

Part 1 General**1.1 DEFINITIONS**

- .1 This section includes packaged, factory-assembled deaerator and condensate tank.
- .2 Boiler Feed Water Pump: Pump that moves feedwater from the deaerator to the boiler.
- .3 Condensate Transfer Pump: Pump that moves feedwater from the condensate tank or surge tank to the deaerator.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for heating boilers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
 - .2 Indicate on drawings:
 - .1 General arrangement showing terminal points, instrumentation test connections.
 - .2 Clearances for operation, maintenance, servicing
 - .3 Design calculations: Tank thickness calculation, calculate requirements for selecting vibration isolators and seismic restraints and for designing deaerator bases.
 - .4 Foundations with loadings, anchor bolt arrangements.
 - .5 Piping hook-ups.
 - .6 Equipment electrical drawings.
 - .7 Wiring diagram
 - .8 Drawings are to be in form of a database compatible with AutoCAD version 2010.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:

- .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for deaerator for incorporation into manual.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.
- .2 ASME Compliance: ASME section VIII pressure vessel code

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra materials:
 - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Gasket: Furnish one replacement gasket for each gasketed opening.
 - .2 Gage glass: Furnish one replacement glass for each gage glass.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect boiler and equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 00 10 – General Instructions.

Part 2 Products

2.1 CONDENSATE TANK/SURGE TANK AND CONDENSATE TRANSFER PUMP

- .1 Furnish and install according to drawings and manufacturer's instructions the quantity of Surge Tank. Each unit shall consist of (1) steel receiver with a quantity of (2) transfer pumps, electrical controls and accessories.
- .2 The receiver shall be of welded black steel construction minimum 5mm thick, elevated to meet the NPSH requirements of the condensate pumps, horizontal with convex flanged and dished heads, supported by a structural steel frame and have a capacity as shown below. The receiver shall be equipped with the following: (1) water level gauge, (1) dial thermometer, (1) modulating make-up water assembly, (1) low water cut-off float switch and (1) magnesium anode. A suction isolation valve shall be installed in the suction piping between the receiver and pump plus a valve in each bleed line will be installed for maintenance to permit servicing the pumps without draining the receiver.
- .3 All controls switches and valves to have a NEMA 4 rating.
- .4 Condensate tank shall be assembled at the factory and disassembled for shipment re-assembly at site.
- .5 Provide two (2) Water Level Alarms using a radar type capacitance continuous level measurement probe i. High-Level Alarm - NEMA 4. The limit set shall provide a signal on rise and break on falling. ii. Low-Level Alarm - NEMA 4. The limit set shall provide a signal on fall and break on rise.
- .6 High level probe, Low level contact, Low Low level contact.
- .7 A modulating water transfer assembly shall be installed on the receiver. The assembly shall consist of a Digital PID controller, transmitter and electric modulating make-up valve with a three-valve manual bypass and wye strainer. The capacity of the electric modulating make-up valve shall be equal to 100% of the load with a 137.9 kPa drop across the valve. Transfer assembly will also send 4-20mA signals remotely as needed as well as alarms.
- .8 The transfer pumps shall be flange mounted on the receiver suction piping. The pump shall be close coupled vertical design, and shall have a cast bronze impeller that is bronze fitted to the cast iron pump housing with a renewable bronze wearing ring. The mechanical seal shall be rated for 250°F service. The entire pump assembly shall be permanently aligned and dynamically balanced to deliver its full rated capacity. The pump shall be driven by an industry standard motor available "off the shelf." The motor shall have a NEMA standard shaft. The horsepower and electrical characteristics shall be as shown on the drawings.
- .9 The manufacturer shall furnish a certified pump performance test. The pump manufacturer shall furnish complete elementary and connection wiring diagrams and installation and operation instructions.
- .10 The entire pump package will be U.L.C. labeled when a control panel is furnished.
- .11 The unit manufacturer shall furnish, mount on the pump unit, and wire a NEMA 2 control cabinet with piano hinged door, enclosing the following:

- 2 Combination magnetic starters (having 2 overload relays) with circuit breakers and cover interlocks.
 - 2 “Auto-Off-Standby” selector switches.
 - 2 Pump running pilot lights.
 - 1 Control Circuit disconnect switch.
 - 1 Numbered terminal block.
 - 1 Fused control circuit transformer when the motor voltage exceeds 130 volts.
 - 2 Momentary contact “test” push buttons.
- .12 The Pumps must run continuously feeding the transfer valve on the Deaerator.
- Receiver Tank: 2271 Liter, 1.22 m dia. x 2.44 m shell length x 5 mm thick steel elevated 1.8 m
- Condensate Transfer Pump: 2 number of Condensate Transfer pumps each rated 3.98 l/s @ 242 kPa with 2.2 kw and 1800 RPM and Motor Enclosure of TEFC;
- Supply electrical characteristics: 575 volts, 3 phase, 60 cycles
- Control voltage: 115 volts, 1 phase, 60 cycles
- Water supply pressure: 415 kPa (g)

2.2 DEAERATOR AND BOILER FEED PUMP

- .1 Furnish and install according to drawings and manufacturer's instructions the quantity of Deaerating boiler feed units as shown on the drawings. Unit shall have a capacity of 14100 kg of steam per hour. The system shall be spray type two tank design and guarantee oxygen removal to not more than 7 ppb in the effluent throughout all load conditions between 5 and 100%. The deaerator shall be designed for operation at 34.5 kPag, but suitable for use from 13.8 to 103.5 kPag. Atmospheric operating designs are not acceptable. Each unit shall consist of (1) steel receiver with a quantity of (3) boiler feed pumps, (2) direct injection steam heating assemblies, (1) spray manifold in a 300 Series stainless steel spray box or Spiral Jet Design - spray nozzle or at least one spring operated spray nozzle. The DA Head shall be protected against the corrosion by a stainless-steel liner screen to avoid contact of non-de-aerated water with carbon steel parts, (1) modulating make-up assembly, electrical controls and accessories.
- .2 The boiler feed receiver shall be of welded steel construction, elevated to meet the NPSH requirements of the boiler feed pumps (with 1 m of safety factor), horizontal with convex flanged and dished heads. The receiver shall be constructed of ASTM A285 Grade C steel, ASME Code and CRN registered Stamped for 350 kPaG with 1.6 mm corrosion allowance added, supported by separable frame of steel tubing and have a capacity as shown above. The boiler feed receiver shall be equipped with the following: (1) top and bottom shut-off water level gauge with automatic shut-off if glass is broken, (1) dial thermometer with separable well, isolation valves between receiver and each pump plus a valve in each bleed line installed for maintenance, (1) manhole for tank inspection, (1) stainless steel chemical feed quill, (1) sampling valve, (1) overflow drainer, (1) full size relief valve to relieve full capacity of the regulators, externally mounted low water cut-off switch. A suction isolation valve and an expansion coupling shall be installed in the suction piping between the receiver and the pump(s) to permit servicing the pump(s) without draining the receiver. A liquid filled discharge pressure gauge with snubbers shall be provided for each pump.
- .3 All controls switches and valves to have a NEMA 4 rating.
- .4 Provide vent valve and two vacuum breakers.
- .5 Deaerator shall be assembled at the factory and disassembled for shipment re-assembly at site.
- .6 A 300 Series stainless steel deaeration spray box with integral cascade trays containing a spray manifold with stainless steel spray manifold and nozzles shall be flange mounted to the boiler feed receiver. A dial thermometer and a pressure gauge shall be an integral part of the manifold assembly.
- .7 A modulating water transfer assembly shall be installed on the receiver. The assembly shall consist of a Digital PID controller, transmitter and electric modulating make-up valve with a three-valve manual bypass. The capacity of the electric modulating make-up valve shall be equal to 100% of the load with a 137.9 kPa drop across the valve. Transfer assembly will also send 4-20mA signals remotely as needed as well as alarms.
- .8 A magnesium anode shall be mounted on the receiver to inhibit electrolytic corrosion and shall be mounted in 1 1/4" removable plug. Internal tank linings would not be accepted.

- .9 Two direct injection steam heating assemblies shall be installed in the receiver. The deaeration assembly and the sustaining assembly shall consist of a double flange mounted stainless steel injection pipe, (2) loosely shipped steam pressure reducing valves, and (1) compound gauge for measuring vacuum or pressure gauge on unit. The heating assemblies shall be sized for the capacities and locations as shown on the drawings.
- .10 The vertical multi-stage boiler feed pumps shall be mounted on the receiver suction piping. The pump shall be a multi-stage cast iron construction with stainless steel trim. The impeller(s) shall be stainless steel for long life and durability. The pump shall be flexible coupled permanently aligned with a C-face motor connected to the bearing housing which is C-face connected to the pump. The bearing frame shall be designed with grease fittings for bearing lubrication. Bearings shall be extra heavy ball type with high temperature grease. The pump suction flange shall be an ASA design. The pump discharge shall be also be an ASA flange design. The Silicon Carbide/ Viton seal shall be rated for 300°F service. The pump shall have a NEMA standard shaft. The horsepower and electrical characteristics shall be as shown below.
- .11 The manufacturer shall furnish a certified pump performance and NPSH test. The pump manufacturer shall furnish complete elementary and connection wiring diagrams and installation and operation instructions.
- .12 The entire pump package will be U.L.C. labeled when a control panel is furnished.
- .13 The unit manufacturer shall furnish, mount on the pump unit, and wire a NEMA 2 control cabinet with piano hinged door, enclosing the following:
- 3 Combination magnetic starters (having 3 overload relays) with circuit breakers and cover interlocks.
 - 3 "Auto-Off-Continuous" selector switches.
 - 3 Pump running pilot lights.
 - 1 Control Circuit disconnect switch.
 - 1 Numbered terminal block.
 - 1 Fused control circuit transformer when the motor voltage exceeds 130 volts.
 - 3 Momentary contact "test" push buttons.
- .14 Furnish and install according to drawings and manufacturer's instructions the quantity of (1) Logic Control System, electrical controls and accessories.
- .15 Deaerator and Condensate tank control panels shall be interconnected and interlocked by the unit manufacturer.
- .16 Nema 4x, 10" Color Touch Screen Logic Controller will contain: Live Graphical and Numeric indication for constant water level and temperature. Operate modulating make-up valve based on water level.
- Failure indication and protection as follows:
- High high water alarm point indicates overflow condition
- High water alarm point quickens response time
- Low water alarm point quickens response time
- Low water alarm point indicates make-up failures

Low water cut-off point protects pumps from running dry

High Temperature alarm point indicates trap or preheat assembly failure

Low Temperature alarm point indicates preheat assembly failure

Alarm log automatically logs any irregular operating conditions

Loss of any sensor signal indicator

- .17 BacNet IP and BACnet MSTP communicate protocols with remote control override capability with shield wiring of 24 volt circuits.
- .18 A Nema 4x level and temperature transmitter needs to be used in lieu of float switches for alarm points, cut-off, plus standard make-up to achieve the full potential of the Logic Control System along with a temperature transmitter for data collection and maximum benefit.
- .19 Provide one differential level transmitter to provide control to a complete electric makeup control valve, mounted, piped and wired on the deaerator.
- .20 High level probe, Low level contact, Low Low level contact.
- .21 Control cabinet shall contain U.L.C. listed or recognized components. Control cabinet shall be listed and labeled by Underwriter's Laboratory.
- .22 Wiring between boiler level control switches to deaerator control panel is the responsibility of the installing contractor. Contractor shall retain the service of existing controls contractor to perform the work.
- .23 The unit shall be factory tested as a complete unit and a certified test report of pump characteristics produced, which shall be submitted prior to shipment. The unit manufacturer shall furnish complete elementary and connection wiring diagrams, piping diagrams, and installation and operation instructions.

Deaerator: 14100 kg/Hr ; Receiver: 2271 net liter, 1.22 m dia. x 2.75 m shell length elevated 2.4 m,
Tag no.: DA-01

Quantity: 3 boiler feed pumps each rated 2.65 l/s@ 1345 kPa with 5.5 kw
and Motor Enclosure of TEFC; 1800 RPM; Tag no.: BFP-01, BFP-02, BFP-03

Supply electrical characteristics: 575 volts, 3 phase, 60 cycles, Motor Enclosure TEFC

Control voltage: 115 volts, 1 phase, 60 cycles ;

Steam heating assemblies sized to heat 3.97 l/s from 65 °C to 109 °C with 690 kPag steam supply pressure

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heating boiler installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

- .1 Install in accordance with ASME Boiler and Pressure Vessels Code, regulations having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by the manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Install units on a flat surface.
- .5 Coordinate all power requirements with equipment supplier
- .6 Provide components furnished as per manufacturer's literature.
- .7 Provide all piping so the supplied equipments are serviceable, without having to dismantle excessive lengths of pipe.
- .8 Provide valves in water piping upstream and downstream of the pumps for maintenance and to balance and trim the system.
- .9 Provide drain valves and vent cocks to each water connection.
- .10 Provide certified wiring schematics to the electrical division for the condensate pump, boiler feed pump and associated equipment and controls.
- .11 Provide all necessary control wiring as recommended by the manufacturer.

3.4 MOUNTINGS AND ACCESSORIES

- .1 Safety valves and relief valves:
 - .1 Run separate discharge from each valve.

- .2 Terminate discharge pipe as indicated.
- .3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.
- .2 Blowdown valves:
 - .1 Run discharge to terminate as indicated.

3.5 FIELD QUALITY CONTROL

- .1 Commissioning:
 - .1 Manufacturer to:
 - .1 Certify installation.
 - .2 Start up and commission installation.
 - .3 Carry out on-site performance verification tests.
 - .4 Demonstrate operation and maintenance.
 - .2 Provide Departmental Representative at least 24 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION