METROLINX

Plumbing Equipment Specification

Specification 22 30 00

Revision 02
Date: March 2023

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Metrolinx,

an Agency of the Government of Ontario

Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
Various	Sept. 20, 2018	Revised to coordinate with corresponding specifications.
2.8.2 b	Mar. 2023	Add gas piston for sump pit cover

LIST OF CONTENT

1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Provide plumbing equipment as required, scheduled and specified herein.

1.2. DESIGN REQUIREMENTS

1.2.1. Effluent ejection system pumps.

a) Select pump type based on the expected properties of the fluid to be ejected from the pit (clean, containing solids and abrasive material, containing fibrous material, etc.). Effluent ejection system pump is to be selected as per herein items 1.2.1 to 1.2.11.

b) By default, there will be two pumps in each effluent ejection system, unless otherwise instructed by Metrolinx.

c) Total ejection capacity of the system shall be 130% of the maximum anticipated discharge into the pit.

d) Each pump shall be selected for 65% of the maximum anticipated discharge into the pit. The pump pressure shall be calculated to overcome the hydraulic resistance of the piping (including fittings such as elbows, valves, check valves, etc.) plus the hydrostatic height between the lowest level of the fluid in the pit and the highest point of the discharge pipe.

e) Minimum level of the fluid in the pit shall not drop below the level recommended by the manufacturer to maintain the system primed.

f) Maximum level of the fluid allowed in the pit (alarm level) shall not exceed the invert of the lowest pipe discharging into the pit.

g) Distance between the "Lead Pump ON" and "Pumps OFF" levels shall be such that the volume of water will keep the lead pump running for minimum 1 minute.

h) Distance between "Lead Pump ON" and "Both Pumps ON" shall be sufficiently large to avoid level sensors interference due to fluid turbulence during pumping.

i) Same interference avoidance principle to apply between "Both Pumps ON" and "Alarm" levels.

j) Vent sanitary pits to the ambient in accordance with the code. Minimum vent size to be 75 mm (3").

k) Sanitary pit covers to be gasketed around perimeter.

1.2.2. Design requirements are also based on Part 2 specified requirements of products.

1.3. RELATED WORKS

1.3.1. Section 20 05 05 - Mechanical Work General Instructions.

1.3.2. Section 20 05 10 - Basic Mechanical Materials and Methods.

1.3.3. Section 20 05 40 – Mechanical Work Commissioning.

1.4. REFERENCE STANDARDS

1.4.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.

1.4.2. ANSI Z21.10.3/CSA 4.3 Gas Water Heaters - Volume III, Storage Water Heaters, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

1.4.3. ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.4.4. ASTM A48 Standard Specification for Gray Iron Castings.

1.4.5. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.4.6. ASTM A148 Standard Specification for Steel Castings, High Strength, for Structural Purposes.

1.4.7. ASTM A479 Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.

1.4.8. CAN/CSA B149 Natural Gas and Propane Code.

1.5. TRAINING

1.5.1. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

1.5.2. Include for 3 training sessions of maximum 7 hours duration per session for 8 Metrolinx people per session.

1.5.3. Refer to Section 20 05 05 for additional general requirements.

1.6. WARRANTY

1.6.1. Warranty shall be in line with Contractual Requirements.

1.7. DELIVERY, STORAGE AND HANDLING.

1.7.1. Handle and store products in accordance with manufacturer's instructions, in locations approved by Metrolinx. Include one copy of these instructions with product at time of shipment.

1.8. SUBMITTALS

1.8.1. Refer to submittal requirements in Section 20 05 05.

1.8.2. Include pump motor product data sheets and pump performance curves with shop drawing/product data sheet submission.

1.8.3. Submit with delivery of heaters, a copy of the factory inspection and test report for each heater, and include a copy of each report with O & M Manual project close-out data.

1.8.4. Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.

1.8.5. Submit a copy of a letter from the domestic cold-water booster pump set supplier certifying proper installation, and a copy of pump supplier’s start-up report, all as specified in Part 3 of this Section.

1.8.6. Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

1.8.7. Submit shop drawings/product data sheets as follows:

a) to regulatory authority for review and approval prior to submitting to Consultant;

b) for all products specified in this Section;

c) copies of all calculations, stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing requirements.

1.8.8. Product Data

a) Submit product data sheets indicating:

1) technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;

2) performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol;

3) product transportation, storage, handling, and installation requirements;

4) product identification in accordance with Metrolinx requirements.

1.8.9. Shop Drawings

a) Submit shop drawings indicating:

1) capacity and ratings;

2) mounting details to suit locations shown, indicating methods and hardware to be used;

3) control components and control wiring schematic.

1.8.10. Commissioning Package

a) Submit the following in accordance with Sections 20 05 05 and 20 05 40:

1) Commissioning Plan;

2) Commissioning Procedures;

3) Certificate of Readiness;

4) complete test sheets specified in Section 20 05 40 and attach to Certificate of Readiness;

5) Source Quality Control inspection and test results and attach to Certificate of Readiness.

1.8.11. Commissioning Closeout Package

a) Submit the following in accordance with Section 20 05 05:

1) Deficiency Report;

2) Commissioning Closeout Report;

3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals in accordance with Section 20 05 05:

i) Identification: manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems;

ii) functional description detailing operation and control of components;

iii) performance criteria and maintenance data;

iv) safety precautions;

v) operating instructions and precautions;

vi) component parts availability, including names and addresses of spare part suppliers;

vii) maintenance and troubleshooting guidelines/protocol;

viii) product storage, preparation, handling, and installation requirements;

ix) Commissioning Report.

1.9. QUALITY ASSURANCE

1.9.1. Site personnel are to be licensed in jurisdiction of the work and under continuous supervision of a foreman who is an experienced equipment installer.

1.9.2. Manufacturers Qualifications

a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced similar product for a minimum period of five years. When requested by Consultant, an acceptable list of installations with similar product shall be provided demonstrating compliance with this requirement.

b) Where manufacturers provide after installation onsite inspection of product installations, include for manufacturer's authorized representative to perform onsite inspection and certificate of approvals.

1.9.3. Installers Qualifications

a) Installers for work to be performed by or work under licensed Mechanical Contractor.

b) Installers of systems are to be fully qualified and experienced installers of respective products and work in which they are installing.

c) Where manufacturers provide training sessions to installers and certificates upon successful completion, installers to have obtained such certificates and submit copies with shop drawings.

1.9.4. Regulatory Requirements

a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.

b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. DOMESTIC COLD-WATER PRESSURE BOOSTER PUMP SET

2.1.1. Packaged type, multi-pump pressure booster set in accordance with drawing schedule, completely factory assembled and pre-piped on a primed and painted steel baseplate with primed and painted structural steel framework, with rubber mounts to isolate pipework from baseplate assembly, integrated variable speed drives and a pre-wired power and control panel, all factory tested, and calibrated, and ready for suction and discharge piping connections and electrical power connections.

2.1.2. Each pump is to be a bronze fitted, centrifugal, single suction in-line pump complete with following:

a) cast iron volute and motor/pump bracket;

b) dynamically balanced closed type cast bronze impeller secured to a stainless steel shaft;

c) motor in accordance with Section 20 05 10;

d) water-tight mechanical seal serviceable without breaking pipe connections;

e) common suction and discharge headers with isolating valves and non-slam check valves for each pump, all minimum 1725 kPa (250 psi) rated;

f) pressure reducing valve for each pump, with by-pass on discharge;

g) thermal bleed circuit with aquastat and solenoid valve.

2.1.3. Control panel to consist of a NEMA 2 primed and painted steel enclosure complete with following:

a) hinged (full length piano hinge) door with catch and padlocking facilities;

b) wiring diagram on back side of door;

c) main door, interlock disconnect switch with a fused circuit for each motor;

d) fully protected, full voltage, non-reversing across-the-line magnetic starter for each motor;

e) current sensing device;

f) H-O-A selector switch for each pump to permit manual or automatic pump operation;

g) control section with 115 volt fused secondary control circuit transformer, adjustable pressure switches, and minimum run time delay;

h) identified suction and discharge pressure gauges conforming to requirements specified in Section 20 05 10;

i) low limit pressure switch with low suction pressure alarm LED, arranged to shut-off pump(s) should pressure in the water service main fall to a dangerously low level, with auxiliary contact to connect to a central control and monitoring system;

j) high pressure cut-out switch with alarm LED and auxiliary contact;

k) power "ON" indicating light;

l) manual alternation of lead pump;

m) required communications interfaces (analogue and digital) for connections for alarm monitoring and BAS integration; exact requirements to be compatible with connected systems and confirmed with Metrolinx.

2.1.4. Pump controls to be factory pre-set to suit job conditions, sequence pumps to deliver constant pressure domestic cold water, and operate as follows:

a) lead pump is to operate continuously;

b) when demand exceeds capacity of lead pump, second pump is to automatically start in parallel, and run for a minimum period of time to prevent pump from cycling on and off;

c) should lead pump fail for any reason, second pump is to start automatically and run continuously.

2.1.5. Variable frequency drives to be suitable in all respects for application as recommended by pump manufacturer, and in accordance variable frequency drives requirements of Electrical Division specification.

2.1.6. Standard of quality assurance manufacturers are:

a) S.A. Armstrong Ltd.;

b) Xylem (Bell & Gossett);

c) Pentair Pump Group "Aurora";

d) or approved equivalent.

2.2. HORIZONTAL IN-LINE CIRCULATING PUMPS

2.2.1. Bronze construction centrifugal pumps in accordance with drawing schedule and complete with:

a) lead free cast bronze casing with flanged pipe connections;

b) alloy steel shaft with integral thrust collar, copper shaft sleeve, and oil lubricated bronze sleeve bearings;

c) balanced lead-free cast bronze impeller;

d) motor conforming to requirements of Section 20 05 10, connected to motor by means of a 4-spring coupling with guard;

e) mechanical seal.

2.2.2. Standard of quality assurance manufacturers are:

a) S.A. Armstrong Ltd.;

b) Xylem (Bell & Gossett);

c) Grundfos Canada Inc.;

d) Patterson Pump Company;

e) or approved equivalent.

2.3. CIRCULATING PUMP AUTOMATIC CONTROL

2.3.1. Xylem (Bell & Gossett) AQS Series or approved equivalent, 115 volt Aquastat to automatically control pump on and off in response to domestic water temperature and equipped with a stainless steel pipe clip, bimetal sensing element, and insulated #18 AWG 450 mm (18") wire leads.

2.4. DRAINAGE PUMP SET

2.4.1. Little Giant Pump Co. VCMA Series or approved equivalent, automatic removal pump in accordance with drawing schedule, complete with:

a) 1.89 L (0.4 gal.) capacity ABS plastic tank with three inlet drain holes;

b) removable 9.4 mm (3/8") dia. barbed check valve;

c) 115 volt, 1-phase, 60 Hz., CSA certified float activated pump integral with a removable and reversible ABS plastic tank cover and complete with overload protected motor, safety switch, ABS impeller, stainless steel shaft, and 1.8 m (6') of power cord with grounding plug.

2.5. GRINDER TYPE PUMPS

2.5.1. Application

a) Pumped medium: sewage and other heavily polluted wastewater that includes rags, long fibers and solids.

b) Each grinder pump shall be a heavy duty pump modified to be used as a grinder. Each grinder pump shall contain special cutters to reduce sewage to a fine slurry.

c) The stationary and rotary cutters shall consist of hardened 316 "L" stainless steel. The cutter materials shall provide maximum corrosion and abrasion resistance. The remaining portion of the grinder pumps, with the exception of seal materials and wet end (volute, impeller, rotary and stationary cutter), shall be similar to the heavy duty pumps used in larger pump stations for daily operation.

2.5.2. Pump Design

a) Grinder pump(s) shall be available in the following configuration:

1) Guide Bar Mounting – 50 mm (2") Discharge.

b) The MP Grinder pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

2.5.3. Approvals

a) The pump/motor assembly shall have CSA approval as one unit, per CSA standard C22.2-108. Proof of this approval shall be submitted by the pump manufacturer with the approval drawings. An approval of the motor unit only will not be acceptable.

b) The pump/motor unit is also approved by CSA for service in Class I, Division 2, Groups A, B, C or D hazardous locations.

2.5.4. Pump Construction

a) Major pump components shall be of grey cast iron, ASTM A-48, Class 30, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal surfaces coming into contact with the pumpage, other than stainless steel, shall be protected by a factory applied spray coating of alkyd primer with a synthetic resin enamel finish on the exterior of the pump.

b) Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton or approved equivalent, rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

c) Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.5.5. Motor

a) The pump motor shall be a NEMA-B design induction type with a squirrel cage rotor, shell type design and be housed in an air filled, watertight chamber.

b) The stator windings and leads shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be trickle impregnated with Class H resin and shall be heat-shrink fitted into the stator housing providing for superior heat transfer. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 40 °C (104 °F). The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

c) The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40 °C (104 °F) ambient and shall have a NEMA Class B maximum operating temperature rise of 80 °C (176 °F). A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

2.5.6. Cable Entry Seal

a) The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.5.7. Cooling System

a) Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

2.5.8. Volute

a) Pump volute shall be single-piece grey cast iron, ASTM 48, Class 30, non-concentric design with smooth passages large enough to pass any media that may enter the impeller. Minimum inlet and discharge size shall be as specified.

2.5.9. Impeller

a) The impeller shall be of gray cast iron, ASTM 48-76, Class 30, dynamically balanced, single-shrouded design having a long throughlet without acute turns. The impellers shall be capable of handling fine slurry from the special cutters. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request.

b) Impeller shall be taper collet fitted and retained with an Allen head bolt. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

2.5.10. Paint Standard

a) The exterior of the pump, including all metal surfaces coming into contact with the pumpage shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer and finished with a polyester, epoxidized resin paint.

b) Prior to the final paint finish being applied, the pump components shall be primed and washed. The components shall then be assembled and washed a second time before the final topcoat is applied. The finish paint or top-coat shall be applied externally to a minimum dry film thickness of not less than 100m m(microns). The film thickness shall be consistent with ISO 2808, method No.6.

2.5.11. Pump Shaft

a) Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be AISI type 304 stainless steel.

b) The use of stainless steel sleeves to protect a lesser grade of shaft material will not be considered equal.

2.5.12. Mechanical Seal

a) Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.

b) The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten carbide rings.

c) The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating ceramic/carbon seal rings. Each seal interface shall be held in contact by its own spring system.

d) The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

e) Independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

f) Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. The seal lubricant shall be non-toxic and FDA approved for potable water applications.

2.5.13. Bearings

a) The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Sleeve or single row lower bearings are not acceptable.

2.5.14. Protection

a) All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

b) A leakage sensor shall be available to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will send an alarm and, if desired, stop the motor. Use of voltage sensitive solid-state sensors and trip temperature above 140°C (284°F) shall not be allowed.

c) The thermal switches and FLS shall be connected to a Control & Status monitoring unit mounted in the control panel.

2.5.15. Performance Guarantee & Standard Tests

a) The pump performance shall conform to ISO 9906:1999. The tests are intended to ascertain the performance of the pump and to compare this with the manufacturer's guarantee.

b) The performance test of the pump(s) shall be carried out to determine the performance of the pump with respect to the discharge rate of flow, total head, power absorbed, etc. For a combined motor-pump unit (for example, submersible pump; or separate pump and motor with overall efficiency guaranteed), the guarantee covers the efficiency of the entire unit.

c) The pump shall be tested for proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment according to ISO 9906.

d) On demand, the pump supplier will supply the following test results:

1) Hydraulic Test Curve, proving that the pump meets the operating conditions in accordance with ISO 9906:1999, Annex A;

2) Current and Power consumed during the test;

3) Megger Test - verification of the electrical resistance to ground;

4) Wet Test - Submerged functional test and electrical verification of the rated current;

5) Dry Test - Test for 15 secs. Minimum in a dry condition with verification that current or power consumption draw does not exceed the normal dry rating;

6) Water Infiltration & Oil Check;

7) Monitoring Device Check - includes, but is not limited to, motor temperature sensors and leakage detectors;

8) Hydrostatic Test of the pump volute or the complete pump unit and Vibration Test shall be conducted when specifically requested by the Owner.

2.5.16. Experience

a) The pump manufacturer shall have several units of similar type pumps installed and operating for no less than five years in Canada.

b) Preference will be given to the supplier who can offer temporary pump replacement on short notice from an existing rental fleet, containing an adequate inventory of pumps and accessories.

c) Preference will also be given to the supplier who can offer local parts and labor service by factory trained technicians.

2.5.17. Control

a) A control system specifically designed for pumping stations, must be used in order to provide monitoring and transfer to a back-up pump when required, to ensure a maximum degree of protection and assurance of continuity of service.

b) Refer to section 25 05 10 for details on controls.

2.5.18. Standard of Acceptance

a) Xylem (Flygt) MP series;

b) Xylem (Flygt) FP series;

c) ABS Piranha series;

d) or approved equivalent.

2.6. NON-CLOG TYPE PUMPS

2.6.1. Application

a) Suitable for both wet and dry installation. Hydraulics with open or closed, single or multi-vane impellers suitable for handling of clear water, polluted water, sewage, abrasive matter, sewage containing up to 3" diam. solids, faecal slurry and sludge.

2.6.2. Pump Design

a) The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well.

b) Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal, watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.6.3. Approvals

a) The pump/motor assembly shall have CSA approval as one unit, per CSA standard C22.2-108. Proof of this approval shall be submitted by the pump manufacturer with the approval drawings. An approval of the motor unit only will not be acceptable.

b) The pump/motor unit is also approved by CSA for service in Class I, Division II, Groups A, B, C or D hazardous locations.

2.6.4. Pump Construction

a) Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blowholes or other irregularities. All exposed nuts or bolts shall be of AISI type 304 stainless steel. An approved, sewage resistant coating shall protect all metal surfaces coming into contact with the pumpage, other than stainless steel or brass.

b) Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton or approved equivalent, rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

c) Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.6.5. Motor

a) The pump motor shall be a NEMA-B design induction type with a squirrel cage rotor, shell type design and be housed in an air filled, watertight chamber. The stator windings and leads shall be insulated with moisture resistant Class H insulation rated for 180 °C (356 °F).

b) The stator shall be trickle impregnated with Class H resin and shall be heat-shrink fitted into the stator housing providing for superior heat transfer. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable.

c) The motor shall be designed for continuous duty while handling pumped media of up to 40 °C (104 °F). The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

d) The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40 °C (104 °F) ambient and shall have a NEMA Class B maximum operating temperature rise of 80 °C (176 °F). A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

2.6.6. Cable Entry Seal

a) The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single, cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessaries using the same entry seal.

2.6.7. Cooling System

a) Motors are sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket is not required.

2.6.8. Volute

a) Pump volute shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

2.6.9. N-Impeller

a) The impeller shall be of semi-open, multi-vane, backswept, non-clog design. The impeller vanes shall be self-cleaned upon each rotation as they pass across a relief groove(s) located in the pump housing (or in an insert ring in the pump housing) and shall keep the vane clear of debris, maintaining an unobstructed pumping.

b) The impeller(s) shall have heavily back swept leading edges with a specific angle distribution enabling the capability of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impellers shall be locked to the shaft. The clearance between the pump housing/insert ring and the impeller shall be adjustable. The impeller shall be of grey cast iron (ASTM A48 Class 35B) with hardened edges.

2.6.10. Paint Standard

a) The exterior of the pump, including all metal surfaces coming into contact with the pumpage shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer and finished with a polyester, epoxidized resin paint. Prior to the final paint finish being applied, the pump components shall be primed and washed. The components shall then be assembled and washed a second time before the final topcoat is applied. The finish paint or top-coat shall be applied externally to a minimum dry film thickness of not less than 100m m(microns). The film thickness shall be consistent with ISO 2808, method No.6.

2.6.11. Pump Shaft

a) Pump and motor shaft shall be the same unit and shall be made of AISI type 431 stainless steel throughout. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable.

b) The use of stainless steel sleeves to protect a lesser grade of shaft material will not be considered equal.

2.6.12. Mechanical Seals

a) Each pump shall be provided with a tandem mechanical shaft seal system consisting of two, totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate.

b) The lower, primary seal unit, located between the pumped liquid and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring.

c) The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating carbon seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

d) The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

e) Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. The seal lubricant shall be non-toxic and FDA approved for potable water applications.

2.6.13. Spin-Out™

a) In order to reduce wear of the lubricant chamber, open surfaces of the seal, seal surfaces, and increase reliability of the seal itself, the lubricant chamber shall incorporate a specially designed seal chamber. The seal chamber houses the outer seal and consists of a spiral track in the wall of the seal chamber. This spiral track catches particles and transports them out towards the impeller, into the main rotational flow, where they are discharged back into the pump medium.

2.6.14. Protection

a) All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125 °C (260 °F) the thermal switches shall open, stop the motor and activate an alarm.

b) A leakage sensor shall be included to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. Use of voltage sensitive solid state sensors and trip temperature above 125 °C (260 °F) shall not be allowed.

c) The thermal switches and FLS shall be connected to a Control & Status monitoring unit mounted in the control panel.

2.6.15. Bearings

a) The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row, or sleeve lower bearings are not acceptable.

2.6.16. Performance Guarantee & Standard Tests

a) The pump performance shall conform to ISO 9906:1999. The tests are intended to ascertain the performance of the pump and to compare this with the manufacturer's guarantee. The performance test of the pump(s) shall be carried out to determine the performance of the pump with respect to the discharge rate of flow, total head, power absorbed, etc. For a combined motor-pump unit (for example, submersible pump; or separate pump and motor with overall efficiency guaranteed), the guarantee covers the efficiency of the entire unit.

b) The pump shall be tested for proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment according to ISO 9906.

c) On demand, the pump supplier will supply the following test results:

1) Hydraulic Test Curve, proving that the pump meets the operating conditions in accordance with ISO 9906:1999, Annex A;

2) Current and power consumed during the test;

3) Megger Test - verification of the electrical resistance to ground;

4) Wet Test - Submerged functional test and electrical verification of the rated current;

5) Dry Test - Test for 15 secs. Minimum in a dry condition with verification that current or power consumption draw does not exceed the normal dry rating;

6) Water Infiltration & Oil Check;

7) Monitoring Device Check - includes, but is not limited to, motor temperature sensors and leakage detectors;

8) Hydrostatic Test of the pump volute or the complete pump unit and Vibration Test shall be conducted when specifically requested by the Purchaser.

2.6.17. Experience

a) The pump manufacturer shall have several units of similar type pumps installed and operating for no less than five years in Canada.

b) Preference will be given to the supplier who can offer temporary pump replacement on short notice from an existing rental fleet, containing an adequate inventory of pumps and accessories.

c) Preference will also be given to the supplier who can offer local parts and labor service by factory trained technicians.

2.6.18. Mix Flush Valve

a) A mix flush valve shall be supplied separately. It shall be mounted by the mechanical contractor, on the volute of one of the pumps in the pump station. The function of this valve is to divert a part of the pumped liquid back into the sump during the first 30 seconds of pumping. This creates a powerful jet, which stirs up the sump and thus prevents settling and the accumulation of hazardous gases.

b) The valve shall be non-electric and operated by the pressure produced by the pump. Valves mounted on the discharge connections, discharge or riser pipes are not acceptable. Neither additional control systems nor modifications to control panels or equipment shall be necessary.

2.6.19. Control

a) A control system specifically designed for pumping stations, must be used in order to provide monitoring and transfer to a back-up pump when required, to ensure a maximum degree of protection and assurance of continuity of service.

b) Refer to section 15900 for details on controls.

2.6.20. Standard of Acceptance:

a) Xylem (Flygt) NP series;

b) ABS AFP series;

c) or approved equivalent.

2.7. EFFLUENT WATER PUMPS

2.7.1. Application

a) Clear liquids or liquids containing large soft solids or for trash. and fluids containing stringy materials that tend to"rope".

2.7.2. Pump Design

a) The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal contact. No portion of the pump shall bear directly on the sump floor.

2.7.3. Approvals

a) The pump/motor assembly shall have CSA approval as one unit, per CSA standard C22.2-108. Proof of this approval shall be submitted by the pump manufacturer with the approval drawings. An approval of the motor unit only will not be acceptable.

b) The pump/motor unit is also approved by CSA for service in Class I, Division 2, Groups A, B, C or D hazardous locations.

2.7.4. Pump Construction

a) Major pump components shall be of grey cast iron, ASTM A-48, Class 30, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by an approved sewage resistant coating.

b) Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

c) Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.7.5. Motor

a) The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, EEMAC B type. Liquid filled motors shall not be considered equivalent. The stator windings and leads shall be insulated with moisture resistant Class F insulation rated for 155 °C (311 °F).

b) The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

c) The motor shall be designed for continuous duty handling pumped media of 40 °C (104 °F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125 °C (260 °F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and assembled by the same manufacturer.

d) The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.10. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40 °C (104 °F) ambient and with a temperature rise not to exceed 80 °C (176 °F).

e) The power cable shall be sized according to the CEC and CSA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 metres.

f) The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.7.6. Cable Entry Seal

a) The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

2.7.7. Cooling System

a) Motors are sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket is not required.

2.7.8. Volute

a) Pump volute shall be single-piece grey cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

2.7.9. Impeller

a) The impeller shall be dynamically balanced, non-clogging. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. The impeller shall be retained with an Allen head bolt. All impellers shall be coated with alkyd resin primer.

2.7.10. Paint Standard

a) The exterior of the pump, including all metal surfaces coming into contact with the pumpage shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer and finished with a polyester, epoxidized resin paint. Prior to the final paint finish being applied, the pump components shall be primed and washed. The components shall then be assembled and washed a second time before the final topcoat is applied. The finish paint or top-coat shall be applied externally to a minimum dry film thickness of not less than 100m m(microns). The film thickness shall be consistent with ISO 2808, method No.6.

2.7.11. Pump Shaft

a) Pump and motor shaft shall be the same unit and shall be made of type 431 stainless steel throughout. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable.

b) The use of stainless steel sleeves to protect a lesser grade of shaft material will not be considered equal.

2.7.12. Mechanical Seal

a) Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal shall be tungsten-carbide/tungsten-carbide standard. The upper seal shall be ceramic/carbon. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

2.7.13. Protection

a) Thermal switches set to open at 125°C shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.

b) Each pump is also supplied with a float leakage sensor (FLS) in the stator housing. When activated, the FLS will stop the motor and send an alarm both local and/or remote. Use of voltage sensitive solid state sensors and trip temperature above 125°C shall not be allowed.

c) The thermal switches and FLS shall be connected to a Control & Status monitoring unit mounted in the control panel.

2.7.14. Bearings

a) The pump shaft shall rotate on two single row ball bearings. Motor bearings shall be permanently grease lubricated.

2.7.15. Performance Guarantee & Standard Tests

a) The pump performance shall conform to ISO 9906:1999. The tests are intended to ascertain the performance of the pump and to compare this with the manufacturer's guarantee. The performance test of the pump(s) shall be carried out to determine the performance of the pump with respect to the discharge rate of flow, total head, power absorbed, etc. For a combined motor-pump unit (for example, submersible pump; or separate pump and motor with overall efficiency guaranteed), the guarantee covers the efficiency of the entire unit.

b) The pump shall be tested for proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment according to ISO 9906.

c) On demand, the pump supplier will supply the following test results:

1) Hydraulic Test Curve, proving that the pump meets the operating conditions in accordance with ISO 9906:1999, Annex A;

2) Current and power consumed during the test;

3) Megger Test - verification of the electrical resistance to ground;

4) Wet Test - Submerged functional test and electrical verification of the rated current;

5) Dry Test - Test for 15 secs. Minimum in a dry condition with verification that current or power consumption draw does not exceed the normal dry rating;

6) Water Infiltration & Oil Check;

7) Monitoring Device Check - includes, but is not limited to, motor temperature sensors and leakage detectors;

8) Hydrostatic Test of the pump volute or the complete pump unit and Vibration Test shall be conducted when specifically requested by the Purchaser.

2.7.16. Experience

a) The pump manufacturer shall have several units of similar type pumps installed and operating for no less than five years in Canada.

b) Preference will be given to the supplier who can offer temporary pump replacement on short notice from an existing rental fleet, containing an adequate inventory of pumps and accessories.

c) Preference will also be given to the supplier who can offer local parts and labor service by factory trained technicians.

2.7.17. Control

a) A control system specifically designed for pumping stations, must be used in order to provide monitoring and transfer to a back-up pump when required, to ensure a maximum degree of protection and assurance of continuity of service.

b) Refer to section 25 05 10 for details on controls.

2.7.18. Standard of Acceptance:

a) Xylem (Flygt) CP series;

b) ABS AFP series;

c) or approved equivalent.

2.8. SUMP ACCESSORIES

2.8.1. Accessories to be supplied by the pump manufacturer and be fully compatible with the pumps and controllers. Include provision of necessary subassemblies (plates, bolts, anchors, hinges, nuts, chains, etc) as required to make them fully operational and suitable for the sump conditions (depth, footprint, construction material).

2.8.2. Sump Pump Access Doors

a) Single- or double-leaf door as required for access and maintenance.

b) Pit cover shall be gas tight, self-opening with piston kit and safety grid.

c) Material of 6061-T6 aluminum for bars, angles, and extrusions. 1/4" diamond plate shall be 5086 aluminum. Where exterior of frame, comes in contact with concrete, coat with black bituminous paint.

d) Safety grate rated at 14.4 kPa (300 lbs/sq.ft.). Cover without safety grate is rated at 7.2 kPa (ISO lbs./sq.ft.).

e) Each door equipped with a cover stay. Door shall lock open in 90 degree position. Hatch frame shall be of extruded aluminum, with continuous anchor flange.

f) Cover hinges of grade 316 stainless steel. Hinge fastened to the frame extrusion and diamond plate with grade 316 stainless steel bolts and ny-lock nuts.

g) Hardware to be stainless steel except for the rail nuts, which to be in aluminum. Each hatch supplied with a recessed padlock clip. Padlock provided by Metrolinx.

h) Each access door designed to combine covering of the opening, fall through protection and controlled confined space entry.

i) Grate openings allow for visual inspection, limited maintenance and float adjustments while the safety grate fall through protection is left in place.

j) Design assures that the fall through protection is in place before the doors can be closed, thereby protecting the next operator.

k) Each grate provided with a permanent hinging system, which will lock the grate in the 90 degree position once opened. Grates in the open position create a visual barrier around the opening, alerting passing pedestrians.

l) Each grate to have a pull opening arm, designed so the grate can be pulled opened, with the grate acting as a barrier between the operator and the pit.

m) Opening arm equipped with a controlled confined space entry lock (lock provided by Metrolinx). When locked this device will aid in controlling unauthorized entry to the confined space. The grating system allows anyone to make visual inspection and float adjustments without entering the confined space.

n) Each aluminum safety grate is coated with a safety orange colour, promoting visual awareness of the hazard. The coating is a thermosetting, powder coat finish with a minimum thickness of 2-4 mils and be baked at 350-375 degrees F until cured.

o) Standard of quality assurance manufacturers are:

1) Xylem (Flygt);

2) ABS;

3) or approved equivalent.

2.8.3. Level Detection

a) Level detection parameters:

1) Pumps Off;

2) One Pump On;

3) Two Pumps On (where duplex systems are employed);

4) Alarm Level – interface with building BAS and local audio-visual alarm.

b) Alarm level to be below the invert of the lowest inlet pipe discharging into the pit.

c) Pumps Off level adequately located above the bottom of the pit to avid de-priming the pump(s). Take into account height of any stand or support.

d) Ultrasonic level sensors used to measure a liquid level and to give a signal to a control system. Ultrasonic level transmitter is designed to be mounted above a liquid and will measure the distance to the liquid surface.

e) Sensor is specially developed to withstand a harsh environment and for media typical for sump pumps: sewage, slurry and viscous liquids (not foamy surface).

f) Ultrasonic sensor is a two wire 24V DC loop powered transmitter and may be connected to any suitable DC power source using the factory fitted cable, ingress protection IP 68.

g) Output is a standard 4 - 20 mA direct current, proportional to the measured level.

h) Ultrasonic sensor transmitter may be mounted in a hazardous area provided that it is supplied from a protected power supply.

i) Sensor fully compatible with the pump controller equipment.

j) Electrical data:

1) Power supply: 12 - 40 V DC, two-wire system;

2) Power supply Ex: 12 - 30 V DC, in hazardous area zone 0, two-wire system;

3) Output signal: 4 - 20 mA;

4) Communications: HART digital communication (rev 5);

5) Grounding: Not required;

6) Cable size: Ø 4mm, 2x0,22 mm²;

7) Cable length: 20 m;

8) Media temperature: -40 °C – 60 °C;

9) Temperature drift: ±0,015% of total range per °C;

k) Physical Data:

1) Material and Operating Body Material: PVC (stabilized);

2) Cable sealant: Epoxy adhesive;

3) Locknut: Nylon;

4) Cable: PVC cable, shielded, two core;

5) Bracket: Stainless steel;

6) Length of sensor: 228 mm (incl. bracket 288 mm);

7) Diameter of sensor: 62 mm (largest measure);

8) Ingress protection: IP68 (5 m H2O);

9) Mounting: Stainless steel mounting bracket;

10) Position dependent: As vertical as possible, to ensure a good echo (beam angle 12°);

l) Approvals:

1) Electromagnetic compatibility, EMC: ref.no. 89/336/EEC, 92/31/EEC;

2) Standard: EN 61326 + A1;

3) Machinery Directive: Ref.no. 98/37/EC;

4) ATEX Directive: ref.no. 94/09/EC;

5) Standard: EN 50014+A1+A2, EN 50020, EN 50284;

6) Certificate number: BAS01ATX1061X;

7) CSA Ex standard: CAN/CSA E60079.

m) Standard of quality assurance manufacturers are:

1) Xylem (Flygt) LSU-100 series;

2) or approved equivalent.

2.8.4. Lifting Equipment:

a) Lifting Davit:

1) Rated at 300 kg, including mounting recessed-in-floor socket of galvanized steel c/w bolting material, 4" diameter pipe pole with davit mounting socket, chain attachment.

2) Standard of acceptance quality manufacturers are:

i) Xylem (Flygt) part 13-52 01 44;

ii) or approved equivalent.

b) Chain Hoist:

1) Suitable for pumps up to 750 kg, c/w hook and hand chain, pump lifting chain and chain holder. Weight: 24 kg.

2) Standard of acceptance quality manufacturers are:

i) Xylem (Flygt) part 13-43-00 06;

ii) or approved equivalent.

c) Chain Hook:

1) Stainless steel, supplied with a stainless steel 316 bolt 3/8 "-16 UNC x 1 " long, nut and lock washer.

2) Standard of acceptance quality manufacturers are:

i) Xylem (Flygt) part 13-542-04-51;

ii) or approved equivalent.

d) Lifting Device:

1) Lifting device consists of the following components:

i) short length of chain attached to the pump handle, suitable for 540 kg;

ii) length of stainless steel cable attached to the chain;

iii) grip eye attached to the lifting equipment hook;

2) Standard of quality assurance manufacturers are:

i) Xylem (Flygt) part 13-50 05 56 complete with lifting equipment hook;

ii) or approved equivalent.

2.8.5. Break-Away Fittings (BAF) and Guide Rails

a) Stationary portion of the BAF consists of a specially designed cast iron base elbow which is bolted to a raised concrete pad of the wet well floor or to a steel base plate attached to the sump floor.

b) Pump bolts to the bronze moveable portion which is free to ride up and down the guide rails. O-Ring is pressed into a dovetailed groove on the tapered face of the moveable. Tapered faces of the moveable and base elbow allow for a positive mating of the O-Ring to base. This elastomer to cast iron contact assures a complete and positive seal which allows pumps to operate without hydraulic leakage, unlike units with metal to metal faces. These mating parts also allow a Non-Sparking joint which is required in Hazardous Locations.

c) Guide rails are attached to the base elbow at one end and to the intermediate and upper stainless steel holders bolted into the pit structure.

d) For the top of the pit, use a stainless steel Guide Cap which is attached to the underside of the wet well cover at the top end. Both the Guide Cap assembly and the base elbow have cast iron plugs with O-Rings mounted in them which aid in locating the guide rails and in reducing noise and vibration of the guide rails.

e) Intermediate guide stainless steel bracket shall be used for depths of 4 m (13') or more.

f) Guide rails serve only to guide, they carry none of the pump weight. 38mm or 50 mm (1½" or 2") schedule 40 galvanized steel pipe to be used for guide rails.

g) Standard of quality assurance manufacturers are:

1) Xylem (Flygt) (fitting, guide rails and supports to suit pump);

2) ABS (fitting, guide rails and supports to suit pump);

3) or approved equivalent.

2.8.6. Cable Protection Assembly

a) Power supply cables to the pumps shall be protected by a system consisting of the following:

1) length of up to 3 m (10') of 3/16" stainless steel chain to hold protection system;

2) upper cable clamp assembly located approx. 0.5 m (19.5") above the maximum water level in the pit;

3) protective 25 mm (1") diameter stainless steel flexible hose shrouding the power cabling; flexible hoses come in lengths of maximum 3 m (10') and can be attached to match any depth;

4) lower cable clamp assembly located at the pump.

5) protective system to include 3 power+1grounding+4 monitoring conductors, rating 90 °C.

b) Standard of quality assurance manufacturers are:

1) Xylem (Flygt) 13-41 00 xx (to suit pump);

2) or approved equivalent.

2.8.7. Pump Stands

a) Where recommended by the manufacturer, supply and install pump stands to maintain the minimum distance between the bottom of the pumps and the sump floor.

b) Pump Support Stand fabricated of 300 series stainless steel with rubberized pads on the feet to eliminate damaging the basin floor.

c) Standard of quality assurance manufacturers are:

1) Xylem (Flygt);

2) ABS;

3) or approved equivalent.

2.9. POINT-OF-USE ELECTRIC DOMESTIC HOT WATER STORAGE TANK AND HEATER

2.9.1. ULC listed and CSA certified electric domestic hot water storage tank and heater with model number and performance as specified on drawings, and complete with:

a) 1035 kPa (150 psi) rated (working pressure) steel tank, glass lined, polyurethane foam insulated, covered with an enamelled steel jacket with access panel, and equipped with a bottom hose end drain cock;

b) immersion heating element imbedded in magnesium oxide and sealed in a seamless copper tube;

c) sacrificial anode rod;

d) surface mounted adjustable thermostat and a high temperature safety cut-out;

e) ASME rated temperature and pressure relief valve;

f) round galvanized steel auxiliary catch pan with drain hole and connection spigot.

2.9.2. Standard of quality assurance manufacturers are:

a) A.O. Smith Water Products Co.;

b) John Wood (GSW Water Heating Co.);

c) Rheem Canada Ltd.;

d) Bradford White Canada Inc;

e) or approved equivalent.

2.10. ELECTRIC DOMESTIC HOT WATER TANK AND HEATER

2.10.1. CSA certified electric domestic hot water tank and heater with model number and performance as specified on drawings, and complete with:

a) 1035 kPa (150 psi) rated (working pressure) steel tank, glass lined, insulated (except for control panel area) with injected minimum R-16 foam insulation, covered with an enamelled steel jacket, and equipped with 40 mm (1-½") dia. NPS brass nipple water inlet and outlet connections, a drain valve, and sacrificial anode rods;

b) removable multiple immersion heating elements, each consisting of a wire filament in a sealed stainless steel sheath;

c) ASME rated temperature and pressure relief valve;

d) factory pre-wired power and control panel.

2.10.2. Equip enamelled steel ventilated control panel with removable glass fibre insulation to cover bare area of tank, a hinged door, multiple knockouts, a ground screw, and following:

a) terminal block for power wiring connections;

b) magnetic contactors for heating elements;

c) adjustable immersion thermostat;

d) manual reset immersed high temperature limit control for each element;

e) fuse block with fuses;

f) element diagnostic panel with LED's for each element to monitor on-off operation of each element;

g) contacts, relays and any other hardware, compatible with building automation system protocol and required to connect heater(s) to BAS in accordance with BAS control points list.

2.10.3. Equip heaters with factory fabricated type "L" hard copper inlet and outlet manifolds.

2.10.4. Standard of quality assurance manufacturers are:

a) A.O. Smith Water Products Co.;

b) John Wood (GWS Water Heating Co.);

c) Rheem Canada Ltd.;

d) Bradford White Canada Inc;

e) or approved equivalent.

2.11. ELECTRIC DOMESTIC HOT WATER BOOSTER HEATER

2.11.1. CSA certified electric domestic hot water booster heater with model number and performance as specified on drawings, and complete with:

a) 1035 kPa (150 psi) rated (working pressure) steel tank with a double coating of high temperature glass, rigidly supported anode rods, blanket type glass fibre insulation, an enamelled steel enclosure with control centre hinged door and element and cleanout access panel, 32 mm (1-¼") dia. NPS brass nipple water inlet and outlet connections, a drain valve, and 150 mm (6") high stainless steel support legs;

b) immersion type screw-in heating elements embedded in magnesium oxide sealed in a tinned copper tube;

c) ASME rated relief valve;

d) stainless steel rewired power and control panel with magnetic contactors, element diagnostic panel with LED's, element fuses, an adjustable thermostat, and immersion type high temperature limit control.

2.11.2. Acceptable manufacturers are:

a) A.O. Smith Water Products Co.;

b) John Wood (GSW Water Heating Co.);

c) Rheem Canada Ltd.;

d) Bradford White Canada Inc.

2.12. INSTANTANEOUS ELECTRIC HOT WATER HEATER (FOR REMOTE SINGLE FIXTURES)

2.12.1. Chronomite Laboratories Inc. or approved equivalent, 1-phase, CSA certified, 98% energy efficient instantaneous point-of-use electric hot water heater with model number and performance as specified on drawings, factory pre-set to deliver 29 °C (85 °F) water, and complete with:

a) back plate for surface mounting;

b) enclosure;

c) Celcon waterways;

d) stainless steel heating coil;

e) fail-safe microprocessor based temperature controls to adjust heater's power to suit variations in flow rate;

f) external digital temperature selection;

g) differential pressure flow activated switch;

h) on/off power switch;

i) electrical access door;

j) compression connection pipe fittings.

2.12.2. Standard of quality assurance manufacturers are:

a) Chronomite Laboratories Inc.;

b) Stiebel Eltron;

c) EEMAX;

d) Bosch;

e) or approved equivalent.

2.13. SEALED COMBUSTION HOT WATER HEATER

2.13.1. A.O. Smith #BTH Cyclone Series or approved equivalent, minimum 95% thermal efficiency, with model number and performance as specified on drawings, meeting requirements of latest edition ASHRAE 90.1, and in accordance with following requirements:

a) 1103 kPa (160 psi) maximum hydrostatic working pressure;

b) natural gas modulating burner to adjust input based on demand;

c) down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up;

d) maintenance-free, non-sacrificial power anodes;

e) seamless glass-lined tank construction, with glass lining applied to all water-side surfaces;

f) factory insulation;

g) CSA certified and ASME rated temperature and pressure relief valve;

h) integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and digital temperature readout;

i) complies with local requirements for low NOx emissions;

j) design certified by UL in accordance with ANSI Z21.10.3/CSA 4.3 standards.

2.13.2. Contacts, relays and any other hardware, compatible with building automation system protocol and required to connect heater(s) to BAS in accordance with BAS control points list.

2.13.3. Equip heaters with factory fabricated type "L" hard copper inlet and outlet manifolds supplied loose.

2.13.4. Standard of quality assurance manufacturers are:

a) A.O. Smith Water Products Co.;

b) John Wood (GSW Water Heating Co.);

c) Rheem-Ruud Canada Ltd.;

d) Bradford White Canada Inc;

e) or approved equivalent.

2.14. DOMESTIC HOT WATER STORAGE HEATER

2.14.1. In accordance with drawing schedule, constructed and tested in accordance with ANSI/ASME Boiler and Pressure Vessel Code, CSA B51, and Provincial pressure vessel regulations, consisting of an immersion heater secured in a storage tank and complete with:

a) 690 kPa (100 psi) rated, double wall (tube within tube), seamless copper U-tube bundle with a scale factor allowance of 0.0005, boiler water actuated, supported by brass tube supports and expanded into a carbon steel tube sheet which is bolted to a cast iron head equipped with supply, return, and vacuum breaker tappings;

b) 1035 kPa (150 psi) rated steel tank of welded fabrication, constructed from ASTM A285 Gr. C black sheet steel, complete with required non-ferrous tappings for pipe connections, control components, and instruments, a 275 mm x 375 mm (11" x 15") manhole, structural steel support saddles or legs as applicable, and a heavy exterior shop coat of epoxy enamel applied over primer to cleaned metal;

c) minimum 15 mm (½") thick 100% covering coat of non-toxic, chemically inert, thermal shock resistant, corrosion resistant and rust preventing hydraulic cement applied to sand blasted clean metal and to all ferrous surfaces so domestic water does not come in contact with ferrous surface.

2.14.2. Standard of quality assurance manufacturers using S. A. Armstrong Ltd., Taco (Canada) Ltd., ITT Bell & Gossett or approved equivalent heaters are:

a) Clemmer Industries Ltd.;

b) DTE Industries Ltd;

c) or approved equivalent.

2.15. DOMESTIC HOT WATER STORAGE TANK

2.15.1. Vertical steel domestic hot water storage tank, 1103 kPa (150 psi) rated, sized in accordance with drawing schedule, constructed in accordance with ASME Boiler Pressure Vessel Code, Section IV, Part HLW, and complete with:

a) double interior coating of high temperature porcelain enamel, 2 magnesium anodes rigidly secured in place, 50 mm (2 ") thick polyurethane foam insulation, and an enamelled steel jacket;

b) tank openings for circulating lines, hot water outlet relief valve, temperature control drain valve and a thermometer;

c) ASME rated relief valve;

d) drain valve;

e) aquastat for pump/heater control;

f) factory fabricated type "L" hard copper manifold kit.

2.15.2. Standard of quality assurance manufacturers are:

a) A.O. Smith Water Products Co.;

b) John Wood (GWS Water Heating Co.);

c) Rheem Canada Ltd.;

d) Bradford White Canada Inc.

3. EXECUTION

3.1. DRAINAGE COORDINATION

3.1.1. Coordinate drain requirements of plumbing equipment provided by Mechanical Division and/or Metrolinx with location of drains specified in Section 22 13 00.

3.2. GENERAL INSTALLATION REQUIREMENTS FOR PUMPS

3.2.1. Prior to operating the pumps, the manufacturer's representative shall inspect work, including installation of the pumps, guide rails, break-away fittings, level detection devices, lifting devices and pumps controller. Any deficiencies reported by the manufacturer's representative shall be corrected prior to testing the system.

3.2.2. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

3.2.3. Supply and install pumps with all accessories, as specified herein; provide power for pumps operation and controls. Provide adequate length of power supply cable and controls wiring to suit the depth of the pit and distance to power supply junction box.

3.2.4. When any defects are detected, correct defects and repeat test.

3.2.5. Prior to installation in the pit, establish correct rotation and mechanical integrity of the pumps.

3.2.6. Seal conduits penetrating sump covers or walls to prevent the escape of gases.

3.2.7. Ensure that access frames are positioned such that access and removal of pumps is possible. Coordinate with concrete formwork trades.

3.2.8. Ensure that pump body does not support weight of piping.

3.2.9. Refer to Section 20 05 10 for equipment/system start-up requirements.

3.2.10. Refer to Section 20 05 10 for equipment/system manufacturer certification requirements. Submit a copy of the letter prior to Substantial Performance of the Work.

3.3. INSTALLATION OF DOMESTIC COLD-WATER PRESSURE BOOSTER PUMP SET

3.3.1. Provide a package type domestic cold-water pressure booster pump set.

3.3.2. Mount assembly on vibration isolation on a concrete housekeeping pad, shim the unit level such that suction and discharge headers are vertical, and secure in place.

3.3.3. Ensure housekeeping pad is keyed to the structure, and pump, motor base and framework are secured to structure by slack cable restraints in accordance with local governing code requirements for seismic control and restraint.

3.3.4. Provide flexible connections to suction and discharge headers, and support suction and discharge piping independent of pump set assembly. Pipe thermal bleed to drain.

3.4. INSTALLATION OF CIRCULATING PUMPS

3.4.1. Provide horizontal in-line domestic hot water circulating pumps.

3.4.2. Install pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer’s instructions.

3.5. INSTALLATION OF CIRCULATING PUMP CONTROL

3.5.1. Provide an aquastat to control pump on and off in response to domestic water temperature. Install in accordance with manufacturer’s instructions. Set on and off temperatures in accordance with Consultant’s instructions.

3.5.2. Provide a programmable timer and an aquastat to automatically control pump on and off in response to pre-set times and domestic water temperatures. Install in accordance with manufacturer’s instructions. Programme both devices in accordance with Consultant’s instructions.

3.6. INSTALLATION OF DRAINAGE PUMP SET

3.6.1. Provide a small package type drainage pump to pump equipment drainage into a gravity discharge main. Conform to drawing installation requirements.

3.6.2. Plug pump set into a receptacle provided as part of electrical work.

3.7. INSTALLATION OF SUMP ACCESSORIES

3.7.1. Install accessories in strict accordance with the manufacturer's instructions.

3.7.2. Make all electrical and controls wiring connections between the level detection devices and the digital controller. Verify the correct operation of the level detection equipment.

3.7.3. Coordinate the installation of lifting devices with local conditions affecting the work, including available clearances, position of access doors and position of the pumps.

3.7.4. Coordinate with the structural division the concrete embedding of all access doors and frames, support plates, anchors, plates and hooks. Ensure that the embedded elements are in the correct position.

3.7.5. Components of the break-away fittings (fixed elbow and pump-attached fitting) to be fully compatible with the selected pumps and when assembled, and make for a water-tight connection. Positioning of the guide rails and the selection of the rails diameter sto suit the type of pump used.

3.8. INSTALLATION OF POINT-OF-USE ELECTRIC DOMESTIC HOT WATER STORAGE TANK AND HEATER

3.8.1. Provide a point-of-use domestic hot water storage tank and heater.

3.8.2. Install in accordance with manufacturer's instructions.

3.8.3. Provide a wall bracket (supplied by heater manufacturer) for heater mounting and rigidly secure in place.

3.8.4. Mount heater in a catch pan, pipe temperature/pressure relief valve outlet to drain, and pipe auxiliary catch pan to drain.

3.8.5. Coordinate installation with electrical trade who will connect heater with power wiring.

3.8.6. Check and test heater operation and, unless otherwise specified or instructed, set thermostat to produce 48.8 °C (120 °F) hot water.

3.9. INSTALLATION OF ELECTRIC DOMESTIC HOT WATER TANK AND HEATER

3.9.1. Provide an electric domestic hot water tank and heater.

3.9.2. Secure heater in place, level and plumb, on a concrete housekeeping pad.

3.9.3. Install in accordance with manufacturer's instructions.

3.9.4. Pipe temperature/pressure relief valve outlet to drain and pipe drain valve outlet to drain.

3.9.5. Coordinate installation with electrical trade who will connect heater with power wiring.

3.9.6. Ensure housekeeping pad is keyed to structure and tank assembly is secured to structure by slack cable restraints, in accordance with local governing code requirements for seismic control and restraint.

3.9.7. Install inlet and outlet manifolds supplied with heaters.

3.9.8. Unless otherwise specified or instructed, set thermostat to produce 48.8 °C (120 °F) hot water.

3.10. INSTALLATION OF DOMESTIC HOT WATER BOOSTER HEATER

3.10.1. Provide an electric domestic hot water booster heater.

3.10.2. Install in accordance with manufacturer's instructions.

3.10.3. Secure heater in place, level and plumb, pipe temperature/pressure relief valve outlet to drain, and pipe drain valve outlet to drain.

3.10.4. Coordinate installation with electrical trade who will connect heater with power wiring.

3.10.5. Unless otherwise specified or instructed, set thermostat to produce 82 °C (180 °F) hot water.

3.11. INSTALLATION OF INSTANTANEOUS ELECTRIC HOT WATER HEATER

3.11.1. Provide a tankless, electric, instantaneous, point-of-use domestic hot water heater.

3.11.2. Secure in place and in accordance with manufacturer’s instructions. Ensure unit is easily accessible.

3.11.3. Coordinate installation with electrical trade who will connect heater with power wiring.

3.11.4. Unless otherwise specified or instructed, set thermostat to produce 49 °C (120 °F) hot water.

3.12. INSTALLATION OF SEALED COMBUSTION HOT WATER HEATERS

3.12.1. Provide gas fired domestic hot water heaters.

3.12.2. Install in accordance with manufacturer's instructions. Secure each heater in place, level, and plumb, on a concrete housekeeping pad.

3.12.3. Ensure housekeeping pad is keyed to structure and tank assembly is secured to structure by slack cable restraints, in accordance with local governing code requirements for seismic control and restraint.

3.12.4. Pipe temperature/pressure relief valve outlet to drain. Pipe condensate drain connection to drain.

3.12.5. Coordinate installation with electrical trade who will connect heater with power wiring.

3.12.6. Unless otherwise specified or instructed, set thermostat to produce 48.8 °C (120 °F) hot water.

3.12.7. Provide combustion air and flue gas vent piping for each heater in accordance with requirements of Section 23 51 23 - Flue Gas Vents.

3.12.8. Install inlet and outlet manifolds supplied with heaters.

3.13. INSTALLATION OF DOMESTIC WATER STORAGE HEATER

3.13.1. Provide a domestic hot water storage heater.

3.13.2. Install in accordance with manufacturer's instructions. Secure tank in place, level, and plumb, on a concrete housekeeping pad.

3.13.3. Ensure housekeeping pad is keyed to structure and tank assembly is secured to structure by slack cable restraints, in accordance with local governing code requirements for seismic control and restraint.

3.13.4. Connect with domestic water piping in accordance with drawing detail and coordinate connection of heating piping with heating piping trade.

3.13.5. Set controls to deliver maximum 49 °C (120 °F) domestic hot water. Confirm domestic hot water supply temperature setting.

3.14. INSTALLATION OF DOMESTIC HOT WATER STORAGE TANK

3.14.1. Provide domestic hot water storage tanks.

3.14.2. Install in accordance with manufacturer's instructions. Secure each tank in place, level and plumb on a reinforced concrete housekeeping pad by means of machine bolts.

3.14.3. Ensure housekeeping pad is keyed to structure and tank assembly is secured to structure by slack cable restraints in accordance with local governing code requirements for seismic control and restraint.

3.14.4. Install piping manifolds factory supplied with tanks.

3.14.5. Provide a tank aquastat for recirculating pump/heater control and connect complete with wiring in conduit in accordance with requirements of electrical work. Refer to drawings for heating coil requirements and related boiler specification sections.

3.14.6. Unless otherwise specified or instructed, set tank control to maintain 48.8 °C (120 °F) hot water. Check control and safeties, and adjust as required.

END OF SECTION