tubing 1 ½" and larger - 10 feet on center.
- c. Steel or brass pipe 1 ¼" and larger - 10 feet on center.
- d. Steel or brass pipe smaller than 1 ¼ inches - 7 feet on center

Vertical Piping:

- a. At each floor.
4. Rod size for Clevis or Trapeze hangers for nominal pipe size shall be as follows:
- a. 3/8" rods for 3/4" to 2" pipe
 - b. 1/2" rods for 2 1/2" to 3" pipe
 - c. 5/8" rods for 4" to 5" pipe
5. Hangers, anchors and supports shall be black iron or black steel and must meet Federal Specifications WW-H-171b.
6. Pipe supports shall be as manufactured by F&S, F&M, Grinnell, or as approved equal.

H. Valves

- 1. Furnish and install valves specified herein and/or necessary for the control and easy maintenance of piping and equipment. Valves shall be first quality of approved manufacturer; shall have proper clearances, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or shall be provided with other means of easy identification. Valves shall be the product of one manufacturer except for special applications. Valves shall be Jenkins, Hammond, Lunkenheimer, Walworth, Crane, or approved equal. Where figure numbers of one manufacturer are stated, equivalent figure numbers can be substituted.
- 2. Valves shall be of minimum working pressure and materials as fitting specified for the service, except as herein modified. All gate and globe valves shall be

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suitable for packing under pressure. Regardless of service, valves shall not be designed for less than 125 pounds per square inch steam working pressure.

3. Globe and angle valves shall have renewable seats and discs of an approved metal-to metal combination.
4. Check valves shall be horizontal swing type with ground seat and renewable or regrinding disc. Spring loaded silent check valves shall be double center guided spring loaded type with brass body, stainless steel spring and bronze seat ring and disc 4 inches or larger. Check valves shall be 125 lb class.
5. All valves of each type shall be of the same manufacturer.
6. All valves shall be tagged with 1 1/2 inch octagonal #18 B & SG brass tags properly marked and fastened to the valves with the brass "S" hooks on NO.8 gauge wire, and attached to the valve spindle. Each valve tag shall indicate the normal operating position, by "N.O." or "N.C." and the valve number of its respective valve. Provide two (2) framed valve charts.
7. Each hydronic convector/baseboard shall be provided with a slotted stem shut-off and balancing valve; all brass unit - Hammond model # 8211-15 or approved equal. Each convector/baseboard assembly shall be provided with a capped 3/4" drain-cock, Hammond-model # 710. All hand wheels must be removed. See detail sheet.
8. The base of each hydronic riser shall be provided with a combination shut-off and balancing valve; all brass unit-Hammond model # 8201 or approved equal. See detail sheet.
9. The top of each hydronic return riser shall be provided with a capped 3/4 inch drain-cock - Hammond model #710 or approved equal. See detail sheet.

I. Pipe Insulation

1. Insulate all pipes, fittings, valves including dry returns, elbow and tees with heavy density fiberglass insulation with vapor retarder jacket composed of aluminum foil in the boiler room and full basement area.
2. Material to meet ASTM C547 Class 1 & 2, and fire safety requirements ASTM E84, UL 723.
3. Sizes for insulation as follows:
 - Supply and return piping of 3/4" diameter and larger shall be provided with 2" thick insulation.
 - All risers with in partitions to be insulated with 1 1/2" thick insulation

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4. Coverings shall be banded at a minimum 18" on centers, as manufactured by Owens-Corning, Johns Manville or approved equal. Insulation shall have UL listing certificate.
5. The only time insulation of less than 2" shall be allowed is if there is no significant clearance to get the insulation around the pipe; in such situations, no insulation less than 1" shall be deemed acceptable.

J. Hydronic Heating System Air Vents

1. The top of each return riser shall be provided with an automatic air vent; all non-ferrous unit-bell and Gossett model 87 or approved equal. See detail sheet.

K. Apartment Baseboard Type Radiators (Hydronic system)

1. Baseboard to be installed where indicated on plans of same rating as indicated. Contractor shall be responsible for routing changes.
2. Baseboard units shall be furnished with slope-top front panel, heating element and required mounting components and accessories.
3. Complete two-piece enclosure assembly shall consist of a full back panel with interlocking slop top front panel, factory packaged with necessary brackets. Front panel shall have permanently open sloped louvers.
4. Front cover shall be fabricated from 16-gauge steel, back panel from 20-gauge steel. The front panels and accessories shall be finished in baked enamel Beige color.
5. Bracket with element guide shall be spot welded or screwed to back panel every 24 inches alternating with cabinet spacer welded to back panel every 24 inches giving rigid support to front every 12 inches.
6. Front panel shall be fastened to brackets using #8 self-tapping screws with countersunk head.
7. Provide all required accessories for a complete installation, including end cap, inside and outside corners, filler sleeve, splice plate and hinged valve doors. Cover accessories shall be telescopic to eliminate the need to perfectly butt one length to cover the next.
8. Provide H-1 heating element consisting of ¾" nominal copper tubing, with 3" x 3 1/4" x .020" aluminum fins (minimum), spaced at 48 per linear foot. The tubing shall not be weakened by expansion in process of manufacture but shall be forced through undersized fin holes to obtain a force fit mechanical bond. A flange with four teeth shall be formed on each fin to increase thermal contact and to space and

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lock the fins uniformly in place. One end of each element tube shall be expanded to receive the unexpanded end of another, without coupling.

9. Enclosures shall be continuous, wall-to-wall (except bathroom and kitchens), unless otherwise indicated on drawings. In general, radiator run-outs will be concealed in enclosures.
 10. Copper element shall be rated at 800 BTU (min.) per linear foot when supplied with 190 F average hot water temperature and a flow of 1GPM.
 11. Elements that do not provide the rating indicated above, shall have their lengths adjusted in direct proportion to the increased or decreased linear foot rating, so that the designed total capacity is achieved. Increased lengths of elements must fit in the space designated.
 12. Enclosure and elements must be a product of the same manufacturer, with ratings certified by the IBR Code for Testing and Rating of Finned Tube Radiation Convectors.
 13. Unit shall be HD 850 Series as manufactured by Slant Fin Corp.
 14. Approved manufactures include Rosemex (RB-10 Series), Embassy Industries, Argo Industries.
- L. Convectors (If required, see drawings)
1. Convectors for living rooms or dining rooms shall be free-standing cabinet type construction of not less than 18 gauge steel for top and front, and 20 gauge back and sides. Top air outlet louver shall be venetian type and arched air inlet at bottom face of front panel. As manufactured by Beacon/Morris model FSG-A or approved equal.
 2. Convectors for kitchens, bedrooms and bathrooms shall be semi-recessed type construction of not less than 18 gauge steel for wrap around front, and 20 gauge for recessed liner. Front cabinet depth from wall shall be 2¼". Top air outlet louver shall be venetian type and arched air inlet at bottom face of front panel. As manufactured by Beacon/Morris model SRG-A or approved equal.
 3. Convectors in public halls and commercial spaces shall be free-standing cabinet type construction of not less than 18 gauge steel for top and front, and 20 gauge back and sides. Top air outlet louver shall be sloped venetian type and arched air inlet at bottom face of front panel. As manufactured by Beacon/Morris model SFG-A or approved equal.
 4. Heating element shall be non-ferrous consisting of 5/8" diameter copper tubing and .010 thick aluminum plate fins. Fins shall be protected front and back by

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formed shield plates running entire length of element. Header shall be cast brass with bottom threaded piping connections.

5. All cabinets shall be factory primed and after installation painted as directed by Architect/Engineer.
6. All cabinet length, height and depth dimensions must be provided as required by field conditions and Architect/Engineer approval. If below windows, cabinet height cannot exceed windowsill. Cabinets cannot obstruct door swings.
7. See drawing schedule for dimensions and output of convectors.

M. Thermometers and Pressure Gauges

1. Furnish and install pipe thermometers with separable sockets in the following locations (this applies to all systems described in the Specification):
 - a. In and out of domestic water heat exchanger coils/tanks.
 - b. Boiler supply and return headers
2. Thermometers shall be as manufactured by Weksler, Moeller, or Weiss, and shall be minimum 4 1/2 inch dial type, flange-less case.
3. Pipe insertion dial thermometers shall have separable sockets of material suitable for each given installation. Sockets for insulated lines shall have 2 1/2 inch extension decks.
4. Pressure gauges shall have 4 1/2 inch diameter dials, cast aluminum range as required, and shall be similar to gauges as manufactured by Weksler, Weiss, Crosley, Ashcroft, or approved. Shut-off cock shall be provided between each gauge and piping to permit removing gauge while system is under pressure.

N. Building Ventilation Systems

1. Roof Exhaust Ventilators
 - a. Roof ventilators shall be standard centrifugal type, with direct drive impellers.
 - b. Housing shall be of aluminum, rigidly braced with heavy angle supports.
 - c. Fan motor, drive and bearings shall be mounted above the fan wheel in a compartment isolating these components from the air handled by the fan.

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- d. Fan wheels shall be of the backward inclined centrifugal type, all welded construction, having blades not less than 12 gauge and wheel plates not less than 10 gauge.
- e. Fans shall have aluminum wire mesh bird screens.
- f. All motors shall be non-overloading throughout their entire range of operation.
- g. All motors shall be rated at 1750 RPM unless otherwise indicated. All motors shall meet NEMA Premium Grade specifications. If motor horsepower is 1.0 or greater, motor shall meet NEMA Premium specifications.
- h. All motors shall be of the proper type for the purpose intended and must have sufficient torque to start and run the equipment to which they are connected. Starting current or running current shall not exceed the limits imposed by the Code or the Local Utility Company. All motors shall have sufficient HP capacity and rated duty so as to operate the apparatus to which they are connected and to give the speeds and performance specified, but shall not be less than the HP's specified.
- i. Each motor shall be equipped with a conduit of ample size and with a removable cover to permit easy access to internal conditions.
- j. Each fan shall be installed on a prefabricated roof curb. Curb shall be sound attenuating type with an all aluminum back draft damper.
- k. Provide a separate timer for each ventilator.
 - 1) Bathrooms ventilators to operate continuously from 6:00 a.m. to 12:00 midnight.
 - 2) Kitchens ventilators to operate continuously 24 hours daily.
 - 3) Timers shall have NEMA 1 enclosure with lock, and ampere rating of contacts shall exceed connected load by 20%, as manufactured by Tork or approved equal.
- l. All electrical starting and controlling devices with approved supports shall be furnished under this contract, but will be installed and connected under the electrical contract, unless otherwise specified.
- m. As manufactured by Penn Ventilator Company, "Domex" Series, or approved equal.

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2. Kitchen and Bathroom Exhaust Duct Work
 - a. All ducts for ventilation of interior bathroom and kitchen areas shall be of galvanized steel.
 - b. The following schedule shall be used for all ductwork in accordance with ASHRAE Standards and Building Code Requirements:
 - 1) All bathrooms:
 - # 26 gauge for ducts up 11" on widest side.
 - # 24 gauge for ducts 12" to 30" on widest side.
 - # 22 gauge for ducts 31" to 60" on widest side.
 - 2) All kitchen ductwork shall be 18 gauge. (Minimum)
 - c. All galvanized ductwork shall be made up with all four sides of the same gauge metal.
 - d. The hangers for all ducts shall be of strap iron, anchored securely to the floor construction and spaced not more than 10 feet apart along the ducts. Seal all joints between masonry and ductwork so that they are airtight.
 - e. Where galvanized ductwork is provided, all collars or ductwork leading to each register shall have adequate frame to secure register face with "PK" Screws.
 - f. Provide access doors in duct work where required for access to fire dampers.
 - g. Inside of exhaust shafts of all interior bathroom and kitchen exhausts shall be lined with 1" thick moisture-proof rigid fiberglass between last top outlet and roof. Sizes indicated on drawings are "net." Approved sound traps may be utilized in lieu of fiberglass liner.
3. Constant Airflow Regulators, Fire Dampers and Registers
 - a. Constant Airflow Regulator (CAR) (If Applicable, See Drawings):
 - 1) Each kitchen and bathroom, requiring mechanical ventilation, shall be provided with a constant airflow regulator assembly with built in 1.5 hour fire damper and register.
 - 2) The Constant Airflow Regulator is a modulating orifice that automatically regulates airflows in duct systems to constant levels. The passive control element responds to duct pressure, and requires no electric or pneumatic sensors or controls.

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- 3) The active control element of the CAR is a flexible bulb, which inflates and deflates in response to the static pressure difference across the control. This operation regulates the free-area opening through the control, resulting in maintenance of velocity and specific airflow set points. Each CAR is designed and produced for control of air in temperatures ranging from -25° to 140° F (-32° to 60° C.)
- 4) Construction: The round CAR regulating element is mounted in a heavy gauge galvanized steel sleeve designed to accommodate installation of 1.5 hour Dynamic type UL fire dampers, as well as standard aluminum or steel louvered return air grilles. Each sleeve is welded to prevent leakage. The assembly shall be sized to fit inside standard duct riser openings and chases. Each sleeve shall be designed to specifically accommodate the control element, and prevent unwanted air leakage.
- 5) Unit as manufactured by American Aldes Ventilation Company, model# CAR-FE or approved equal. Unit must have UL and N.Y.C M.E.A. approval numbers.

b. Fire Damper:

- 1) Areas (other than kitchens and bathrooms, see above) shall be provided with fire dampers at all penetrations of rated wall or floors. Fire dampers must be installed within six (6) inches of face registers for removal. If branch work from main duct is required, the damper will be provided near the register and duct fire stopping/fireproofing will extend to the fire damper. See specifications sections 9B.04C and 9B.05E for fire stopping information.
- 2) Unit to be supplied with 165 degree F. fusible link.
- 3) Unit to have 1.5 hour Dynamic type UL fire damper label per UL standard 555, and meet all NFPA requirements for primary fire dampers.
- 4) As manufactured by Ruskin Manufacturing Company, model DIBD2 style B or approved equal.

c. Registers:

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- 1) Registers to be secured and arranged to finish flush with plaster, drywall or other finished walls unless otherwise shown or directed. Registers shall be opposed blade damper.
 - 2) Registers shall be metal and delivered with one prime coat of paint.
 - 3) Where required provide collars at supply and exhaust wall openings for fastening of registers.
 - 4) Frame to be four (4) 7/8" x 20 gauge galvanized steel channels; blades shall be curtain type 24 gauge galvanized steel.
4. Boiler Room Fresh Air Louver
- a. Provision must be made to supply sufficient air to the boiler room at all times for combustion, ventilation, operation of the barometric draft regulator (where used), and prevention of less than atmospheric air pressure in the boiler room as required under Fuel Gas Code section 304.
 - b. Stationary Type (See drawings if required)
 - 1) All stationary fresh air louvers shall be permanently open type and vented directly to outside air.
 - 2) Entire louver construction shall be extruded aluminum with "J" blades at 45-degree angle on approximately 5" centers and a flatten aluminum 3/4" square mesh bird screen.
 - 3) Unit as manufactured by Ruskin model# ELF811 or approved equal.
 - c. Motorized Type (See drawings if required)
 - 1) All motorized fresh air louvers vented directly to outside air.
 - 2) The electrically motorized damper/louver shall open when energized, spring return close when de-energized and provided with an end switch and wiring to prove louver is fully open before boiler operation begins.
 - 3) Unit shall be able to mount horizontal or vertically.
 - 4) Unit shall be constructed with a galvanized steel or aluminum frame, aluminum blades and a flatten aluminum 3/4" square mesh bird screen.

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- 5) Unit to be provided with an appropriately sized field installed 120V motor pack(s), relays, wiring to control panel, all brackets, etc. for complete operation.
- 6) Units as manufactured by Greenheck WD-200 series, United Enertech model LBD-4I or approved equal.

5. Laundry Dryer Exhaust System

- a. Each dryer shall be provided with individual 4" diameter exhaust vent run up to roof level or as indicated on drawings.
- b. An Inline Dryer Booster fan must be provided on all applications when the dryer exhaust duct exceeds 20 linear feet from dryer to final duct discharge. Unit shall automatically activate the fan, via a pressure switch, when the dryer comes on and stay on until dryer cycle is completed. In all installations there needs to be at least 15 linear feet of duct between booster fan and the dryer. Unit as manufactured by Fantech #DBF110 or HPD approved equal.
- c. Unit shall be positioned at recommended by manufacture and be located a minimum of 15 linear feet downstream from dryer.
- d. A secondary dryer lint trap shall be installed when the 15 linear feet of duct between booster fan and the dryer can not be provided. The lint trap must be installed on the vertical dryer duct just above the dryer so it is easily accessible to the dryer user. Unit as manufactured by Fantech #DBLT4 or HPD approved equal.
- e. All ducts for laundry dryers shall be 26gauge galvanized steel.
- f. Booster fan shall be located with in drop ceiling area of apartment where dryer is located and must be provided with a 12"x12" access panel for servicing.
- g. System shall comply with requirements of Fuel Gas Code section 614.

O. Excavation and Backfill

1. Perform all excavation, backfilling and sheathing required for installation of all work described herein. Backfilling shall be carefully done and thoroughly compacted. For excavation below 8'-0", fill shall be made in layers not more than one (1) foot deep and each layer tamped. All piping shall be thoroughly insulated and properly pitched.

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P. Cutting and Patching

1. When access to the heating system is required and requested in the Scope of Work, this Contractor shall be responsible for all cutting and patching of existing ceilings, walls and floors in apartments and basement/cellar areas. This Contractor shall furnish all labor, materials, tools and equipment to perform all patching as follows:
 - a. Plaster walls and ceilings:
 - 1) All existing plaster to be cut back to a plumb line and new work erected flush with same.
 - 2) All new work to be installed over metal lath and to be three coat operation consisting of scratch, brown and hard white finish.
 - 3) New plasterwork over masonry work to be two coat, consisting of brown and hard white finish not less than 1/2" thick.
 - b. Drywall Construction:
 - 1) All existing gypsum to be cut back to a plumb line and new work erected flush with the same.
 - 2) All new gypsum board shall be screw fastened with 1 1/4" self-tapping drywall screws.
 - 3) Joints shall receive a scratch coat with tape reinforcement, followed by two finish coats of joint compound. Compound to be manufactured U.S. Gypsum Company or equal.
 - 4) Water resistant gypsum wallboard to be used at bathrooms, kitchens and all locations considered "wet areas."
2. All finished areas shall be sanded flush with existing surfaces as to where no joints can be detected. Entire area shall be primed and considered paint ready.
3. When penetrations through a concrete slab are required, a boring device of proper size shall be used.

Q. Fire Extinguisher(s)

1. A fire extinguisher shall be wall mounted in boiler room and be Class "B" type 20 lbs, dry chemicals. As manufactured by Ansul, Kidde or approved equal.

R. Access Doors in Finished Construction

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1. Access doors and frames shall be formed from sheet steel and shall have expanded or perforated metal wings where adjacent to plastered surfaces. The frames shall be No. 16 U.S. Standard Gauge steel sheet and the doors shall be formed from not less than No. 14 U.S. Camlock and concealed hinges. Doors and frames shall be given a shop coat of an approved rust inhibitive primer. Access doors shall be furnished by this Contractor and installed by the General Contractor.
2. Access doors shall be of the following types as manufactured by Inryco/Milco Inc., or approved equal.
3. 12" x 12" Access doors to be provided on top floors only. Provide for coordination with general contractor for placement of doors for complete access to hydronic riser vents, concealed fans, etc.

15A.14 HEATING SYSTEM TESTING

- A. Complete heating system testing and distribution balancing shall be performed with written verifications of results submitted to HPD and Architect/Engineer.
- B. All of the testing work shall be done when and as directed before the system is accepted. Place the system in operation and make all required corrections and adjustments.
- C. All piping shall be tested with water and made tight to 100 pounds before any covering is applied and being closed in or connected to the boiler.
- D. Clean interior of piping and boiler with approved compound and rust inhibitor. Flush until clean.
- E. Supply all apparatus material and labor, including hydraulic pump and any temporary connections required for making tests.
- F. Examine joints and pipe carefully for leaks or porous material and repair or replace same without resorting to caulking. Carefully note expansions and see that they are amply provided for.
- G. After system is complete, the contractor shall operate same for four hours with temporary air valves and clean system with an approved make wash out type boiler compound.
- H. Fuel for tests shall be furnished by this contractor.
- I. Arrange for and conduct performance tests in accordance with the latest Department of Air Resources criteria and shall obtain Certificate of Operations for the boiler room.

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15A.15 HEATING SYSTEM CLEANING

- A. The entire system shall be cleaned according to manufacturer specifications and upon the completion of all piping.
- B. The entire system shall be filled. All pumps shall then be operated continuously for four (4) hours with the boiler at full operating temperature. At the conclusion of this period the entire system shall be completely drained and allowed to cool and then refilled with clean fresh water prior to the final activation of the system.
- C. Thoroughly wash all iron grinding from boiler sections during boiler erection.

15A.16 START UP AND SERVICE

- A. Supervision of start up and instruction of operating personnel shall be provided for three (3) days (4 hours each). This training shall be done after completion of installation and maintenance and operating manuals shall be submitted prior to this training session.
- C. Contractor to provide a one (1) year service contract from date of permanent boiler start up.

15A.17 GUARANTEES

- A. Upon completion of all work to be performed under this Contract and acceptance of same by Architect/Engineer, this contractor shall guarantee that all workmanship and materials used in the performance of this contract, shall remain free from defects for a period of one (1) year, in addition to manufacturer's standard warranties. All guarantees to be from the date, when **Final Certificate of Occupancy** is issued from Department of Buildings. This contractor shall guarantee to repair or replace, as determined by Architect/Engineer, any defective portions of the various systems described herein the guarantee period.
- B. All boilers and DHW materials and equipment shall be warrantee for 10 years on heat exchangers and 5 years for all other parts.

15A.18 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Submit three comprehensive sets of typewritten maintenance and operating instructions for all equipment to building owner or tenant group.
- B. Give full instructions to building owner or tenant group regarding operation and maintenance of all machinery, apparatus and other work installed by Contractor including functions of all valves.

END OF SECTION