

SECTION 15513 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 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 attachments to other Work. Shop Drawings shall be signed and sealed by a qualified professional engineer.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 4. Wiring Diagrams: Detail power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that condensing boiler, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls" when anchored to a concrete base. Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

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.
- D. Source quality-control test reports.
- E. ASME "A" Stamp Certification and Report: Submit "A" stamp certificate of authorization, and document hydrostatic testing of piping external to boiler.
- F. Startup service reports.
- G. Operation and Maintenance Data: For condensing boilers to include in emergency, operation, and maintenance manuals.
- H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of condensing boilers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. 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.
- C. ASME Compliance: Fabricate and label condensing boilers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. ASHRAE/IESNA 90.1 Compliance: Condensing boilers shall have minimum efficiency according to Table 10-8.
- E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- F. UL Compliance: Test condensing boilers to comply with UL 726, "Oil-Fired Boiler Assemblies."
- G. UL Compliance: Test condensing boilers to comply with UL 795, "Commercial-Industrial Gas Heating Equipment."

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing boilers that fail in materials or workmanship within specified warranty period.
- B. Warranty Period for Pulse-Combustion Boilers:
 - 1. Heat Exchanger Damaged by Thermal Shock: 10 years from date of Substantial Completion.
 - 2. Heat-Exchanger Corrosion: Prorated for five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PULSE-COMBUSTION CONDENSING BOILERS

- A. Manufacturers:
 - 1. Teledyne Laars
 - 2. Hydrotherm, Inc./Mestek, Inc.
 - 3. Weil-mclain.
- B. Description: Factory-fabricated, -assembled, and -tested pulse-combustion 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.
- C. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist boiler movement during a seismic event when boiler base is anchored to building structure.
- D. Boiler Characteristics and Capacities:
 - 1. Heating Medium: **Hot water.**
 - 2. Maximum Design Pressure Rating: **150 psig.**
 - 3. Operating Pressure: **60 psig.**
 - 4. Entering-Water Temperature: **140 deg F.**
 - 5. Leaving-Water Temperature: **180 deg F.**
 - 6. Water Flow Rate: **2.1 gpm.**

7. Maximum Pressure Drop: 10 **psig**.
8. Minimum Efficiency: 92.2 **AFUE**.
9. AGA Output Capacity: 289.0 **MBh**.

E. Pulse-Combustion Boiler Components:

1. Heat Exchanger: Cast aluminum primary and secondary combustion chamber.
2. Pressure Vessel: Carbon steel with welded heads and tube connections.
3. Exhaust Decoupler: Fiberglass composite material in a corten steel box.
4. Burner: Natural gas, self-aspirating and self-venting after initial start.
 - a. AGA Input: 310.0 **MBh**.
5. Blower: Centrifugal fan to operate only during start of each burner sequence.
 - a. Refer to Division 15 Section "Motors" for general requirements.
 - b. Minimum Motor Sizes: 1/16 HP.
 - c. RPM: 3450.
 - d. Electrical Characteristics: 120 V, single phase, 60 Hz.
6. Gas Train: Combination gas valve with manual shutoff and pressure regulator. Include 100 percent safety shutoff with electronic flame supervision.
7. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
8. Casing:
 - a. Jacket: Sheet metal, with snap-in or interlocking closures.
 - b. Control Compartment Enclosure: NEMA 250, Type 1A.
 - c. Finish: Baked-enamel protective finish.
 - d. Insulation: Minimum **2-inch- (50-mm-)** thick mineral-fiber insulation surrounding the heat exchanger.
 - e. Draft Hood: Integral.
 - f. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
9. Mufflers: Carbon-steel intake muffler and stainless-steel exhaust.
10. Condensate Trap: Cast-iron body with stainless-steel internal parts.

2.3 HOT-WATER BOILER TRIM

- A. Include devices sized to comply ANSI B31.9, "Building Services Piping.
- B. Aquastat Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve: ASME rated. **150 psig**.
 1. Pressure Setting: 125 **psig**.

- D. Altitude and Temperature Gage: Minimum **3-1/2-inch- (89-mm-)** diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is at approximately 50 percent of full range.
- E. Boiler Air Vent: Automatic Drain Valve: Minimum **NPS 3/4 (DN 20)** hose-end gate valve.
- F. Circulation Pump: Non-overloading, horizontal, in-line pump with rubber-mounted, split-capacitor motor having thermal-overload protection and oil-lubricated bearings; designed to operate at specified boiler pressures and temperatures.
- G. Expansion Tank: Welded carbon steel, rated for operating pressure and temperature or minimum **125-psig (860-kPa)** working pressure and **240 deg** operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible butyl-rubber bladder securely sealed into tank. Include hose-end gate drain valve, pressure gage with minimum **3-inch (75-mm)** dial, and air-charging fitting. Factory fabricate and test tank with taps installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Tank Volume: **132 gal.**
 - 2. Acceptance Volume: **46 gal.**
 - 3. Charging Pressure: **125 psig.**

2.4 BURNER OPERATING CONTROLS

- A. Description: To maintain safe operating conditions, burner safety controls limit the operation of burner.
 - 1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design pressure.
 - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
 - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
 - 4. Alarm Bell: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

2.5 BOILER OPERATING CONTROLS

- A. Refer to Division 15 Section "HVAC Instrumentation and Controls."
- B. Boiler operating controls shall include the following devices and features:
 - 1. Control Transformer: 115 V.
 - 2. Operating Pressure Control: Factory wired and mounted to cycle burner.
 - 3. Low-Water Cutoff and Pump Control: Cycle feedwater pump(s) for makeup water control.
 - 4. Sequence of Operation: Electric, factory-fabricated, and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.

5. Sequence of Operation: Electric, factory-fabricated, and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
6. 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. At **0 deg F** outside-air temperature, set supply-water temperature at **185 deg**; at **60 deg** outside-air temperature, set supply-water temperature at **140 deg F**.
 - a. Include automatic, alternating-firing sequence for multiple boilers.

- C. Building Management System Interface: Factory-installed hardware and software to enable building management system to monitor and control hot-water set point and display boiler status and alarms.

2.6 VENTING KITS

- A. Kit: ASTM A 959, Type 29-4C, stainless-steel, horizontal vent terminal, wall passage thimble, indoor wall plate, vent adapter, condensate trap, and sealant.
- B. Combustion-Air Intake: Stainless-steel, horizontal vent terminal with screen, inlet air coupling, and sealant.

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code: Section I, for high-pressure boilers and Section IV, for low-pressure boilers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before boiler installation, 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 boiler performance, maintenance, and operations.
 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 15 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

- B. Concrete Bases: Anchor boilers to concrete base.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around full perimeter of base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Cast-in-place concrete materials and placement requirements are specified in Division 3.
- C. Vibration Isolation: Rubber pads with a minimum static deflection of **0.25 inch**. Vibration isolation devices and installation requirements are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."
- D. Install gas-fired boilers according to NFPA 54.
- E. Assemble and install boiler trim.
- F. Install electrical devices furnished with boiler but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Connect gas piping full size to boiler gas-train inlet with union.
- D. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- E. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.
- F. Install piping from safety relief valves to nearest floor drain.
- G. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- H. Connect breeching full size to boiler outlet, Install piping adjacent to boiler to allow service and maintenance.
- I. Ground equipment according to Division 16 Section "Grounding and Bonding."
- J. Connect wiring according to Division 16 Section "Conductors and Cables."

- K. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to test, inspect, and adjust boiler components and equipment installation and to perform startup service.
- B. Perform installation and startup checks according to manufacturer's written instructions.
- C. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
- D. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
- E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Adjust initial temperature set points.
- G. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- H. 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 site outside normal occupancy hours for this purpose, without additional cost.
- I. Prepare written report that documents testing procedures and results.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing boilers. Refer to Division 1 Section "Closeout Procedures Demonstration and Training."

END OF SECTION 15513