SECTION 23 52 00

HEATING BOILERS

1.0 GENERAL

1. DESCRIPTION
   1. All work specified in this Section is governed by the Common Work Results for HVAC Section 23 05 00.
   2. This Section 23 52 00 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction and installation of the boilers as specified herein and as shown.
2. BASIS OF DESIGN
   1. The basis of design is as scheduled. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design. Any modifications to piping, electrical work, controls, building structure, etc., that result from any substitution shall be coordinated with all trades. This coordination shall occur before delivery of equipment and any modifications shall be performed without incurring additions to the Contract.
3. ACCEPTABLE MANUFACTURERS
   1. For gas boiler and storage tank systems, acceptable substitute manufacturers are Teledyne-Lars, Lochinvar, CleaverBrooks, Raypak, and AO Smith, provided that their pumps, performance, appearance, and physical characteristics are equal in all respects to the basis of design for this specific project.
   2. \*\*For electric boilers, acceptable substitute Manufacturers are Precision Boiler, Lochinvar, AO Smith, and Fulton, provided that their pumps, performance, appearance, and physical characteristics are equal in all respects to the basis of design for this specific project.

2.0 PRODUCTS

1. GENERAL REQUIREMENTS
   1. All plumbing equipment installed in locations with a water hardness of 25 grains per gallon or more, shall be resistant to corrosion. Where copper materials are in the water stream, it shall be Cupro-Nickel of not more than 90% copper.
   2. All boilers shall have ASME rated temperature and pressure relief valve(s). Valve(s) shall be provided by the Manufacturer and sized for the discharge location noted in the plans.
   3. All boilers and tanks shall be glass-lined, 1600°F fired, with a working pressure of 150 psi, a test pressure of 300 psi, or the system pressure at the installation location, whichever is greater, and shall have magnesium anodes for electrolytic protection. Separate storage tanks may also be cement-lined. Tanks shall be ASTM stamped.
   4. All boilers shall meet or exceed the energy efficiency requirements of the latest version of ASHRAE 90.1.
   5. All boilers and pumps shall be UL approved and labeled, and be AGA certified where applicable.
   6. All boilers and pumps shall be NEMA rated appropriate for the installation location in which they are installed.
   7. Boiler controls shall include an operating thermostat and manual reset high limit control for each heating element or burner. The safety high limit control shall prevent over heating in the event of a thermostat failure.
   8. All controls shall be factory-wired and require no external power source.
   9. Boilers and tanks shall have drain with external access and hose end connection.
   10. Boiler system volume shall be a minimum of 25% above the Manufacturer’s minimum recommend system volume. Specific attention is called to minimum firing times and minimum gas stage firing. Submittal shall note minimum recommended system volume and calculated system volume. Provide and install storage tank(s) to supplement volume as needed.
   11. \*\*Boilers shall be provided with accessory condensate neutralization kit prior to condensate discharge. Boiler combustion vent shall be provided with drain connection as recommended by the Manufacturer. All boiler condensate lines, kit, etc. shall be protected from freezing or shall be heat traced in accordance with Section 23 05 93.
   12. \*\*See specification Section 23 31 00 for combustion air and flue ductwork as applicable. Specific attention is called to coordination of scope with Division 23. Combustion air and flue system shop drawings, including any fans required, shall be submit for review and must be coordinated with Division 26.
   13. \*\*The boiler shall be certified by an Independent Laboratory for Oxides of Nitrogen (NOx) of less than 10 ppm corrected to 3% O2.
   14. \*\* The gas train shall modulate to match the scheduled boiler turndown, with a mechanical primary high limit shut-off feature. Modulating valves may be operated simultaneously or set for stage firing to effect a greater modulation range. The boiler shall be factory-equipped with an automatic reset secondary electric high limit with a fixed setting. The main electric gas valve and all controls shall be 24 volt with a 110/24 volt transformer.
   15. \*\*The gas train shall be AGA and IRI approved.
   16. \*\*Where classified as a boiler by the Department of Labor, AHJ, or applicable Codes, the system shall additionally meet all requirements. An emergency power off (EPO) switch shall be provided at locations required by the AHJ. The EPO(s) shall be accessible, clearly labeled, and shall shut-off all power to the boilers and cause the equipment to be disengaged. EPO(s) shall be coordinated with controls and Division 26, and shall be installed and wired under this scope.
2. NON-CONDENSING GAS BOILERS
   1. DESCRIPTION
      1. The boiler shall be capable of operating with return hot water temperatures down to 105°F without sustaining condensation. A low temperature bypass shall be provided and installed as required.
      2. The boiler shall be AHRI listed and have a minimum efficiency of 80%.
   2. HEAT EXCHANGER
      1. Each boiler's water tube heat exchanger shall be of a horizontal grid design constructed with copper fin tubes and extra heavy galvanized steel "V" baffles secured tightly to the tubes above the point of tangency of the fins. Each end of the tubes shall be rolled into an ASME fire box steel tube sheet and sealed to bronze headers with "O" rings having a minimum temperature rating over 500°F. The headers shall be of high pressure bronze with integral bronze baffles to direct water through heat exchanger in two to four passes. The heat exchanger shall be capable of withstanding 1200 psi hydrostatic pressure.
      2. The headers shall be secured to the tube sheet by stud bolts and flange nuts. The heat exchanger shall be readily cleanable from either the right or left sides of the boiler and on one of the sides without removing external piping. Heat exchanger shall be explosion proof on the water side. It shall have 100% copper and bronze waterways to positively protect the boiler from galvanic action.
      3. The complete heat exchanger assembly shall carry a five (5) year limited warranty.
   3. BURNER
      1. Burner to be raised port and die formed from stainless steel alloy mounted in an easily removable burner drawer, capable of quiet ignition and extinction, and equipped with fixed primary air ports.
3. CONDENSING GAS BOILERS
   1. DESCRIPTION
      1. The boiler shall be AHRI listed and have a minimum efficiency of 96%.
   2. HEAT EXCHANGER
      1. Each boiler's fire tube heat exchanger shall be of a vertical design constructed with 316L stainless steel tubes. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. There shall be no banding material, bolts, gaskets or “O” rings in the heat exchanger design. Cast iron, aluminum, or condensing copper tube boilers will not be accepted. The heater exchanger shall bear the ASME “H” stamp for 160 psi working pressure and shall be National Board listed.
      2. The headers shall be secured to the tube sheet by stud bolts and flange nuts. The heat exchanger shall be readily cleanable from either the right or left sides of the boiler and on one of the sides without removing external piping. Heat exchanger shall be explosion proof on the water side. It shall have 100% copper and bronze waterways to positively protect the boiler from galvanic action.
      3. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.
   3. BURNER
      1. Burner shall be force draft, single burner premix design with an upper and lower chamber supplied by individual combustion systems. Burner shall be constructed of a high temperature stainless steel with a woven Fecralloy outer cover to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency. The minimum turn down shall be 7:1 for 400,000-725,000 BTU/h, 15:1 for 750,000 BTU/h, 20:1 for 1,000,000-3,500,000 BTU/h, and 10:1 for 4,000,000-6,000,000 BTU/h. Burner shall be easily removable and capable of quiet ignition and extinguishing.
   4. BLOWER
      1. Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
   5. GAS TRAIN
      1. The gas train shall have one or two gas valves as required by the units size and be designed with negative pressure regulation.
   6. CONTROLS
      1. Boilers shall be equipped with have an integral controller with LCD display that is capable of controlling a variable speed boiler pump to keep a constant Delta T at all modulation rates. The boiler shall have a built-in “Cascade” to sequence and rotate while maintaining modulation of up to eight boilers of different BTU inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The control must include cascade redundancy to allow a member boiler to become the temporary leader if the original lead boiler shall loose communication with the members.
4. ELECTRIC BOILERS
   1. CONSTRUCTION
      1. Boilers shall be factory packaged and all field electrical wiring connections to the boiler shall be made to a main terminal block.
      2. Boilers shall have immersion heating elements of low watt density and an incoloy outer sheath material for long life. They shall be mounted in individual tank flanges.
      3. All power circuits to heating elements shall be fused with a minimum 100,000 amp interrupting capacity.
      4. The boiler shall carry a three (3) year limited warranty.
   2. CONTROLS
      1. Boilers shall be controlled with On-Off thermostats for up to four stages of control.

3.0 EXECUTION

1. INSTALLATION
   1. The boiler and accessories shall be installed in strict accordance with the manufacturer's recommendations and the Contract Documents.
   2. \*\*The boiler air intake and combustion venting shall meet all manufacturer’s requirements and recommendations. Note additional requirements for any materials in return air plenums.

END OF SECTION