SECTION 23 5233 - HOT WATER BOILERS

Maintain Section format, including the UH master spec designation and version date in bold in the center columns of the header and footer. Complete the header and footer with Project information.

Edit and finalize this Section, where prompted by Editor's notes, to suit Project specific requirements. Make selections for the Project at text identified **in bold**.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:

1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction.*

1.2 DESCRIPTION OF WORK:

A. Section Includes: Provide gas-fired hot-water fire-tube boilers as indicated.

1.3 QUALITY ASSURANCE:

A. ASHRAE/IES Compliance: Boiler complying with ASHRAE 90.1.

B. ASME Compliance: Fabricate and stamp boilers according to ASME Boiler and Pressure Vessel Code.

C. NFPA: Electrical components, devices and accessories listed and labeled according to NFPA 70.

D. UL: Boiler tested, listed and labeled according to UL 795.

1.4 ACTION SUBMITTALS:

A. Submittals shall include, but not be limited to, the following:

1. Product data with all capacities, characteristics, features, accessories and options clearly indicated.

2. Shop drawings indicating dimensions, weights and operating and service clearances.

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3. Copies of ASME short form test proving capacities and certified guaranteed efficiency ratings of his equipment. Ratings shall accompany submittal, or the boiler manufacturer may perform ASME short form test at job site at his own expense.
4. Additional information as required in Section 23 0100.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver boiler in factory-fabricated water-resistant wrapping.

B. Handle boiler carefully to avoid damage to material components, enclosure and finish.

C. Store boiler in a clean, dry space and protect from the weather.

1.6 WARRANTY

A. Warranty: The entire boiler(s) shall have a minimum one-year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide boilers manufactured by one of the following:

1. A. O. Smith.
2. Ray Pak.
3. Approved equal.

2.2 GENERAL:

A. General: Provide complete packaged hot-water boilers of the type, size, and capacities required.

2.3 PERFORMANCE

A. Efficiency: Boiler shall be guaranteed to operate at a minimum fuel-to-hot water efficiency of [**80**] [**Insert efficiency**]% from 30 to 100% of capacity rating.

B. Emissions: Not to exceed allowable ambient-air quality standards in governing jurisdiction and following:

1. Carbon monoxide: [**Insert value**] parts per million.
2. Nitrogen Compounds: [**Insert value**] parts per million.
3. Sulfur Compounds: [**Insert value**] parts per million.
4. Hydrogen and Volatile Organic Compounds: [**Insert value**] parts per million.
5. Particulate Matter: [**Insert value**] parts per million.

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6. Smoke: No visible smoke; not to exceed No. 1 on Bacharach smoke scale.

2.4 GENERAL BOILER DESIGN:

A. Requirements: Boiler shall be a horizontal fire-tube updraft boiler with a minimum of 5 square feet of heating surface per rated boiler horsepower. Boiler shall be mounted on a heavy steel frame with integral forced draft burner and burner controls. The complete packaged boiler shall be approved as a unit by Underwriters' Laboratories, Inc. (UL) and shall bear the UL label. The unit shall comply with all applicable sections of the ASME Boiler and Pressure Vessel Code and be suitably stamped.

B. Packaged Unit: Boiler shall be completely preassembled and fire-tested at factory. Unit shall be ready for immediate mounting on floor or simple foundation and ready for attachment of water, fuel, electrical, and vent connections.

2.5 BOILER SHELL:

A. General: Boiler shell shall be constructed in accordance with ASME Boiler Code and receive authorized boiler inspection prior to shipment. Provide a copy of the inspection report to the Construction Manager. Locate two lifting eyes on top of boiler.

B. Doors: Front and rear doors on the boiler shall be hinged. Seal doors with tadpole gaskets and fasten tightly using heavy-duty cap screws which thread into replaceable brass nuts.

C. Formed Door: Rear refractory and insulation shall be contained in the formed door which shall swing open for inspection of brick work.

D. Inspection and Cleaning: Front and rear tube sheets and all flues shall be fully accessible for inspection or cleaning when the doors are swung open. Furnish shell with adequate handholes to facilitate boiler inspection and cleaning. Provide a manhole for boilers over 48" in diameter.

E. Exhaust Vent: Exhaust gas vent shall be located near the front of boiler on top center line and shall contain a stack thermometer.

F. Ports: Provide observation ports for inspection of flame conditions at each end of boiler.

G. Insulation: Boiler insulation shall consist of a 2-inch thick fiberglass blanket under a sectional preformed sheet metal lagging. This insulation shall be readily removed and reinstalled, if required.

H. Finish: Factory-paint entire boiler base frame and other components before shipment using a hard-finish enamel.

2.6 BOILER TRIM:

A. Low Water Cutoff: Low water cutoff shall be an integral part of boiler control. Cutoff shall be wired in the burner control circuit to prevent burner operation if boiler water falls below a safe level. An auxiliary low water contact shall also provide remote annunciation at the Engineer's office.

B. Gauge: Water temperature and pressure gauges shall be located at the front end of the boiler and shall include cock and test connection.

C. Relief Valves: Provide safety relief valves of a type and size to comply with ASME Code requirements.

D. Controls: Factory mount hot water temperature controls for regulation of burner operation.

2.7 FUEL BURNING AND FIRING EQUIPMENT:

A. Comply with more stringent of [**ASME CSD-1**] [**NFPA 85**] [**FMG**] [**UL**].

B. Burner: Burner, integral with the front head of boiler, shall be a high radiant multiport-type for gas. Burner shall be approved for operation with natural gas and be UL-labeled.

C. Type of Burner Operation: Burner shall operate on the full modulation principle with a turndown of not less than [**6 to 1**] [**Insert turn down**]. Burner shall return to low fire position for ignition.

D. Gas Pilot: Gas pilot shall be premix-type with automatic electric ignition. An electronic detector shall monitor pilot so that the primary fuel valve cannot open until pilot flame has been established.

E. Forced-Draft Blower: All air for combustion shall be supplied by a blower mounted in front of boiler door, above burner, and directly connected to a flanged-type motor. This rigid mounting with the blower wheel inside the head shall reduce vibration and noise level. Balanced blower wheel shall be cast aluminum with radial blades.

1. Motor: Premium efficient; [**ODP**] [**TEFC**] enclosure; 1.15 service factor. Inverter duty rated with shaft grounding protection if controlled through variable frequency controller.

F. Combustion Air Control: Combustion air damper and cam-operated fuel-metering valve shall operate by a single damper control motor which regulates the fire according to load demand. Potentiometer-type positioning controls shall regulate operation of damper control motor.

G. Gas System: Gas burner shall be of the multiple-jet, flame retention type with the following features:

1. A main gas control group consisting of an automatic motorized gas valve, automatic safety gas valve, gas volume control valve with adjustable cam operator, gas pressure regulator, gas gauge, gas cock, gas/ electric ignition assembly consisting of a pilot burner, 6,000 volt ignition transformer, flame rod, airflow safety switch, ultraviolet or lead sulfide flame detector, and low fire start.

H. Modular Control Panel: Control panel shall be mounted at eye level height on the front door of the boiler. Provide hinged metal cabinet, NEMA 250 Type [**1**] [**12**] enclosure with neoprene dust seal and cabinet key lock. This panel shall contain the electronic programming relay, FVNR blower motor starter, self-locking plug-in fuel modules, four indicating lights, and the control switches. Indicating lights and switches shall be mounted in a separate hinged drop-panel for easy access to all wiring.

1. The programming relay shall control the ignition timing, starting and stopping of burner, a pre-combustion purge, and post-combustion purge. Through a flame scanner, the relay shall shutdown the burner in the event of ignition, pilot, or main flame failure.
2. A manual-automatic selector switch and damper motor positioning switch shall be provided on all units. These switches shall permit automatic firing in accordance with load demand or manual control of the firing rate and any desired point between low fire and maximum rating.
3. Four indicating lights shall show operating conditions of: red - low water level; red - flame failure; white - fuel valve open; white - load demand.
4. All electrical equipment shall be wired in conformance with UL requirements. Oil, heat, and moisture-resistant wire shall be used throughout.
5. Control circuit transformer shall be mounted in control panel.

I. Remote Control System Interface: Factory install hardware and software to monitor, control and display boiler status and alarms.

1. Monitoring (Hardwired I/O): On/off status, common trouble alarm.
2. Control (Hardwired I/O): On/off operation, supply temperature setpoint.
3. Communication Interface: ASHRAE 135 (BACnet) MS/TP or IP communication to share control and monitoring points available at boiler control panel.

2.8 ELECTRICAL:

A. Factory wire boiler to a single point field connection for electrical power.

B. Factory install a mounted [**disconnect switch**] [**circuit breaker**] as point of field power interface.

2.9 FACTORY TESTS:

A. General: Packaged boiler shall receive factory tests to check construction, control, and operation of unit.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: The boiler shall be installed in accordance with the manufacturer's instructions and prevailing state, county, and local governing codes.

B. Pipe relief valve, drain and blow-down discharge to terminate 4-inches above floor drain.

C. Provide power wiring to the control cabinets. The unit shall have relays for future connection to the energy management system.

3.2 MANUFACTURER'S SERVICES AND FIELD QUALITY CONTROL:

A. General: The boiler manufacturer's authorized factory-trained technician shall inspect the boiler installation, ascertain that the boiler and supporting systems have been installed in compliance with

the boiler manufacturer's instructions, perform start-up, make adjustments, and write a letter on boiler manufacturer's letterhead stating that the installation is in compliance with manufacturer's instructions and that the boiler is operating properly. This technician shall devote two eight-hour days instructing the Owner's operating personnel at a time designated by the Owner.

B. Start-up Service: Entire unit shall have a start-up service and one-year service period by factory-trained personnel.

END OF SECTION 23 5233