23 53 00

**HEATING BOILER FEEDWATER EQUIPMENT**

**BASED ON DFD MASTER SPECIFICATION DATED 10/1/2012**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

**PART 1 ‑ GENERAL**

**Scope**

This section includes specifications for hot water and steam heating equipment. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Reference Standards

Quality Assurance

Submittals

Operation and Maintenance Data

PART 2 - PRODUCTS

Deaerator

Condensate Receiver Tank and Feedwater Pump Assembly

Part 3 - Execution

Installation

Deaerator Assembly

Construction Verification Items

Functional Performance Testing

Agency Training

**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 23 21 13 – Hydronic Piping

Section 23 05 23 – General Duty Valves for HVAC Piping

Section 23 51 00 – Breeching, Chimneys and Stacks

Section 26 29 00 – Low Voltage Controllers

**REFERENCE**

Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

NFPA 70 Electrical wiring and devices

National Electric Code

**QUALITY ASSURANCE**

Refer to division 1, General Conditions, Equals and Substitutions

**SUBMITTALS**

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, and material of construction, ratings, weights, manufacturer's installation requirements and performance limitations.

Submit manufacturer's installation instructions including required clearance to combustible materials.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

***Delete the following if there are no additional requirements.***

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. ***[A/E and commissioning provider to define detailed operation and maintenance data requirements for equipment specifications added to this section.]***

**PART 2 ‑ PRODUCTS**

**DEAERATOR**

Spray type, horizontal, packaged, two‑tank design as manufactured by Cleaver Brooks, BFS Industries, Burnham or Industrial Steam.

Provide unit with capacity and operating characteristics indicated on schedules.

Guarantee oxygen removal to not more than .005 cc/liter in effluent by recognized test method throughout all load conditions from 5% to 100%.

Deaerator shall be designed for operation at 5 psig, but shall be suitable for use from 2 to 15 psig.

Deaerator tank shall have minimum of \_\_\_ minutes of storage and have capacity of **\_\_\_** gallons measured to overflow.

Surge tank shall have minimum of \_\_\_ minutes of storage and have capacity of \_\_\_ gallons measured to overflow.

Approximately \_\_\_ % of load shall be make‑up at 40°F and \_\_\_\_ % low pressure returns at 180°F. Amount of direct high pressure returns is negligible.

Deaerator Assembly:

Two‑tank or single split-tank design consisting of deaerating section and surge section constructed in accordance with the latest ASME Code for 50 psig working pressure. Minimum tank wall thickness shall be 0.25". ASME stamp and certification shall be required.

Deaerator tank shall be \_\_\_ diameter x \_\_\_\_ straight shell length. Surge tank shall be \_\_\_diameter x \_\_\_\_ straight shell length.

Entire deaerator package shall be maximum of \_\_\_ feet long and \_\_\_ feet wide.

Each tank section shall be furnished with a manhole for access.

Deaerator shall be designed as pressurized vessel with orifice vent for free release of non-condensible gases.

Deaerator shall be of such configuration as to allow all maintenance to be performed from front and sides of unit, allowing rear of unit to be placed against wall.

Deaeration shall be through pressurized brass or wrought iron manifold, equipped with stainless steel spray nozzles.

Steel interior of surge tank and vent condenser and all internal surfaces which come in contact with undeaerated water shall be completely protected with baked on epoxy or baked‑on phenolic lining. Apply lining to sandblasted white metal surface with 4 to 6 coats for a total thickness of 6 mils dry minimum. Bake and test each coat using Holiday Spark Testing method to assure uniform coating free of pinholes. Lining shall be suitable for temperature up to 250ºF.

Temperature Control System:

Provide inline heat exchanger between transfer pumps and deaerator spray nozzles or provide direct steam injection heater in deaerator tank.

System shall have capacity to raise **\_\_\_** gpm from \_\_\_ºF to 220ºF with \_\_\_ psig steam supply pressure at regulator. Furnish pressure regulator and control valve or combination pressure ‑ temperature regulator on steam inlet with stainless steel trim, dead end shut off capability, and shall be responsive to 2ºF temperature change. Assembly shall also include” stainless steel dial temperature gauge, all interconnecting piping, drainage means, steam strainer, and heavy duty pressure gauges.

Equip deaerating heater with manual and automatic vent valve \_\_\_ outlet size to vent non-condensible gases to atmosphere. Connect this vent to \_\_\_ vent line from surge tank.

Deaerating section of heater shall be of all stainless steel construction.

Furnish make‑up water assembly to pass required amount of water at \_\_\_ psig maximum inlet water pressure.

Furnish manufacturer's standard make‑up water assembly for surge tank and remote valve to pass \_\_\_ gpm at \_\_\_ psig water pressure. Provide by‑pass line with globe valve.

Furnish deaerating heater with properly sized overflow drain, Fisher No. 38.

Provide 2" thick, 7 lb/ft3 density fiber glass insulation to the exterior of the deaerating and surge tanks, applied at factory with minimum 22 gauge steel jacket spray coated with one coat of heat resistant enamel prior to shipment.

Insulate deaerator assembly after installation as specified in Section 15250B ‑ INSULATION.

***Choose one of the above two paragraphs.***

Pump Assembly:

Furnish two bronze fitted, close‑coupled centrifugal transfer pumps equipped with mechanical seal suitable for temperatures encountered. Size each pump to accommodate transfer load. Each pump shall be driven by \_\_\_ HP, [208] [480] volt, 3 phase, 60 hertz drip‑proof motor. Equip transfer pumps with suction and discharge shut‑off valve, discharge pressure gauges and non‑slam union check valves.

One pump will be of standby use. Provide pump selector switch. Selected pump shall operate continuously with by-pass orifice.

Where required, provide external, direct contact type vent condenser mounted on top of surge tank with mechanical jet or electrical circulating pump and pressure gauge. Condenser shall have lined interior with stainless steel distributing plate. Vent condenser shall have unrestricted vent for free release of non-condensible gases.

Furnish two boiler feed pumps having capacity of \_\_\_ gpm at \_\_\_ feet total discharge head. Pumps shall have 250ºF mechanical seals. Pumps shall not cavitate nor overload driving motor beyond nameplate rating. Pumps shall have low NPSH requirement which shall not be exceeded at any time during normal operation.

One pump will be of standby use. Selection of standby pump shall be manual. Standby pump shall be piped to be able to feed either boiler thru piping/valve arrangement.

Provide selection switch to manually change normal interlocking between boiler feed pumps to associated boiler level controller to standby pump to each boiler level controller.

Provide performance curves for each pump. Select pumps to operate near point of maximum efficiency.

Pumps shall have iron casing, replaceable shaft sleeve, bronze enclosed impeller and stainless steel shaft.

Pumps shall be mounted on heavy duty channel base and shall be complete with suction shut‑off valve and flexible connector on suction and non-slam check valve and dial type pressure gauge with recalibrator feature, siphon pipe and tee cock on discharge.

Driving motors shall be maximum of \_\_\_ HP at [208] [480] volt, 3 phase, 60 hertz, 1750 or 3500 rpm.

Deaerator manufacturer shall guarantee pumping system for 5 years excluding parts of normal wear. Guarantee that pumps will retain 85% of their capacity after 5 years of operation. Provide space for addition of one future feedwater pump.

Furnish NEMA 1 control panel mounted on deaerator package.

Control panel shall contain necessary magnetic motor starters with 3 phase overload protection, indicating lights, relays, alarms, terminal block, fused disconnect switches with external operating handles, control circuit transformer of adequate size, control power switch, and other necessary controls.

Deaerator package shall require only one power connection at [208] [480] volt, 3 phase 60 hertz.

All of above shall be factory internally wired and tested in accordance with provisions of National Electrical Code.

Provide ON‑OFF‑AUTO switches for each pump and provide necessary switches for feedwater pumps to allow any one boiler interlock to operate any one of 2 boiler feed pumps.

Provide the following accessories for deaerator assembly.

ASME safety valve. Set at manufacturer's recommended pressure.

Manhole for each tank.

Safety‑type water gauge set for each tank.

3" dial stainless steel temperature gauge for each tank.

High and low level alarm for deaerator section.

Low level alarm for surge section.

Alarm silencers.

Contacts for remote alarm indication.

Provisions for high pressure condensate.

Provide gauge panel suitable for six 4‑1/2" pressure dial indicators and two 4‑1/2" temperature dial indicators with indicating range as follows. Dial indicators shall be flush mounted with corrosion proof cases. Temperature units shall have stainless steel tank wells.

Pressure gauges:

(4) 0‑60 psig: Boiler feed

(1) 0‑60 psig: Transfer discharge header

(1) 0‑30 psig: Deaerator tank

Temperature gauges:

(1) 0‑300ºF: Deaerator tank

(1) 0‑300ºF: Surge tank

***Cooordinate below with Section 15540B - Condensate pumps***

**CONDENSATE RECEIVER TANK AND FEEDWATER PUMP ASSEMBLY**

Manufacturers: Aurora, Burnham, Cleaver‑Brooks, Domestic, Shipco, Sterling or Roth.

Two standard fitted (1750)(3450) rpm (centrifugal)(turbine) pumps certified by manufacturer for minimum of \_\_\_ gpm at 212ºF water at \_\_\_ psi. Guarantee pumps for one year against defects in workmanship and material and for 10 years against shaft breakage. Drip proof motors, 3 phase [208] [480] volt current. Motors shall not be loaded into NEMA service factor.

Pumps to be equipped with mechanical seals rated for up to 225ºF.

One non‑code welded steel receiver with minimum wall thickness of 1/4" up thru tank diameter 48" and 3/8" over 48" diameter, integral supports and connection for inlet, outlet, drain, vent, float operated automatic make‑up valve, thermometer, pressure gauge and sight gauge glass. Receiver to be \_\_\_ inches diameter by \_\_\_ inches long with \_\_\_ gallon capacity.

Furnish unit with factory assembled suction piping between receiver and each pump with expansion type elbow and strainer with stainless steel screen and pump suction isolation valve.

Provide steam preheat system consisting of stainless steel perforated diffuser tube, combination pressure-temperature steam regulating valve, strainer for regulating valve, pressure gauge, and temperature sensor with heating capacity as necessary to maintain feedwater temperature at 200ºF, adjustable.

Unit to be furnished with magnetic starters with overload and undervoltage protection, mounted and wired in NEMA 1 enclosure with reset buttons and hand-off-automatic switches mounted on outside surface of enclosure.

**PART 3 ‑ EXECUTION**

**INSTALLATION**

Install units as shown on plans, as detailed, and according to manufacturer's installation instructions.

Set units on concrete housekeeping pads.

Install all items shipped loose by equipment manufacturer under supervision of equipment manufacturer's field service personnel.

**BOILER BLOW DOWN SEPARATORS**

Install separators on structural steel framework as shown. Extend vent line to atmosphere.

Install aftercooler, valves, piping specialties and associated piping including cold water piping from branch pipe provided by Plumbing Contractor.

# CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 or 01 91 02 in accordance with the procedures defined for construction verification checklists.

# FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for utilizing the functional performance test procedures supplied under specification Section 01 91 01 or 01 91 02 in accordance with the procedures defined for functional performance test procedures.

# AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of [XX] hours.

END OF SECTION