SECTION 23 5216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating heating hot water.

1.2 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and wiring diagrams.

C. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 80%, 60%, 40%, 20% and 7% input firing rates at incoming water temperatures ranging from 80 deg. F to 170 deg. F.

D. Pressure Drop Curve. Submit pressure drop curve for flows ranging from 0 GPM to maximum boiler flow.

1. Should submitted material be different from that of the basis of design, boiler manufacturer shall incur all costs associated with reselection of necessary pumps.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and maintenance data.

H. Warranty: Standard warranty specified in this Section.

1.3 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. I=B=R Performance Compliance: Condensing boilers shall be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.

C. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV “Heating Boilers”.

D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

F. 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.

G. NOx Emission Standards: When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.1; and the Texas Commission on Environmental Quality (TCEQD), Title 30, Chapter 117, Rule 117.465.

1.4 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fire-Tube Condensing Boilers:

a. The pressure vessel/heat exchanger shall carry a 10-year nonprorated warranty from date of start up against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
b. Manufacturer labeled control panels shall be warranted against failure for two (2) years from start up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Thermal Solutions – Arctic Series
2. Bryan Boiler – FF Series
3. RBI – Torus
4. *Aerco – Benchmark (Addendum 1 – 7/31/2023)*

2.2 CONSTRUCTION

A. Description:

1. Boiler shall be natural gas fired, fully condensing water tube design. Power burner shall have full modulation with a minimum 5:1 turndown ratio, and discharge into a positive

pressure vent. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boiler shall be factory-fabricated, factory assembled and factory tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket, flue-gas vent, combustion air intake connections, water supply, return and condensate drain connections, and controls.

B. Heat Exchanger:

1. The heat exchanger shall be constructed of 316L stainless steel water tubes.

2. Heat exchanger to be ASME stamped for a working pressure not less than 160 psig.

3. Access to the tubesheet and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be not less than 10-inch diameter.

C. Pressure Vessel:

1. The pressure vessel shall have a maximum water volume of 50 gallons. The water pressure drop shall not exceed 5.5 psig at 258 GPM. The boiler water connections shall be 4-inch flanged 150-pound, ANSI rated. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and a 0.50-inch thick upper head.

2. Inspection openings in the pressure vessel shall be in accordance with ASM Section IV pressure vessel code.

D. Modulating Air/Fuel Valve and Burner:

1. The boiler shall be capable of a 5 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall produce less than 30 ppm of NOx corrected to 3% excess oxygen. The unit shall be certified by the South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.1 for boilers and water heaters greater than 2 MBTU's and less than 5MBTU's. The burner shall be metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and fuel input. The modulating motor shall be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment. A variable frequency drive (VFD), controlled cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

E. Exhaust Manifold:

1. The exhaust manifold shall be of corrosion resistant cast aluminum with an 8-inch diameter flue connection. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

F. Blower:

1. The boiler shall include a variable speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.

G. Ignition:

1. Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

2.3 TRIM

A. Safety Relief Valve: 50 psig ASME rated.

B. Drain Valve: Minimum 0.75" hose-end ball valve.

2.4 CONTROLS

A. The boiler control package shall be an integrated boiler management system capable of receiving signals from the building DDC system. The controls system shall be integral to each boiler, creating a control network that eliminates the need for a "wall mounted" stand-alone boiler control system.

B. The boiler management control shall be capable of operating in the following ways:

1. As a standalone boiler control system using its own control protocol with one "Master" and multiple "Member" units.

2. As a boiler network, enabled by a Building Management System, using its own protocol with one "Master" and multiple "Member" units.

3. As "Member" boilers to a Building Management System with multiple input control methods.

C. Each boiler control panel shall be networked together and shall have the following standard features.

1. Digital Communications Control

a. Boiler to Boiler: control panel protocol.
b. Building Management System: BACNET, coordinate with DDC system.

2. Analog 4:20 and 010vdc also supported.

3. Distributed control using boiler protocol for up to 16 total boilers.

4. System/Boiler operating status in English text display.

5. Interlock, Event, and System logging with a time stamp.

6. Advanced PID algorithm optimized for specific boilers.

7. Four (4) dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet) Temperature, Return Temperature (Inlet), and Header Temperature.

8. Flow Rate sensor.

9. Automatically detects the optional temperature sensors on start up.

10. Menu driven calibration and setup menus with display.

11. Eight (8) dedicated 24vac interlock monitors and eight (8) dedicated 120vac system monitors used for diagnostics and providing feedback of faults and system status.

12. Multiple boiler pump or motorized valve control modes.

13. Combustion Air Damper control with proof time.

14. USB/RS485 network plug-in to allow firmware updates or custom configurations.

15. BACNET interface.

16. Alarm contacts.

17. Runtime hours.

18. Outdoor Air Reset with programmable ratio.

19. Time of Day clock to provide up to four (4) night setback temperatures.

20. Failsafe mode when a Building Management System is controlling setpoint. If communication is lost, the boiler/system shall run off the local setpoint.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 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.

2.6 VENTING KITS

A. The exhaust vent shall be UL listed for use with Category III and IV appliances and compatible with operating temperatures up to 480 degrees F, positive pressure, condensing flue gas service. UL-listed vents of Al 29-4C stainless steel shall be used with boilers.

B. The minimum exhaust vent duct size for each boiler shall be 8-inches diameter.

C. Combustion Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via an insulated metal duct connected between the boiler and the outdoors.

2.7 SOURCE QUALITY CONTROL

A. 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.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

A. Install boilers level on concrete base. Concrete base shall be installed by the HVAC contractor.

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 Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve.

D. 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.

E. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Route condensate piping to the nearest floor drain and provide neutralizing cartridge prior to discharge into floor drain. Flue drains are to be routed to condensate neutralizing cartridge with trap so flue gas does not escape.

H. Boiler Venting:

1. Install flue venting kit and combustion-air intake.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

K. See section 23 0993 for control sequence and operation.

L. Connect boiler control panel to facility DDC system.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. 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.
   b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. 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.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 5216

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