### SECTION 235223 - CAST-IRON BOILERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes cast-iron boilers, trim, and accessories for generating hot water.

### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories.
  - 1. Include plans, elevations, sections, mounting, and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For each boiler.
  - 1. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
    - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
    - b. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for boiler, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.
- E. Product Test Reports:
  - 1. CSA B51 pressure vessel Canadian Registration Number (CRN).
  - 2. Startup service reports.

## 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.

## 1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace controls and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Controls: Two years from date of Substantial Completion.
  - 2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers Minimum Efficiency Requirements."
- D. I=B=R Compliance: Boilers shall be tested and rated according to AHRI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.
- E. UL Compliance: Test boilers for compliance with UL 726. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- F. Mounting Frame: Steel rails used to mount assembled boiler package on concrete base.
  - 1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic

forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Lochinvar.
  - 2. Weil-McLain.
  - 3. Parker

### 2.3 MANUFACTURED UNITS

- A. Description: Factory fabricated and assembled.
  - 1. Cast-iron sections shall be sealed pressure tight and held together with tie rods, including insulated jacket and flue-gas vent connection.
- B. Cast-Iron Section Design:
  - 1. Sectional Joints: High-temperature sealant to seal flue-gas passages not in contact with heating medium, tapered cast-iron push nipples, O-ring gaskets, or fiber roping, and held together with tie rods.
  - 2. Drain and blowdown tappings.
  - 3. Return injection tube to equalize water flow to all sections.
  - 4. Crown inspection tappings with brass plugs.
- C. Combustion Chamber: Equipped with flame observation ports, front and back.
- D. Casing:
  - 1. Jacket: Sheet metal, with snap-in or interlocking closures and baked-enamel or powdercoated protective finish.
  - 2. Insulation: Minimum 1-inch-thick, mineral-fiber insulation surrounding the heat exchanger.
  - 3. Access: For cleaning between cast-iron sections.
  - 4. Draft Hood: Flue canopy and flue connection shall be constructed of aluminized or stainless steel containing adjustable outlet damper assembly.

#### 2.4 ATMOSPHERIC-GAS BURNER

- A. Burner Tubes and Orifices: Stainless steel or Cast iron, for natural gas.
- B. Gas Train: Control devices and control sequence shall comply with requirements in ASME CSD-1.

- C. Gas Train: Combination-gas valve with manual shutoff, pressure regulator, and pilot adjustment.
- D. Pilot: Standing or Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

### 2.5 SEALED-COMBUSTION BURNER

- A. Burner Tubes and Orifices: Stainless steel or Cast iron, for natural gas.
- 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.
- C. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
- D. Pilot: Standing or Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

### 2.6 FORCED-DRAFT BURNER

- A. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural gas.
- 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.
- C. Gas Train: Control devices and control sequence shall comply with requirements in ASME CSD-1.
- D. Pilot: Intermittent or Interrupted-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

#### 2.7 TRIM FOR HOT-WATER BOILERS

- A. Include devices sized to comply with ASME B31.9.
- B. Aquastat Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve: ASME rated.
- D. Pressure and Temperature Gage: Minimum 3-1/2-inch-diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.
- E. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- F. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.

- 1. Tappings NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
- 2. Tappings NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

## 2.8 CONTROLS

- A. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" Building Management System Interface: Factory install hardware and software to enable building management system to monitor, control, and display boiler status and alarms.
  - 1. A communication interface with building management system shall enable building management system operator to remotely control and monitor the boiler from an operator workstation. Control features available and monitoring points displayed, locally at boiler control panel shall be available through building management system.

### 2.9 ELECTRICAL POWER

- A. 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 factory wiring outside of an enclosure in a metal raceway.
  - 4. Field power interface shall be to fused disconnect switch.
  - 5. Provide branch power circuit to each motor and to controls.
  - 6. Provide each motor with overcurrent protection.

### 2.10 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to 2010 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 EXAMINATION

A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

- 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 BOILER INSTALLATION

- A. Equipment Mounting:
  - 1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- 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.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.
- 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 gastrain connection. Provide a reducer if required.
- D. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest floor drain.
- F. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- G. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- H. Connect breeching full size to boiler outlet. Comply with requirements in Section 235116 "Fabricated Breechings and Accessories" for venting materials.
- I. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Section 235123 "Gas Vents" for recirculation duct materials.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following 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. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
    - b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    - c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Performance Tests:
  - 1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
  - 2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
  - 3. Perform field performance tests to determine capacity and efficiency of boilers.
  - 4. Repeat tests until results comply with requirements indicated.
  - 5. Provide analysis equipment required to determine performance.
  - 6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are inadequate.
  - 7. Notify Architect in advance of test dates.
  - 8. Document test results in a report and submit to Architect.
- F. Boiler will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

### 3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

## 3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235223