

Electric Boilers

Hot Water - Minke

Sample Specification

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SECTION 235212 – HOT WATER ELECTRIC BOILERS

Part 1 – GENERAL

Section includes electric boilers, trim, and accessories for generating hot water.

1.1 SUBMITTALS

- A. Product Data
 - 1. Include details of equipment assemblies.
 - 2. Include diagram(s) for dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagram(s) for power, signal, and control wiring.
 - a. Factory wiring and field wiring by others clearly identified.
 - b. Detailed descriptions and labels for power, signal, and control system wiring.
- B. Field quality-control reports
- C. Boiler Manufacturer's Certification:
 - 1. ASME Stamp on the boiler vessel.
 - 2. cULus packaged boiler label affixed to the control panel.

1.2 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Manufacturer's printed operation and maintenance manuals shall be submitted prior to final acceptance by the engineer. Operation and maintenance manuals shall contain, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, etc.
- B. Manufacturer's data reports.
 - 1. Form H-2.
 - 2. ASME CSD-1 certification.
 - 3. Factory Acceptance Test Report.
 - 4. Source quality-control.
- C. Start-up reports.
 - 1. The specified factory tests have been satisfactorily performed.
 - 2. The specified field tests have been satisfactorily performed.
 - a. The boiler and other associated mechanical and electrical equipment are properly coordinated and integrated to provide a complete and operable boiler package.

1.3 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or provide replacement components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty period
 - a. The pressure vessel shall be warranted against defective workmanship and materials for a period of one (1) year warranty from startup and (18) months from shipment. This warranty does not include issues caused by improper water treatment or incorrect use and/or abuse of the boiler.

- b. Heating elements shall be warranted against defective workmanship and materials for a period of one (1) year warranty from startup and (18) months from shipment. This warranty does not include issues caused by improper water treatment or incorrect use and/or abuse of the boiler.
- c. All parts not covered by the above shall carry a one (1) year warranty from startup and (18) months from shipment.

1.4 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 1. "National Electrical Code," Article 424, Part VII.
- B. ASME Compliance: Fabricate and label boilers to comply with the current version of the ASME Boiler and Pressure Vessel Code, Section IV.
- C. UL Compliance: Test boilers for compliance with UL 834. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- D. Boiler and controls shall be compliant with ASME CSD-1 Code requirements.
- E. For securing boiler to concrete base.
 - 1. Seismic Fabrication Requirements: Attach a base skid to any boiler pressure vessel, accessories, and components. Boiler manufacturer shall provide anchoring pockets in boiler skid base. Contractor shall anchor boilers to meet specification requirements.

Part 2 – PRODUCTS

2.1 ELECTRIC BOILER

- A. Manufacturers:
 - 1. Precision Boilers – Minke Series (Basis of Design)
 - 2. Vapor - HWR
 - 3. Lochinvar – BW Series
- B. Description: Each unit shall be a complete boiler with automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested and properly packaged for shipping. Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum working pressure of 160 PSIG.

Boiler shall be a vertical pressure vessel design consistent with Precision Minke Series construction. Pressure Vessel:

- 1. Vertical carbon steel with welded heads and flanged element insertion openings.
 - 2. The boiler shall have one supply connection and one return water connection. The supply and return connections shall be positioned so that water flow cannot short circuit heating elements.
- D. Casing:
 - 1. Jacket: 16 gauge metal wrapped casing.
 - 2. Control compartment enclosures: NEMA 250, Type 1A.

3. Finish: Powder Coat.
4. Insulation: Minimum four (4) inch thick fiberglass blanket insulation having minimum 1-1/2 lbft³ density surrounding the pressure vessel. Radiation and convection losses shall not exceed 0.5% of total boiler output.

2.2 HEATING ELEMENTS

- A. The heating elements shall be individually field replaceable with standard tools.
 1. Heating elements shall be mounted on circular flanges for convenient inspection.
 2. Heating elements shall be secured using torqued ferrule fittings.
- B. The heating elements watt density shall not exceed 75 watts per square inch.
- C. The heating elements shall be Incoloy 800 sheathed.
- D. The heating elements length shall not exceed 42 inches.

2.3 TRIM

- A. Safety valve(s) shall be ASME Section IV approved side outlet type. Size shall be in accordance with code requirements and set to open at specified pressure or maximum allowable boiler pressure.
- B. Pressure gauge.
- C. Thermometer.
- D. Solid state low water cut-off probe control with manual reset and test switch.
- E. Status lights for power on, low water cutoff, step status for each step.
- F. Alarm buzzer (electronic sounder)

2.4 CONTROLS

- A. All controls to be panel mounted and located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.
- B. When multiple boilers are to be installed together, an optional system integration control can be provided to stage up to eight (8) boilers using a separate boiler lead-lag panel.
 1. The control shall include automatic selection of needed boilers based on load demand. The control shall monitor local boiler water temperature using an Ethernet connection.
- C. Boilers controls shall communicate with [Watlow] [BACnet I/P] [BACnet MSTP] [LONWorks] [ModBus TCP/IP] [ModBus RTU] building management system utilizing a protocol translator for requirements other than the native ModBus RTU.
 1. Protocol translator mounted in a NEMA 1 panel with power supply and terminals.
 2. Protocol translator shipped loose for installation in boiler control panel with required power supply.
- D. The boiler controls shall include provisions for [outside air reset] [remote setpoint].
- E. Include provisions for shutting down the boiler on loss of system pump signal.
- F. Include a flow switch and provisions for indication of loss of flow.
 1. Mount flow switch to the boiler return nozzle
- G. Step control capabilities shall include:

1. Steps: (1) solid state electronic proportional temperature control with progressive step control, adjustable span, and interstage time delay.
 - a. Temperature and set-point temperature shall be displayed at all times. A supply water temperature transmitter shall be provided and wired to the PID process controller.
 - b. Control shall be equipped with an optional touchscreen display for set up, trouble shooting, and operational display, and shall include ModBus communication capability.
 - c. Control shall include the programming to control of up to two heating demand loops.
 - d. Set-points and configurations shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions and to be configured at the time of initial jobsite operation.
2. Silicon controlled rectifier (SCR) control (Optional)

2.5 ELECTRICAL POWER

- A. Electrical power supply shall be [480][600] volts, [60] cycle three phase.
- B. Main lugs for supply circuits.
 1. Mechanical lugs bolted to copper bus bars or distributions blocks with pressure connectors.
 2. Panel electrical short circuit current rating (SCCR) shall be 100,000 amps interrupting current. The rating contingent on installed OCPD upstream, per NEC
- C. Fused 120V control circuit transformer.
- D. Supplemental internal branch circuit fuses, current limiting, non-renewable, rated at 200,000 amps interrupting capacity.
- E. Magnetic contactors rated at 500,000 cycles, 80A resistive up to 600V.
- F. Housed in NEMA 250, Type 1 enclosure with louvers.
- G. Wiring shall be numbered and color coded to match a wiring diagram.
 1. Install factory wiring outside of an enclosure in a metal raceway or conduit.
 2. Minimum heating element wire size shall be #8 AWG.
 3. Minimum control circuit wire size shall be #16 AWG.

2.6 QUALITY CONTROL

- A. Hydrostatic Test: Factory to perform a functional controls test for all safety devices; perform hydrostatic test; and continuity test for contactors and relays.
- B. Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.
- C. All wiring shall be in compliance with the National Electric Code.

Part 3 – EXECUTION

3.1 BOILER INSTALLATION

- A. Installation shall be provided by the contractor in accordance with the requirements of the codes specified hereinbefore. All of the contractor's work shall be performed by experienced personnel previously engaged in boiler plant construction and shall be under the supervision of a qualified installation supervisor.
- B. Equipment Installation:
 - 1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases.
 - 2. Comply with requirements for seismic-restraint devices.
 - 3. Install equipment in strict compliance with manufacturer's installation instructions.
 - 4. Install equipment in strict compliance with state and local codes and applicable NFPA standards.
 - 5. Maintain manufacturer's recommended clearances around sides and over top of equipment.
 - 6. Install components that were removed from equipment for shipping purposes.
 - 7. Install components that were furnished loose with equipment for field installation.
 - 8. Provide all interconnecting electrical control and power wiring.
 - 9. Provide all piping for boiler pipe connections.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other 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 if required.
- D. Connect hot-water piping to supply and return boiler tapplings with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to nearest floor drain or point of safe discharge.
- F. Ground equipment according to specification requirements.
- G. Connect wiring according to specification requirements.

3.3 FIELD QUALITY CONTROL

- A. General: The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. All labor, equipment, and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.
- B. Equipment inspection: Boiler representative shall inspect boilers and other equipment upon arrival, verifying completeness of equipment supplied and potential damages. All shipped loose components, to be mounted and installed on boiler by contractor.
- C. Equipment shall be flushed prior to start-up per the water treatment company guidelines and product installation manual requirements.

- D. Pre start-up walk through: Boiler representative shall review the installation with the mechanical contractor prior to start-up and note any required changes prior to start-up.
- E. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:
- F. Demonstrate that boiler, controls, and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.
- G. Demonstrate that boiler performs at different rates of load to ensure progressive step controller function.
- H. Auxiliary Equipment and Accessories: Observe and check all valves, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non-compliance with referenced standards or overloading as applicable.
- I. Commissioning Requirements:
 - 1. Set up operating set points
 - 2. Set up modulating process controller
 - 3. Check all safeties, including low water cutoff and high limits.
 - 4. Check heating elements for moisture accumulation.

3.4 DEMONSTRATION

- A. Training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures. Training to be provided in a single 2 hour continuous session to accommodate operator's availability on site.

END OF SECTION 235212