

SECTION 235239 - FIRE-TUBE BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged, factory-fabricated and assembled, gas, oil or dual fuel-fired, horizontal; scotch marine type fire-tube boilers, trim, and accessories for generating steam.

- B. Reference and Industry Standards

Enterprise Green Communities Criteria

- 1. Mandatory Requirements: See the current edition of the NYC overlay of EGC reference standard for full specifications.
 - a. NYC New Construction projects must achieve at least 60 optional points, and Substantial and Moderate Rehab projects must also achieve at least 55 optional points.
 - b. Building Performance Standard Criterion 5.1b
 - c. Sizing of Heating and Cooling Equipment 5.6
 - d. Combustion Equipment 7.3
- C. Comply with the current edition of the New York City Energy Conservation Code.
- D. Comply with the relevant HPD design guidelines section or appendix.
- E. Project will elevate new equipment above 2050's SLR-adjusted DFE or above grade if applicable for projects in flood-prone areas.
- F. <https://www.nyc.gov/site/hpd/services-and-information/sustainability.page>
- G. <https://www.nyc.gov/site/hpd/services-and-information/blds.page>

1.2 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Warranty: Special warranty specified in this Section.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. UL Compliance: Test Boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Description: Factory-fabricated, -assembled, and -tested, fire-box boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
- B. Pressure Vessel Design: Straight, steel tubes rolled or welded. Three passes with wet-back design. Minimum heat-exchanger surface of 5 sq. ft./bhp (2.1 sq. m/10 kW). Include the following features and accessories:
 - 1. Tube Thickness: 10 gauge.
 - 2. Brass washout plugs.
 - 3. Lifting lugs on top of boiler.
 - 4. Minimum NPS 1 (DN 25) hose-end drain valves at shell low point.
 - 5. Tappings or flanges for supply- and return-water piping.
 - 6. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 7. Tappings for steam supply, makeup, level controls, and chemical treatment.
- C. Combustion Chamber: Welded steel, water-leg design with refractory insulation poured in the floor. Flame observation port.
- D. Casing:
 - 1. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the boiler shell.
 - 2. Insulated removable smoke boxes and reversing chamber cover.
 - 3. Flue Connection: Steel top or rear.
 - 4. Jacket: Sheet metal, with screw-fastened closures and field applied protective finish.
 - 5. Mounting base to secure boiler to concrete base.

- E. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum ~~3-1/2-inch-~~ (89-mm-) diameter dial.

2.2 BURNER

- A. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural gas or oil.
- B. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- C. Gas Train: Control devices and modulating, on-off or low-high-low control sequence shall comply with requirements in ASME CSD-1 and UL.
- D. Power Gas Burner: Unit shall be listed by Underwriters' Laboratories and displays the listing label. All controls and trim shall be in compliance with UL Standard 795, suitable for use with natural gas.
 - 1. The burner shall be complete with electronic flame safeguard, air pressure switch, blower motor and controls with modulating or two-stage firing over 700,000 BTUH.
- E. Oil Burner: Unit shall be listed by Underwriters' Laboratories and displays the listing label. All controls and trim shall be in compliance with UL Standard 296.
 - 1. The burner shall be the high pressure atomizing type approved for operation with A.S.T.M. D396 No. 2 oil.
 - 2. Unit shall be modulating or two-stage firing over 500,000 BTUH.
 - 3. Unit shall be provided with two (2) main oil valves, oil pump, nozzles, blower and starter, air pressure switch for automatic firing.
- F. Dual Fuel Gas/Oil Burner: Unit shall be listed by Underwriters' Laboratories and displays the listing label. All controls and trim shall be in compliance with UL Standard 296 and 795, suitable for use with natural gas or oil meeting standards of A.S.T.M. D396.
 - 1. Fuel change-over shall be accomplished by a fuel selector switch.
 - 2. Burner shall be complete with electronic flame safeguard, oil pump with separate motor, nozzles, blower motor, oil pump, starter, and air pressure switch control for modulating or two-stage firing.
- G. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

2.3 TRIM

- A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
- B. Pressure Controllers: Operating and high limit.

C. Safety Relief Valve:

1. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - a. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

D. Pressure Gage: Minimum **3-1/2-inch (89-mm)** diameter. Gage shall have normal operating pressure about 50 percent of full range.

E. Water Column: Minimum **12-inch (300-mm)** glass gage with shutoff cocks.

F. Drain Valves: Minimum **NPS 3/4 (DN 20)** or nozzle size with hose-end connection.

G. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1.

2.4 CONTROLS

A. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.
3. Operating Pressure Control: Factory wired and mounted to cycle burner.
4. Low-Water Cutoffs and Pump Control: Cycle feedwater pump(s) for makeup water control.
5. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature.

B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design pressure.
2. Operating Pressure Control: Automatic stops burner if operating conditions rise above maximum boiler design pressure.
3. Low-Water Cutoff Switch: Float and electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual and automatic-reset type.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - 1. House in NEMA 250, Type 1 enclosure.
 - 2. Wiring shall be numbered and color-coded to match wiring diagram.
 - 3. Install wiring outside of an enclosure in a metal raceway.
 - 4. Field power interface shall be to circuit breaker.
 - 5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
 - 6. Provide each motor with overcurrent protection.

2.6 CAPACITIES AND CHARACTERISTICS

- A. Heating Medium: Steam.
- B. Design Pressure Rating: Low Pressure steam.
- C. Safety Relief Valve Setting: 15PSI
- D. Minimum Efficiency AFUE: 80 percent.
- E. Number of Passes: Three or four

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Equipment Mounting: Install boilers on cast-in-place concrete equipment base(s).
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct bases to withstand, without damage to equipment, seismic force required by code.
 - 3. Construct concrete bases **6 inches (150 mm)** high (based on field conditions) and extend base not less than **6 inches (150 mm)** in all directions beyond the maximum dimensions of boiler unless otherwise indicated or unless required for seismic anchor support.
 - 4. Minimum Compressive Strength: **3000 psi (20.7 MPa)** at 28 days.

5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of concrete base.
6. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
7. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
8. Install anchor bolts to elevations required for proper attachment to supported equipment.

- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- D. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapplings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest sump pump pit.
- F. Install piping from equipment drain valve and blowdown connections to nearest sump pump pit. Piping shall be at least full size of connection. Provide an isolation valve if required.
- G. Connect breeching full size to boiler outlet. Comply with requirements in Section 235100 "Breechings, Chimneys, and Stacks" for venting materials.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Perform installation and startup checks according to manufacturer's written instructions.
 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature and steam pressure.

- b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 235239