SECTION 23 52 39 – FIRE-TUBE BOILERS

MOHAWK (HOT WATER)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Scotch Marine Fire-tube boilers.
2. Hot Water boiler trim.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. BPVC Section IV - Rules for Construction of Heating Boilers
2. B31.1 - Power Piping
3. CSD-1 - Controls and Safety Devices for Automatically Fired Boilers

B. National Electrical Manufacturers Association

1. NEMA 250 - Enclosures for Electrical Equipment

C. National Fire Protection Association (NFPA):

1. 85 - Boiler and Combustion Systems Hazards Code

1.3 SUBMITTALS

A. Submittals shall include:

1. Product Data: Full product description including all accessories and control settings.
2. Drawings: Submit general arrangement drawing; including dimensions, weights and ratings, wiring diagrams, and all other shop related drawings.
3. Include materials of construction of major pressure vessel parts and fittings.
4. Controls Cutsheet: Submit complete set of cutsheets for trims and controls.
5. Rigging instruction: Submit detailed instructions on manufacturers recommended lifting and unloading procedures.
6. Warranty: Submit standard form equipment warranty.

B. Closeout Submittals:

1. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, recommended spare parts list, and maintenance and repair information.
2. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
3. Test Reports: Indicate boilers meet or exceed specified performance and efficiency. Submit results of combustion test, as applicable.
4. ASME Data Reports: Submit code paperwork required for field acceptance.

1.4 QUALITY ASSURANCE

A. The packaged boiler must receive factory tests to check the construction, controls, and operation of the unit.

B. Allow witnessing of factory inspections and tests at manufacturer’s test facility.

C. At a minimum the testing shall include: Low fire electrical check and gas train leak test, ASME required tests.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Cover all openings, leave drain valves in open position, wrap electronics in plastic, shrink wrap burner.
B. Off load boiler in accordance with boiler rigging instructions.

1.6 WARRANTY

A. All equipment is to be guaranteed against defects in workmanship and materials for a period of 12 months from date the equipment is first placed in use, or 18 months from date of completion; whichever shall be less.
B. 15-year extended warranty for parts and labor on major pressure vessel components.
C. 15-year extended warranty for parts and labor on front and rear smoke box door.

PART 2 – PRODUCTS

2.1 BOILER

A. Type: The boiler shall be a three-pass dryback Scotch marine horizontal fire tube industrial hot water boiler manufactured by Superior Boiler. The furnace shall be located in the bottom third of the boiler shell to provide for maximum heat transfer. Semi-wetback construction shall not be approved. The heat release in the furnace shall not be greater than (See R&D). Designed for (natural gas and No. 2 oil) firing.
    1. The boiler shall not have less than five square feet of AMSE heating surface, measured on the fireside, per rated boiler horsepower.

B. Service: Continuous long-term generation of hot water throughout the burner firing range in conformance to the specified performance requirements.

C. Performance:

1. The boiler shall be designed to heat _____ (GPH) _____ of water with a maximum temperature differential of (degrees F), and a minimum temperature differential of (degrees F).

D. Construction:

1. Codes: Comply with ASME BPVC Section IV (Boilers ≤ 160 psig and ≤ 250° F), and all other applicable sections of the current edition of the ASME code.
   a. Boilers smaller than 300 HP are to be constructed to meet the requirements of CSD-1; boilers 300 HP and larger are to comply with the requirements of NFPA 8501. Boilers are to be built and equipped in conformance with applicable UL standards.

2. Tubes: All tubes are to have a minimum wall thickness of 0.105"and have an OD of 2.5". The second pass shall have turbulators for increase heat transfer efficiency. Tubesheets of 100" diameter or less will be a minimum of 5/8". Tubesheets larger than 100 inches in diameter will be a minimum of 3/4". All ligament spacing shall be a minimum of 3/4".

3. Manway: Boiler shall have a 12" by 16" manway located along the top centerline of the boiler to facilitate water side cleaning and inspection. The top of the furnace is to be visible when the manway cover is removed from boiler shell.

4. Handholes: All necessary handholes shall be provided in accordance with the A.S.M.E. Code. Provide two additional handholes to improve the ease of waterside inspection and cleaning. Locate additional handholes in the front

tubesheet near the bottom of the boiler on either side of the furnace. Boiler shall have a total of five handholes size 3" by 4".

5. Access to Tubes and Furnace: The front and rear tubesheets must be fully accessible for inspections or cleaning when the front doors or rear door is open. Fuel lines, linkages, and electrical connections shall not impede opening of the doors. Front and rear doors shall be davited. Provide a minimum of 17" inside diameter removable furnace plug to access the furnace.

6. Shell Piping and Connections:
   a. (125HP or greater) Water return nozzle shall be 150 psig ASME flanged. Nozzle and shell assembly to be designed to withstand forces and moments imposed by connected piping.
   (100HP or less) Water return nozzle shall be threaded FNPT. Nozzle and shell assembly to be designed to withstand forces and moments imposed by connected piping.

   b. (125HP or greater) Water supply nozzle shall be 150 psig ASME flanged. Nozzle and shell assembly to be designed to withstand forces and moments imposed by connected piping.
   (100HP or less) Water supply nozzle shall be threaded FNPT. Nozzle and shell assembly to be designed to withstand forces and moments imposed by connected piping.
   c. The hot water return (size) and supply (size) connections are to be located along the top centerline of the boiler. The return connection is to be designed to increase the velocity of the return water to insure rapid mixing of the return water. The boiler outlet connection shall incorporate a dip tube.
   d. Air vent valve connection shall be located on top of boiler shell with optional manual vent valve.
   e. Safety valve outlets shall permit straight run of vents through roof.

f. A (size) flue gas connection shall be located at the rear of the boiler on the top centerline. The stack shall be designed for easy attachment of the exhaust flue by flange connection. The flue gas connection will be designed to support a minimum of 2,000 lbs. dead weight. The stack shall have a 1/2" connection for a stack thermometer.

g. Connections for water level controls, water temperature gauge, pressure gauge, and temperature limit controls.

h. Drain: Located in rear of boiler to permit complete collection of sediment and complete drainage.

7. Support System:
   a. Base Frame: The boiler shall be mounted on a heavy structural steel base with extended runners on the front to provide burner support and protection. The rear legs are to be slotted to provide for expansion when the boiler goes from a cold to a hot condition. All doors are to be held in place by lugs that are secured by replaceable brass nuts. The doors are to be sealed with a gas tight, non-proprietary ceramic fiber rope with a minimum density of 20 lbs. per cubic feet and a continuous use limit of 1800 F.
   b. Rigging and Jacking: The boiler is to be equipped with two lifting eyes, located on the top center line. Provisions for jacking. Jacking locations shall be clearly marked.

8. Refractory and Insulation: The boiler shell is to be insulated with two-inch-thick, eight pounds per cubic foot density mineral wool with a k factor of .27. The insulation is to be held in place by bands and then covered with a 22-gauge phosphate coated galvanized steel jacket. All opening in the jacket are to have trim rings. The front doors are to be insulated with a 1" think ceramic fiber blanket. The insulating blanket is to have a K-factory of .44 and is to be coated with a hardener to prevent erosion from the flue gases. Doors on all boilers are to be of the davit design.

9. Casing: Sheet steel covering all areas of boiler shell. Flash or seal all openings at top of boiler at piping and flue connections to prevent leakage of water into insulation.

10. Observation Port: All heating surfaces must be fully accessible for inspection and cleaning without disturbing the burner equipment.

E. Factory Inspection and Certification: Inspect the completed boiler assembly in accordance with the requirements of the ASME BPVC Section IV. The boiler inspection shall be certified.

F. Finish: The entire boiler is to be painted with a high temperature, 400 degrees Fahrenheit minimum, silicone-based enamel. The front and rear doors are to be sand blasted before painting and the jacket is to be primed with a vinyl wash primer before painting.

2.2 BOILER TRIM (ACCESSORIES)

A. Conform to ASME BPVC Section IV.

B. Water Pressure Safety Valves:
   1. Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors (NBBI)
   2. Type: Bronze or cast-iron bodies, side outlet, flanged or threaded inlet and outlet, lifting lever, dual control rings, stainless steel trim, O-ring EPDM seats on bronze valves.
   3. Setting and Adjustments: Relief valves set at a minimum of 17% higher than the operating pressure of the boiler, but no higher than the boiler design pressure shall be provided.

C. Water Pressure Gauge:

1. Case: Turret-style, bottom connection, threaded ring, blowout disc in rear.
2. Dial: (4 ½", 6", 8") diameter, aluminum, black markings on white background.
3. Measuring Element: Bourdon tube designed for water service.
4. Movement: Rotary; Stainless steel.
5. Pointer: Micrometer adjustable.
6. Window: Laminated safety glass or plastic.
7. Accuracy: ½ percent of full scale
8. Range: (0-300 psig) gauge.

D. Water Level Safety and Operating Controls Indicators:

1. Aquastats:
   a. A probe type operating temperature limit. Shall be automatic reset type.
   b. A probe type high temperature limit shall be provided. Shall have manual reset.
   c. A probe type fire rate control or resistance temperature detector (RTD) shall be provided.

2. Water Temperature Gauge:
   a. Case: Stainless steel, hermetically sealed.
   b. Dial: (3" 5") diameter, stainless steel, black markings on white background.
   c. Measuring Element: Bimetal.
   d. Movement: Rotary; Stainless steel.
   e. Pointer: Black.
   f. Window: Heavy-duty glass, plastic or, shatter-proof glass.
   g. Accuracy: 1 percent of full scale
   h. Range: (50° to 400° F) gauge.

3. Electrical: Provide circuit breakers, transformers, and all devices for complete control system. All control electronics and relays shall be in NEMA (1, 12, 4, 4x) panels.

4. Low Water Cutout Operation: Manual reset of primary low water cutoff shall be combined with the burner management manual reset. The burner management system annunciator and associated alarm horn shall indicate the primary and optional auxiliary low water cutoff operation. The manual resets for primary and optional auxiliary low water cutoffs shall be separate, such that an operator would be alerted to a failure of the primary cutoff.

E. Stack Thermometer:
   1. Case: Stainless steel, hermetically sealed.
   2. Dial: (3" 5") diameter, stainless steel, black markings on white background.
   3. Measuring Element: Bimetal.
   4. Movement: Rotary; Stainless steel.
   5. Pointer: Black.
   6. Window: Heavy-duty glass, plastic or, shatter-proof glass.
   7. Accuracy: 1 percent of full scale
   8. Range: (100° to 8000° F) gauge.

F. Blending Pumps: (Note to the specification writer), Contact your local Superior Boiler Distributor to determine if the specified system design parameters require the use of blending pumps to prevent thermal shocking of the boiler.

   1. Two factory piped blending pumps (this section required when two blending pumps are specified, please, contact your local Superior Boiler Distributor for guidance), one on each side of the boiler, shall be supplied. Each pump shall be designed to circulate ___ (GPM) ___ of water from the rear of the boiler to the front. The piping will be Schedule 40 and shall include flow switches wired into

the burner control circuit that will prevent the burner from operating unless circulation in the blending pump piping is proved. Four gate valves, one on each side of each pump, are to be integral with the piping. The piping is to be factory insulated with fiberglass pipe insulation that has a temperature limit of 850 F and shall be covered with an embossed aluminum jacket.

2. One factory piped blending pump (this section is to be used if one blending pump is being specified, please contact your local Superior Boiler Distributor for guidance), piped between the boiler water supply and water return nozzle. The piping shall not interfere with performing routine maintenance. The piping will be Schedule 40 and will include a flow switch wired into the burner control circuit that will prevent the burner from operating unless circulation in the blending pump piping is proved. Two gate valves, one on each side of the pump, are to be integral with the piping.

END OF SECTION