Part 1 General

1.1 SECTION INCLUDES

.1 Material, equipment, installation and start-up for hot water heating pumps PU-1, PU-2, PU-3 & PU-4 and associated triple duty valves and suction diffusers.

.2 Materials, equipment, installation and start up for boiler circulation pump PU-5 & PU-6.

1.2 REFERENCES

.1 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-B214, Installation Code for Hydronic Heating Systems.

.3 National Electrical Manufacturers Association (NEMA).

.1 NEMA MG 1, Motors and Generators.

1.3 SUBMITTALS

.1 Submit shop drawings and product data.

.2 Submit product data of pump curves for review showing point of operation.

.3 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

.4 Provide maintenance data for incorporation into O & M manuals.

1.4 EXTRA MATERIALS

.1 Provide additional maintenance materials.

.2 Provide one spare seal for each pump provided by this Section.

Part 2 Products

2.1 HOT WATER HEATING CIRCULATION PUMPS, PU-1 TO PU-4:

.1 Performance: Refer to schedule at end of specification

.2 The pumps shall be long coupled, base mounted, single stage, end suction, vertical split case design, in cast iron bronze fitted construction specifically designed for quiet operation. Suitable standard operations at 225° F and 175 PSIG working pressure. The pump internals shall be capable of being services without disturbing piping connections, electrical motor connections or pump to motor alignment.

.3 The pumps shall be composed of three separable components a motor, bearing assembly, and pump end. The motor shaft shall be connected to the pump shaft via a replaceable flexible couple.

.4 A bearing assembly shall support the shaft via two heavy-duty regreaseable ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreaseable without removal of the bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.

.5 The bearing assembly shall have a solid steel shaft. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.

.6 Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Seal assembly shall have a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.

.7 Bearing assembly shaft shall connect to a bronze impeller. Impeller shall be both hydraulically and dynamically balanced to relevant standards and keyed to the shaft and secured by a stainless steel locking cap screw or nut.

.8 Pump should be designed for access to the pump's working components, without disturbing motor or piping, for ease of maintenance.

.9 A center drop-out type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps shall be fitted with a suitable coupler sleeve for variable speed application. Coupler shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. The coupler sleeve should be constructed of an EPDM material to maximize performance life.

.10 An ANSI and OSHA rated coupler guard shall shield the coupler during operation. Coupler guard shall be dual rated ANSI B15.1, Section 8 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling. No more than 7 mm of either rotating assembly shall be visible beyond the coupling guard.

.11 Pump volute shall be of a cast iron design for heating systems with integrally cast pedestal volute support, rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges. Volute shall include gauge ports at nozzles, and vent and drain ports.

.12 Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92. **Motors to be compatible for use of vfd.**

.13 Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.4.

.14 Pump shall be of a maintainable design and shall use machine fit parts.

.15 The pump vibration limits shall conform to Hydraulic Institute ANSI/HI 1.1-1.5 for recommended acceptable unfiltered field vibration limits for pumps with rolling contact bearings.

.16 Each pump shall be factory tested and name-plated before shipment.

.17 Pump shall conform to ANSI/HI 9.6.3.1 standard for Preferred Operating Region. The pump NPSH shall confirm to the ANSI/HI 9.6.1 standards for Centrifugal and Vertical Pumps for NPSH Margin.

.18 Provide a minimum One (1) year warranty on materials and installation under provision of Section 15010.

.19 Acceptable Product: "Bell & Gossett" or approved equivalent in accordance with B6. See schedule below for model number.

Equipment No.	Flowrate L/s (gpm)	Head kPa (ft)	Voltage	BHP	Motor HP	Efficiency %	Connections		RPM	Series/ Model
							Suction mm (in.)	Discharge mm (in.)		
PU-1	14.7 (233)	200 (67)	208/3/60	5.2	7.5	75.87	75 (3)	63 (2.5)	1750	1510 / 2-1/2BB
PU-2	14.7 (233)	200 (67)	208/3/60	5.2	7.5	75.87	75 (3)	63 (2.5)	1750	1510 / 2-1/2BB
PU-3	10.2 (162)	266 (89)	208/3/60	5.14	7.5	70.75	68 (2.5)	50 (2)	1750	1510 / 2BC
PU-4	10.2 (162)	266 (89)	208/3/60	5.14	7.5	70.75	68 (2.5)	50 (2)	1750	1510 / 2BC

2.2 PU-1 & PU-2 TRIPLE DUTY VALVES:

.1 Performance: To match PU-1 and PU-2. Valve to have a pressure loss of approximately 27 kPa (3.9 psi). Pressure loss shall not drop below 10 kPa (1.5 psi) for proper system balancing.

.2 Straight patterned valve to perform functions of a check valve, throttling shut-off valve and calibration balancing valve. Valve shall be heavy-duty cast iron and rated for maximum working pressure of 1207 kPa (175 psig) at 121°C (250°F). Valve shall have a bronze seat, replaceable brass disc with EPDM seat insert, stainless steel stem and chatter-preventing spring and calibrated nameplate. Valve design shall permit repacking under full system pressure. Valve shall be equipped with brass readout valve for taking differential pressure readings across the orifice.

.3 Acceptable Product: "Bell & Gossett" model 3DS-2 1/2S or approved equivalent in accordance with B6.

2.3 PU-3 & PU-4 TRIPLE DUTY VALVES:

.1 Performance: To match PU-1 and PU-2. Valve to have a pressure loss of approximately 13 kPa (1.9 psi). Pressure loss shall not drop below 10 kPa (1.5 psi) for proper system balancing.

.2 Straight patterned valve to perform functions of a check valve, throttling shut-off valve and balancing valve. Valve shall be heavy-duty cast iron and rated for maximum working pressure of 1207 kPa (175 psig) at 121°C (250°F). Valve shall have a bronze seat, replaceable brass disc with EPDM seat insert, stainless steel stem and chatter-preventing spring and calibrated nameplate. Valve design shall permit repacking under full system pressure. Valve shall be equipped with brass readout valve for taking differential pressure readings across the orifice.

.3 Acceptable Product: "Bell & Gossett" model 3DS-2 1/2S or approved equivalent in accordance with B6.

2.4 PU-1 & PU-2 SUCTION DIFFUSERS:

.1 Performance: To match PU-1 and PU-2. Pressure drop at design flow rate is approximately 9 kPa (1.4 psi).

.2 Unit shall consist of angle type body, flanged system connection and pump connection, stainless steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16") diameter for pump protection. Orifice cylinder shall be equipped with disposable fine mesh strainer which shall be removed after system startup.

.3 Acceptable Product: "Bell & Gossett" model ED-3X or approved equivalent in accordance with B6.

2.5 PU-3 & PU-4 SUCTION DIFFUSERS:

.1 Performance: To match PU-1 and PU-2. Pressure drop at design flow rate is approximately 8 kPa (1.1 psi).

.2 Unit shall consist of angle type body, grooved system connection, flanged pump connection, stainless steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16") diameter for pump protection. Orifice cylinder shall be equipped with disposable fine mesh strainer which shall be removed after system startup.

.3 Acceptable Product: "Bell & Gossett" model EC-3X or approved equivalent in accordance with B6.

2.6 PU-5 & PU-6: BOILER CIRCULATION PUMP

.1 Performance: Pump PU-5 shall be selected to match boiler B-1 requirements and pump PU-6 shall be selected to match boiler B-2 requirements. Confirm boiler requirements with vendor prior to submitting shop drawings.

.2 The pumps shall be of the quiet wet rotor in-line design.

.3 The pump housing shall have a stainless steel neck ring to minimize recirculation and increase pump efficiency.

.4 The impellers shall be laser welded stainless to obtain maximum efficiency. Composite material shall not be acceptable. The impellers shall be secured to the shaft with a neck ring and a nut.

.5 The suction and discharge flanges shall be tapped and drilled to allow gauge installation on the pump.

.6 All 3 speed pumps shall have indicator lights for operation indication and trouble shooting

.7 The pumps shall have radial tungsten carbide sleeve bearings for extended life. Metal impregnated carbon radial bearings shall not be acceptable

.8 Pump Construction:

.1	Pump housing:	Cast iron EN-JL-1040 (A 48 Cl 40B)
.2	Impellers, rotor can, rotor cladding,:	304 Stainless Steel

.3	Shaft	303 Stainless Steel
.4	Bearings:	Tungsten Carbide
.5	Axial thrust bearing:	Carbon MY106
.6	Shaft journals/ inner bearings:	Silicon Carbide
.7	O-rings:	EPDM
.8	Bearing plate:	304 Stainless Steel

.9 Each motor shall be of the asynchronous squirrel cage design and tested with the pump as one unit by the same manufacturer

.10 The stator housing shall be made of pressure die cast aluminum. The stator housing shall have 8 drain holes to enable condensed water to escape.

.11 The motor shall be cooled by the pumped fluid. Motor shall be self ventilating. The stator housing shall have nickel plated brass inspection screw. Minimum insulation class for the motors shall be Class F.

.12 The terminal box shall be made of black composite material. Enclosure class shall be IP44.Aluminum terminal boxes shall not be acceptable.

.13 The pump shaft shall be installed horizontally per manufacturer's recommendations. The terminal box shall be located as per manufacturer's recommendations. The system shall be vented out from a higher location from the pump. The required inlet pressure by the pump shall be available at the pump inlet.

.14 Acceptable Product: PU-5 – "Grundfos" model UPS 50-160/2 or approved equivalent in accordance with B6.
PU-6 – "Grundfos" model UPS 50-80/4 or approved equivalent in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Do work in accordance with CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible. If pump is mounted on vertical piping, support in accordance with manufacturer's recommendations.

.3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.4 Check rotation prior to start-up.

.5 Install pressure gauges isolation ball valves and equipment as shown on schematics.

3.2 START-UP

.1 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Run-in pumps for 12 continuous hours.

.5 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.6 Adjust alignment of piping and conduit to ensure true flexibility at all times.

.7 Eliminate cavitation, flashing and air entrainment.

.8 Measure pressure drop across strainer when clean and with flow rates as finally set.

END OF SECTION