
Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 20 05 53 - MECHANICAL IDENTIFICATION
- .2 Section 22 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
- .3 Section 22 07 15 - THERMAL INSULATION FOR PIPING
- .4 Section 22 08 02 - CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS
- .5 Section 22 11 16 - DOMESTIC WATER PIPING
- .6 Section 22 13 18 - DRAINAGE WASTE AND VENT PIPING - PLASTIC

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 National Fire Code of Canada (NFCC 2005)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIAL

- .1 Sealants: in accordance with manufacturer's recommendations and applicable codes and standards.
- .2 Fire Stopping.

- .1 When combustible pipe passed through a rated assembly in both horizontal and vertical directions, a rated fire stop device is to be used on both sides of separation. Fire separation devices shall be in accordance with CAN4-S115. When non-combustible pipe passes thru a rated assembly in both horizontal and vertical direction, intumescent caulking shall be to fill all voids between pipe and wall on both sides of wall. All fire stopping shall be by General Contractor.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer and as indicated without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.

- .4 Over NPS 2: isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Install pipework to applicable application codes and standards.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where specified.
- .16 Check Valves:
 - .1 Install silent check valves on discharge of pumps in vertical pipes with downward flow and as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.7 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 stainless steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one-piece type with set screws.
 - .1 Chrome or nickel-plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 22 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 22 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections and provide written confirmation to Departmental Representative.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .6 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.13 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and components for metering potable water including installation.
- .2 Related Sections:
 - .1 Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME Fluid Meter's Handbook: Their Theory and Application, Sixth Edition 1971.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submittals to include:
 - .1 Piping configuration and sizing - straight pipe upstream and downstream, distances to first weld, protrusion, thermowell, pressure tap.
 - .2 Service conditions.
 - .3 Full details of primary element - standard of design and construction, materials, type serial number, flow rate, differential pressure, irrecoverable head loss (IHL), calculation sheets.
 - .4 Accuracy statements for each component at specified flow rates and other conditions.
 - .5 Flow and temperature ranges.
 - .6 Signal processor calibration data.
 - .7 Minimum turndown ratio.
- .4 Samples:
 - .1 Submit sample in accordance with Section 01 33 00 - Submittal Procedures.

- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .6 Closeout Submittals:
 - .1 Submit maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 WATER METERING

- .1 Type of metering: Electromagnetic flow meter.
- .2 Design data:
 - .1 Flow rates: See control strategy.
 - .2 Pressure Rating: 150 PSIG
 - .3 Water Temperature 0-25 °C
- .3 Flow Transmitter shall be mounted on the flow sensor.
- .4 Available lengths of straight pipe to first fitting, and intrusion: as shown on the drawings.
- .5 Diameter of main for installation of primary element: as noted on the drawings.
- .6 Acceptable types of readout instruments:
 - .1 Integrators: 6-digit, 8 mm high lettering, non-reset.
- .7 Read-out instrument display options:
 - .1 Water flow rate: L/s, USgpm or Imp. gpm.
 - .2 Total flow: USGal., m3 or Imp. Gal.
- .8 Signal transmission between primary measuring element and signal conditioners:
 - .1 Power: 115 VAC powered.
 - .2 Signal: 4-20 mA.
 - .3 Cable: colour coded, twisted and shielded pair with grounding wire.
- .9 Locations and installation mountings:
 - .1 Transmitters: Mounted on the flow meter inside precast manhole located outside of building on existing effluent line.
 - .2 Signal conditioners: Integrated to flow meter.
 - .3 Computing devices: Integrated to Transmitter.
- .10 Additional Requirements:
 - .1 Signal Converter (Transmitter) shall have at least the following:
 - .1 115 Vac powered.

- .2 $\pm 0.25\%$ accuracy of rate.
- .3 1 x 4-20 mA (HART) & 1 x pulse outputs.
- .4 1 x status input.
- .5 Display of instantaneous flow and total flow, 3 line with 20 characters.
- .2 Flow meter shall be CSA approved, field programmable, NEMA 4X enclosure, complete with polyurethane liner, designed to measure flow for clean potable water, with flow rates varying.
- .3 Flow meter housing to be epoxy coated.
- .4 Flange: ANSI B16.1, Class 125 with EPDM gaskets.
- .5 Flow meter shall be supplied with a factory calibration certificate.
- .6 Flow meter to be supplied with grounding rings.
- .7 Acceptable Products:
 - .1 Krohne Tidalflex 2300 F c/w IFC 300 transmitter.

2.2 PRESSURE GAUGES

- .1 Gauge installations shall be complete with all tubing and fittings, and shall include a shut off valve, tee and nut (clean-out) installed in each gauge inlet at the point of connection to suction and discharge pipes. Additional locations as indicated on the drawings or as directed by Departmental Representative in the field.
- .2 Gauges to be glycerine filled.
- .3 Dual indication dial range: 270° – 0 to 145 psi (0 to 1000 kPa) to be white with black figures and gradations c/w clear glass window.
- .4 Dial size: 100 mm (4").
- .5 Case, ring and pointer: Stainless steel.
- .6 Accuracy: 1% of full scale reading.
- .7 Acceptable product: US Ametek

2.3 CHLORINE ANALYZER

- .1 Chlorine Analyzer is to be installed as shown on the drawings and installation to be done in accordance with the Manufacturer's recommendations. Wiring of the chlorine analyzer is to be done as shown on the drawings. Four (4) Analyzers in total.
- .2 Chlorine analyzer Specifications:
 - .1 The chlorine analyzer consists of a sample and reagent valve and pump, measurement cell and controller.
 - .2 Accuracy: 5% or 0.03 mg/L
 - .3 Measurement range: 0 to 10 mg/L (ppm) free chlorine. (require a minimum of 20 mg/L for (3) of the analyzers (to be determined))
 - .4 To be free available chlorine analyzer type and mounted on the wall.
 - .5 The analyzer must be housed in a NEMA 12 enclosure that is IP62 rated with the gasketed door latched.

- .6 Unit will be used to control and monitor the chlorine concentration of the water. Connected to SCADA/PLC system for monitoring and control.
- .7 Results from the chlorine analyzer shall be used to control a chlorine feed pump for chlorine adjustment at both locations.
- .8 Chlorine monitor unit shall be complete with one (1) year of supply of reagents and parts, one (1) Maintenance kit, 4-20mA output for chlorine residual monitoring, start-up, training and all parts and accessories required for a complete installation.
- .9 Chlorine monitor unit shall be supplied with the required piping/tubing and fittings and pressure sustaining valves, as required for proper operation.
- .10 All piping for chlorine monitoring shall be PVC schedule 80 process piping unless noted otherwise on the drawings.
- .11 Training: minimum ½ day of training at start-up.
- .12 Acceptable Analyzer: Severn Trent Micro DPD 24996-1

2.4

CHLORINATION AND DECHLORINATION SYSTEMS

- .1 The contractor will be responsible to supply and install two (2) complete systems, one for chlorination and one for dechlorination. Each system to be supplied with 2 pumps (duty and standby) as shown on drawings. These shall include all accessories, wiring and programming as required for a complete installation.

.2 CHLORINE FEED PUMP PANEL

- .1 The Contractor will be responsible to supply and install two (2) new chlorine feed pump panels.
- .2 Pump panels to be mounted on the wall or on floor mounted support as shown on the drawing and as per Manufacturer's recommendation. Location shall be approved by the client prior to installation.
- .3 Chlorine feed pump panel:
 - .1 Chlorine feed pump panel is preferable to be built for wall mounted applications.
 - .2 Dual Pump System Package:
 - .1 The unit shall include valves for single suction configuration with dual discharge.
 - .2 Suction/discharge connections shall be ½" FNPT, maximum and size will be confirmed during shop drawing review.
 - .3 All system components to be corrosion-resistant, self-contained and completely factory assembled and factory tested.
 - .4 Unit shall have air release capability.
 - .5 Unit shall have the following components:
 - .1 Stand: PP Wall Board.
 - .2 Piping Assembly: PVC/Viton Socket-weld.
 - .3 Calibration Column to be an integral part of the panel.
 - .4 Pressure Relief Valve: PVC.

- .5 Y-Strainer: As required.
- .6 Back-pressure Valve: PVC.
- .7 Pressure Gauge: 2" SS with PVC Isolator.
- .8 Multi-Function Valve: PVC.
- .9 Flow Monitor: Type 2, PVDF/Viton.
- .3 All piping for chlorine injection shall be PVC schedule 80 process piping unless noted otherwise on the drawings. Valves shall be PVC.
- .4 Piping and fittings to be supplied for general pressure application (\pm 100/150 PSI working pressure).
- .5 Feed pump assembly shall be supplied with required valves and related piping, flow indicator, pressure gauge and equilibration column.
- .6 Spare parts: One (1) flow indicator per panel (total of three (3) required).
- .7 Acceptable feed pump assembly: Panel model Q30-D-H-I as manufactured by APS

.3 CHLORINATION AND DECHLORINATION FEED PUMPS

- .1 As noted on the drawings, the Contractor will be responsible to supply and install four (4) new chemical feed pumps (2 per panel).
- .2 New chlorination and dechlorination feed pumps:
 - .1 Pumps will be controlled by a PLC (4-20 mA signal) based on signal from flow meter and chlorine analyzer.
 - .2 Pumps shall be peristaltic type with at least the following:
 - .1 Pumphead Replacement shall be done without tools.
 - .2 Pumphead shall be Cartridge Replaceable type.
 - .3 Flow Rate: 0.1 to 500 ml/min at 100 PSI
 - .4 Flow Control: 5000:1
 - .5 Manual, Analogue or Contact mode function.
 - .6 Colour Display with keypad.
 - .7 Numerical Display: Flow, Speed and Percentage.
 - .8 Operation status LED lights.
 - .9 NEMA 4X enclosure rating.
 - .10 Required control cable for proper assembly.
 - .11 Feed pump shall be supplied with required valves and related piping, flow indicator.
 - .12 Feed pump shall be installed as per Manufacturer's recommendations.
 - .13 Feed pumps shall be supplied with flow indicator confirming that liquid is moving inside the discharge piping while the pump is in operation.
 - .14 All piping for chlorine and dechlorination chemical injection shall be 6mm dia. tubing as per manufacturer's recommendations.

- .3 Injector lance to be general pressure rated with stainless steel corporation stop, one (1) per pump panel.
- .4 Wiring of chemical feed pumps to be done as per manufacturer's recommendations.
- .5 Spare parts: Each pump panel shall be supplied with two (2) repair kit, two (2) pumphead and one (1) injector lance.
- .6 Acceptable chemical feed pumps: Watson Marlow QDOS30 Universal+ model 0M0.225H.GRA.
- .7 Training: minimum of ½ day of training after start-up.

.4 CHLORINE DRUMS

- .1 The chlorine drums shall be supplied and installed by the owner as shown on the drawings.
- .2 Drums shall be seated on 50mm thick SM insulation.

.5 SECONDARY CONTAINMENT (CHLORINATION AND DECHLORINATION)

- .1 Owner to provide secondary containment for the tanks that are in use.
- .2 Secondary containment is to be from the same manufacturer/supplier of chemical tanks. To be sized for 100% of total volume of chemical tanks.
- .3 Acceptable Product: ACO (OT-45)

.6 ULTRASONIC LEVEL TRANSMITTERS

- .1 Chlorination system:
 - .1 Ultrasonic level controller will be used to monitor the level of chlorine in the chlorine tank.
 - .2 Level controller shall be sized for the depth of the chlorine tank in order to provide the maximum accuracy in level measurements.
 - .3 To be installed on top of tanks.
 - .4 Controller 4-20 mA output signal shall be wired to electrical panels in accordance with Division 16 for monitoring and alarm purposes.
 - .5 Controller enclosure shall be NEMA 4X, encapsulated, corrosion resistant and submersible. Length of control cable shall be made specific for the installation, minimum of 1.2 m long. Item shall be delivered complete to the site including set-up and training.
 - .6 Operation range of controllers to be set for the application.
 - .7 Acceptable Controller: EchoPod Model No. DL 14-00 E c/w mounting bracket, as manufactured by Flowline, or approved equal.
- .2 Dechlorination system:
 - .1 Ultrasonic level controller will be used to monitor the level of dechlorination chemical in the tank.
 - .2 Level controller shall be sized for the depth of the tank in order to provide the maximum accuracy in level measurements.

- .3 To be installed on top of tanks.
- .4 Controller 4-20 mA output signal shall be wired to electrical panels in accordance with Division 16 for monitoring and alarm purposes.
- .5 Controller enclosure shall be NEMA 4X, encapsulated, corrosion resistant and submersible. Length of control cable shall be made specific for the installation, minimum of 1.2 m long. Item shall be delivered complete to the site including set-up and training.
- .6 Operation range of controllers to be set for the application.
- .7 Acceptable Controller: EchoPod Model No. DL 14-00 E c/w mounting bracket, as manufactured by Flowline, or approved equal.
- .3 Dechlorination Tank:
 - .1 Ultrasonic level transmitter will be used to monitor the water level in the Dechlorination Tank where the UV pumps draw water
 - .2 Submersible level transmitter, range 5 psi (11.54 ft wc) (3.52 m wc), 40 ft (12.2 m) polyurethane cable.
 - .3 To be installed through top of tank and suspended below water level.
 - .4 Controller 4-20 mA output signal shall be wired to electrical panels in accordance with Division 16 for monitoring and alarm purposes.
 - .5 Acceptable Controller: Dwyer Series SBLT2-5-40 c/w mounting bracket, as manufactured by Mercoid, or approved equal.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION OF PRIMARY ELEMENT

- .1 Follow manufacturer's instructions.

3.3 INSTALLATION OF SIGNAL TRANSMISSION CABLE

- .1 Ground shielding at one point only.
- .2 Protect against RF interference.
- .3 Cross electrical cables, conduits at 90 degrees leaving at least 150 mm space between.

3.4 START-UP

- .1 Follow manufacturer's recommendations.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

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- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM F1970 - Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

2.2 PVC BALL VALVES:

- 1. Pressure rated up to 230 psi (PVC, CPVC, PVDF)
- 2. Double O-ring seals on stem for added protection
- 3. Full bore, sizes 1/2" – 2"
- 4. Full vacuum rated, all sizes
- 5. Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve

6. Integrally molded ISO mounting pad for both manual and actuated operations
7. Integrally molded base pad to mount valves securely or panel mounting
8. PTFE seats with elastomeric backing cushions ensure bubble-tight shut-off and a low fixed torque, while at the same time compensating for wear
9. True union design for easier installation or repairs without expanding the pipe system
10. Built-in spanner wrench on the handle for valve disassembly and assembly
11. Two sets of end connectors (socket and threaded included with all PVC and CPVC valves in sizes 1/2" – 2"
12. CPVC threaded end connectors on sizes 1/2" – 1" come with stainless steel reinforcing rings
13. New PTFE seat design – Facilitates easier field maintenance if required
14. Tapered O-ring groove – Helps to keep the end connector O-rings on the valve body during installation
15. Body flats – Flats have been added to either side of the valve body where a wrench can be applied to prevent the valve body from turning when the union nuts are tightened
16. Acceptable Product: Asahi/America T-21 Ball Valve.

2.3 CHECK VALVES:

- .1 Ball Check Valve:
 - .1 Uniseat/seal of EPDM or FKM
 - .2 Ball is the only moving part. It unseats to permit flow in one direction but seals against seat to prevent back flow
 - .3 May be used vertically or horizontally
 - .4 Minimum shut-off of 5 psi
 - .5 All sizes rated for full vacuum service
 - .6 Solid thermoplastic ball
 - .7 Acceptable Product: Asahi/America.
- .2 Wafer Check Valve:
 - .1 A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of PVC with an EPDM or NBR resilient seat.

2.4 BUTTERFLY VALVES:

1. Standard model (1-1/2" – 14") has PVC body and PP disc for superior chemical resistance and elevated temperature capabilities
2. 316 stainless steel shaft has full engagement over the entire length of the disc and is a non-wetted part
3. Only solid and abrasion resistant plastic disc and elastomeric liner are wetted parts

4. ISO bolt circle on top flange – No body or stem modifications required for accessories
5. Stem retainer – PP retainer to prevent stem removal
6. Seat overtightening protection – Molded body stops and seat stress relief area
7. Spherical disc design offers increased Cv, ultimate sealing and high cycle life
8. 21-position throttle plate for lever handle style
9. Acceptable Product: Asahi/America T-57 with Lever.

2.5 3-WAY BALL VALVES:

1. Multiport True Union Ball Valve (1/2" – 6") has PVC body and EPDM O-rings.
2. End connections to be socket
3. Valves shall be rated to 150psi at 70 degF
4. Acceptable Product: Asahi/America Type-23 Multiport.
5. Include reversing bi-directional electric actuator, 120VAC, 60 Hz, suitable for 1/2" - 4" ball valves.
 - Brushless, capacitor-run motors (AC models)
 - Integral thermal overload protection with auto-reset (AC models)
 - Permanently lubricated gear train
 - Duty cycle 100% for high cycle applications
 - Combination Type 4X, 7 and 9 enclosure with thermally bonded powder coating with stainless steel trim
 - ISO bolt circle
 - Two 1/2" NPT conduit ports prevent interference between control and power signals
 - Declutchable manual override
 - Standard travel-stop limit switches can simultaneously be used for indicator lights
 - Highly visible position indicator
 - Include Peaktronics Positioner DHC-100, c/w transmitter/relay module
 - Acceptable Product: Asahi/America Electronically Actuated Series 92.

2.6 INSTALLATION

- .1 Install valves as shown on drawings and as per manufacturer's recommendations.

2.7 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 11 16 - DOMESTIC WATER PIPING

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A276-08, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit data for valves specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
- .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 NPS 2 and under:
 - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
 - .2 NPS 2 1/2 and larger:
 - .1 Flanged ends.
- .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 NPS 2 and under, swing type, bronze disc, Class 150:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 Acceptable Manufacturer (or approved equal):
 - .1 Crane
 - .2 Jenkins
 - .3 Watts
 - .4 Apollo
 - .5 Kitz
- .5 Silent Check Valves:

-
- .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.
 - .7 Acceptable Manufacturer (or approved equal):
 - .1 Crane
 - .2 Jenkins
 - .3 Watts
 - .4 Apollo
 - .5 Kitz
 - .2 Standard of Acceptance: Victaulic Series 716 and Series W715.
 - .3 Acceptable Manufacturer (or approved equal):
 - .1 Crane
 - .2 Jenkins
 - .3 Watts
 - .4 Apollo
 - .5 Kitz
 - .6 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125 WOG 2760-kPa CWP 4140-kPa CWP, 860 kPa steam.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders solder ends to ANSI/ASME 16.18.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.
 - .2 Acceptable Manufacturer (or approved equal):
 - .1 Crane 9202 or 9222,
 - .2 Jenkins 201SJ or 202 SJ,
 - .3 Watts B-6000 or B-6001,
 - .4 Red & White 5044A or 5049A,
 - .5 Kitz 58 or 59,
 - .6 Apollo 77C series

-
- .7 Victaulic Series P569.
 - .8 For Aquatherm or Aquarise piping use compatible valves from respective pipe manufacturers.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 11 16 DOMESTIC WATER PIPING.
- .2 Section 22 11 18 DRAINAGE WASTE AND VENT PIPING - PLASTIC

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International
 - .1 ASTM A123-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
 - .5 ASTM A653-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for:

- .1 Bases, hangers and supports.
- .2 Connections to equipment and structure.
- .3 Structural assemblies.
- .4 Upper attachment
- .5 Middle attachment
- .6 Pipe attachment.
- .7 Riser clamps
- .8 Shields and saddles
- .9 Sway braces
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions for incorporations into manual.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

- .5 Provide for vertical adjustments after erection and during commissioning.
Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

2.3 PIPE SUPPORTS

- .1 Finishes:
 - .1 Pipe hangers and supports: stainless steel.
- .2 Pipe channel support:
 - .1 Provide 12 gauge stainless steel channel pipe support to MSS-SP-58 c/w stainless steel hold down clamp and Hilti bolts for each support.
 - .1 Acceptable Manufacturer (or approved equal):
 - .1 Grinnell
 - .2 Anvil
 - .3 Unistrut
 - .4 Myatt

2.4 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers, supports and all nuts/bolts/accessories: stainless steel.
 - .2 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: stainless steel C-clamp to MSS-SP-58, type 19. ULC listed with hardened steel cup point setscrew, locknut retaining clip.
 - .1 Rod: 9 mm UL listed.
 - .2 Acceptable Manufacturer: Anvil fig. 229 or approved equal.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: beam clamp, eye rod, jaws and extension with retaining clip, tie rod, nuts and washers, type 28 or 29, UL listed, to MSS-SP58.
 - .1 Acceptable Manufacturer: Anvil fig. 229 or approved equal.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: top-of-beam C-clamp with cup point setscrew, locknut and retaining clip, type 19, UL listed, to MSS-SP58.
 - .1 Acceptable Manufacturer: Anvil fig.61 or approved equal.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut, type 25 ,UL listed, to MSS-SP58.
 - .1 Acceptable Manufacturer: Anvil fig.227 or approved equal.
- .4 Upper attachment to concrete:

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- .1 Inserts for cast-in-place concrete steel wedge to MSS-SP-58, type 18 ULC listed for pipe NPS 3/4 through NPS 8
 - .1 Acceptable Manufacturer: Anvil fig.281 or approved equal.
 - .2 Steel plate with clevis, for surface mount: socket and expansion case and bolt. Minimum two expansion cases and bolts for each hanger. UL listed, to MSS SP69.
 - .1 Acceptable Manufacturer: Anvil, Plate fig.49, Eye Nut fig. 290, Expansion Case Fig. 117. or approved equal.
 - .5 Upper attachment to steel joist:
 - .1 Piping NPS 2 and under: steel washer plate with double locking nuts.
 - .1 Acceptable Manufacturer: Anvil fig. 60 or approved equal.
 - .2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.
 - .1 Acceptable Manufacturer: Anvil: washer plate, fig. 60; clevis, fig 66; eye nut, fig 290. or approved equal.
 - .6 Upper attachment to steel channel or angle (top):
 - .1 Piping NPS 2 and under; "top of beam" C clamp to MSS-SP-58, type 19. ULC listed
 - .1 Acceptable Manufacturer: Anvil or approved equal.
 - Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.
 - .1 Acceptable Manufacturer: Anvil: fig.227 or approved equal.
 - .7 Upper attachment to wood joist (bottom):
 - .1 Piping NPS 2 and under.
 - .1 Acceptable Manufacturer: Anvil Fig. 142 or approved equal.
 - .8 Hanger rods: Carbon steel threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
 - .4 Acceptable Manufacturer: Anvil: fig.146 or approved equal
 - .9 Pipe attachments: material to MSS SP58:
 - .1 Cold piping, steel: hot piping steel, with less than 25 mm horizontal movement; hot piping, steel, with more than 300 mm middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1. ULC listed.
 - .1 Acceptable Manufacturer: Anvil: fig.260 or approved equal
 - .2 Cold copper piping, with less than 25 mm horizontal movement; hot copper piping, with more than 300 mm middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1 Copper plated. ULC listed.
 - .1 Acceptable Manufacturer: Anvil: fig.CT-65 or approved equal

- .3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25mm; hot steel piping with middle attachment (rod) 300 mm or less; pipe roller to MSS-SP-58, type 43.
 - .1 Acceptable Manufacturer: Anvil: fig.174 or approved equal
- .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
 - .1 Acceptable Manufacturer: Anvil: fig.271 or approved equal
- .5 Use insulation shields for hot pipework.
- .6 Oversize pipe hangers and supports.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.5 RISER CLAMPS

- .1 Steel pipe: stainless steel to MSS SP58, type 42, UL listed.
 - .1 Acceptable Manufacturer: Anvil fig 261 or approved equal
- .2 Copper pipe: stainless steel copper plated to MSS SP58, type 42.
 - .1 Acceptable Manufacturer: Anvil fig CT-121 or approved equal
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.6 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield with uninterrupted vapor barrier to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
 - .1 Acceptable Manufacturer: Anvil fig 167 or approved equal
- .2 Insulated hot piping:
 - .1 Protective saddle with insulation under saddle.
 - .1 Acceptable Manufacturer: Anvil fig 160 to 166 or approved equal

2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade stainless steel.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.9 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table, whichever is more stringent.
 - .1 Plumbing piping: to Canadian Plumbing Code.
 - .2 Fire protection: to applicable fire code
 - .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8m
 - .4 Copper piping: up to NPS 1/2: every 1.5 m.
 - .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Rod Diameter NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	10 mm	2.4 m	1.8 m
1-1/2	10 mm	3.0 m	2.4 m
2	10 mm	3.0 m	2.4 m
2-1/2	10 mm	3.7 m	3.0 m
3	10 mm	3.7 m	3.0 m
3-1/2	10 mm	3.7 m	3.3 m
4	16 mm	3.7 m	3.6 m
5	16 mm	4.3 m	
6	22 mm	4.3 m	
8	22 mm	4.3 m	
10	22 mm	4.9 m	
12	22 mm	4.9 m	

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 **11** - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Related Requirements
 - .1 Section 22 11 16 - DOMESTIC WATER PIPING.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-16, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335-2010, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-2011, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-2013, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-2013, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-2015, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-2013, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-2015, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts
 - .3 CGSB 51.9-92, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project and member of TIAC.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
 - .3 Accepted Manufacturer (or approved equal):
 - .1 John Manville
 - .2 Fibrex
 - .3 Mason AK Board
 - .4 Industrial Insulation Group, LLC
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Insulation: to CGSB 51.9-92
 - .2 Mineral fibre: to CAN/ULC-S702.
 - .3 Jacket: to CGSB 51-GP-52Ma.
 - .4 Maximum "k" factor: to CAN/ULC-S702.
 - .5 Accepted Manufacturer (or approved equal):

- .1 John Manville
- .2 Fibrex
- .3 Mason AK Board
- .4 Industrial Insulation Group, LLC

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.

- .8 Special requirements:
 - .1 Outdoor: UV rated material at least 0.5 mm thick.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Bands at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.

- .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Up to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8	up to 175
Run out		A-1	38	50	65	75	90	90
Domestic HWS		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25

- .5 Finishes:

- .1 Exposed indoors: PVC jacket.
.2 Exposed in mechanical rooms: PVC jacket.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.
.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.
- .2 Related Requirements
 - .1 Section 22 11 16 - DOMESTIC WATER PIPING

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CLEANING HYDRONIC AND STEAM SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
 - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers: clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.

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- .6 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 05 - INSTALLATION OF PIPEWORK.
- .2 Section 22 07 15 - THERMAL INSULATION FOR PIPING
- .3 Section 22 42 01 - PLUMBING SPECIALTIES AND ACCESSORIES
- .4 Section 22 42 03 - COMMERCIAL FIXTURES

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02a, Butterfly Valves.
 - .2 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .7 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with manufacturer's instructions.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

Part 2 Products

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Crosslinked polyethylene (PEX) to CSA B137.10 or CSA B137-9 or CSA B137.5, ASTM F1281 and NSF shall be used above and below grade for all domestic water piping systems. All PEX piping shall be type PEX-a. **No exceptions.**
 - .1 When PEX piping is used in exposed applications fit entire length of exposed pipe with pipe manufacturer's metal snap on pipe cover and fasten to Unistrut support with pipe manufacturer's pipe clips. Use rubber guards between clip and pipe
 - .2 Use stainless steel long sleeve 90° supports for PEX piping leaving walls for fixture supplies so that all piping leaving walls is stainless steel.
 - .3 The following shall be the standard of acceptance for PEX-a piping material:
 - .1 Rehau;
 - .2 Uponor;
 - .3 Heat-Link.

2.2 FITTINGS

- .1 All fittings for PEX-a piping shall be of the same manufacturer as the piping system installed.
- .2 NPS ½ through NPS 2: Fittings, elbows and tees to ASTM F1960, cold-expansion fitting.

- .3 All transitions shall be one-piece brass fitting with male or female threaded adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring or brass sweat to PEX-a. Use dielectric couplings where necessary.
- .4 All fittings shall be UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Teflon tape: for threaded joints.
- .4 Dielectric connections between dissimilar metals:
 - .1 dielectric fitting, complete with thermoplastic liner.
 - .2 UL classified in accordance with NSF-61 for potable water service, and shall meet the low-lead requirements of NSF-372.
- .5 All pipe joints for Pex piping to be jointing systems as supplied by pipe manufacturer. Do not join Pex piping below floor.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install in accordance with NPC, local authority having jurisdiction and Province(s) Plumbing Code.
- .2 Install pipe work in accordance with Section 22 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Install all PEX-a tubing in accordance with manufacturer's recommendations. Contractor shall periodically have PEX-a installation reviewed by PEX-a piping manufacturer's representative.
- .7 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

- .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 20 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.8 START-UP

- .1 Timing: start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.

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- .4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .3 Sterilize HWS and HWC systems for Legionella control.
 - .4 Verify performance of temperature controls.
 - .5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .6 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
 - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 22 05 05 - Installation of Pipework.

3.11 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 05 - INSTALLATION OF PIPEWORK.
- .2 Section 22 05 29 - HANGER AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D2235-04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564-04e1, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800-06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 For buried DWV sanitary and vent piping inside building to:
 - .1 ABS to CAN/CSA – B181.1.

- .2 PVC to CAN/CSA B181.2.
- .3 PVC SDR-35 to CAN/CSA B182.2
- .4 'BDS PVC to CAN/CSA B182.1 will not be accepted.
- .2 For above grade DWV sanitary and vent piping except where used in a return air plenum.
 - .1 PVC to CAN/CSA-B181.2

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.
- .3 ABS or PVC - DWV - Clean all joints with ABS or PVC - Cleaner. Use ABS or PVC solvent cement on both sides of joints. All work carried out to CSA Standard B181.1-M90 and B181.2-M90 recommended practice for the installation of ABS or PVC DWV pipe fittings. PVC SDR35 pipe to have gasketed Bell & Spigot joints to CSA B182.1 or .2

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 **11** - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 20 05 53 - Mechanical Identification.
- .3 Section 22 05 19 - Meters, Gauges and instruments.
- .4 Section 22 05 23 - Valves - Process
- .5 Section 22 05 23.01 - Valves - Bronze

1.2 REFERENCES

- .1 American Iron and Steel Institute (AISI)
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ASME B31.1-07, Power Piping.
- .3 ASTM International
 - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A193/A193M-08b, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - .3 ASTM A194/A194M-08b, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 - .4 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .4 CSA International
 - .1 CSA B51-09, Boiler, Pressure Vessel and Pressure Piping Code.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide Project Record Documents in accordance with Section 01 78 00 - Closeout Submittals supplemented with:
 - .1 Information relating to elevations, inverts and location of piping.
 - .2 Valve data.
 - .3 Details of permanent instrumentation.
 - .4 Drainage provisions at low points.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial regulations.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 61 00 - Common Product Requirements.

Part 2 Products

2.1 PIPE AND FITTINGS FOT TREATMENT PLANT PROCESS

- .1 Piping and fittings:
 - .1 Rigid PVC (polyvinyl chloride) used in the extrusion of Schedule 80 pipe and fittings complies with the material requirements of ASTM D1784 (formerly Type 1, Grade 1) and has a cell classification of 12454. Raw material used in the extrusion shall contain the standard specified amounts of color pigment, stabilizers and other additives. The compounds used are listed to the requirements of NSF 61 for use in potable water service.
 - .2 All PVC Schedule 80 pipe shall conform to ASTM D1785, NSF 14, and/or CSA B137.0/B137.3. Schedule 80 socket fittings shall conform to ASTM D2467 and Schedule 80 threaded fittings shall conform to ASTM D2464. All fittings must be third party certified to NSF 14.
 - .3 Physical dimensions and properties Schedule 80 pipe and fittings shall meet the requirements of ASTM D1785 and/or be certified to CSA B137.3. Socket dimensions of belled end pipe shall meet the requirements of ASTM D2672 or F480.
- .2 Joining:

- .1 The PVC pipe and socketed fittings shall be joined by use of solvent base cements manufactured in accordance with ASTM D2564. Ends of pipe shall be cut square; pipe and sockets of fittings cleaned; all dirt, grease and glossy finish removed. Joints shall be made in accordance with the pipe manufacturer's recommendations and conform to the recommended practice for making solvent-cemented joints described in ASTM D2855. The ends of pipe and sockets of fittings shall be prepared with an approved pipe primer and coated with an approved solvent cement and pushed together. Where piping is to be joined to other materials or fittings, suitable socketed adapters shall be used. Where metallic couplings or other connections are used, the manufacturer's recommendations shall be strictly adhered to.
- .3 Solvent Cementing:
 - .1 All socket type joints shall be made using primers and solvent cements that meet or exceed the requirements of ASTM F656 and ASTM F493 respectively. The standard practice for safe handling of primer and cement shall be in accordance with ASTM F402 and the manufacturer's material safety data sheets (MSDS). Only PVC primer and solvent cement shall be used when making PVC solvent cement joints.

2.2 VALVES

- .1 Refer to Section 22 05 23 – Valves - Process
- .2 Refer to Section 22 05 23.01 – Valves - Bronze
- .3 Refer to Section 22 05 19 – Meters, Gauges and Instruments.

2.3 FABRICATION

- .1 Do work in accordance with ASME B31.1.
- .2 Joints:
 - .1 Accessible locations: screwed, flanged or solvent cementing to match piping specification.
 - .2 Elsewhere: welded throughout, except at flanged components.
- .3 Branch connections:
 - .1 Branch connections shall be made with tees or other approved fittings.

Part 3 Execution

3.1 PREPARATION

- .1 Lay out work in accordance with lines and grades as indicated.
- .2 Verify lines, levels, dimensions as indicated against established benchmarks. Report discrepancies to Engineer and obtain written instruction.
- .3 When required by Engineer, provide drawings showing relative locations of various services.

3.2 INSTALLATION

- .1 Installation to be performed by certified pipe fitters.
- .2 Install pipework as shown on drawings.
- .3 Clearances:
 - .1 Maintain clearance around systems, equipment and components and between pipes and structures for O M to manufacturer's recommendations.
- .4 Flanges: use suitable graphite lubricant on bolts and nuts.
- .5 Branch take-offs:
 - .1 Use tees.
 - .2 Where reducing tees of proper size are unavailable, use available tees with reducers. Tees with increasers not acceptable.
- .6 Cap open ends of piping during installation. Remove foreign material from inside piping.
- .7 Grade nominally horizontal piping at 0.4% slope to high point for air removal.
- .8 Flanges: tighten bolts evenly with torque wrench.
- .9 Revisions to location of piping require written approval of Engineer.
- .10 Connections to equipment:
 - .1 Use flanged valves for isolation and ease of maintenance and assembly.

3.3 PIPE SUPPORTS

- .1 In accordance with Section 22 05 29 - Hangers and Supports for HVAC Piping and Equipment, supplemented as specified herein.
- .2 Install to manufacturer's recommendations.

3.4 VALVES

- .1 Install isolating valves as shown on drawings.
- .2 Install in accordance with manufacturer's recommendations.
- .3 Install valves, where specified, between flanges to ensure full compression of liner.
- .4 Install in accessible locations.
- .5 Valve operating levers/handwheels to be located at elevations and orientations that are easily accessible for operation.
- .6 Valves to be accessible for maintenance without removing adjacent piping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections:
 - .1 Leave joints in piping systems uncovered until tests are completed and system inspected as directed by Engineer.

- .2 Engineer to inspect new piping prior to hydrostatic pressure tests for compliance with approved drawings and specifications.
- .3 Obtain from Engineer requirements for inspection and testing of system modifications, design changes and repairs performed in-house.
- .4 Pay costs for inspections.

3.6 PRESSURE TESTS:

- .1 Refer to Section 33 11 16 – Water Service, Pipe Fittings and Valves

3.7 FLUSHING AND CLEANING

- .1 Refer to Section 33 11 16 – Water Service, Pipe Fittings and Valves
- .2 COMMISSIONING
- .3 Instrumentation: verify accuracy of pressure gauges by comparison with calibrated test instruments.
- .4 Full scale tests: upon completion, conduct full scale tests at maximum design flow rates, operating temperatures and pressures for continuous consecutive period of 2 hours to demonstrate compliance with design requirements.

3.8 IDENTIFICATION

- .1 In accordance with Section 20 05 53 - Mechanical Identification, supplemented as specified herein.
- .2 In addition, identify piping at building entries.

3.9 DEMONSTRATIONS

- .1 Operate at design temperatures, pressures, flow rates for consecutive period of 2 hours to demonstrate compliance with design criteria and design intents.
- .2 Demonstrations also to show completeness of O & M personnel training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 NSF/ANSI STANDARD 61.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fire pump control and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

- .1 Extra Materials:
 - .1 Furnish spare parts for each pump in accordance with Section 01 78 00 - Closeout Submittals and as follows:
 - .1 One set of packing.
 - .2 One casing joint gasket.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports:
 - .1 Test each pump/driver package at factory to provide detailed performance data and to demonstrate compliance with specification. Submit certified test curves for approval of Engineer.
 - .2 Test hydrostatically to meet requirements of system to which it will be connected.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

- .4 Manufacturer's Field Reports: manufacturer's field reports specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements:
- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Packaging Waste Management: remove of pallets, crates, padding, and packaging materials in accordance with Division 1 Sections.

Part 2 Products

2.1 PUMPS

- .1 UV system Pumps:
- .1 Goulds SSH series end suction pump - 316L SS 22SHFRM3D0
- .2 Closed coupled , Size: 2.5 x 3 - 8 (8 1/4" imp)
- .3 Motor (5 hp, 575V/3/60 hz)
- .4 Pump Construction:
- .1 Each pump shall be designed for clockwise rotation viewed from driven end and include the following design features.
- .1 Casing
- The pump casing shall be concentric volute type, back pull-out design with ANSI class 150 flanged suction and discharge connections and shall be constructed of AISI TYPE 316L stainless steel material.
 - The pump discharge nozzle shall be center line oriented to allow simplified system design and installation.
 - The complete pump unit shall be supported by the motor.
 - Pump casing drain shall be provided with stainless steel plugs.
- .2 Wear Ring
- A replaceable labyrinth type suction wear ring of AISI TYPE 316L stainless steel shall be provided and held securely by means of an interference fit in the casing suction.
- .3 Impeller
- The pump impeller shall be of enclosed design, constructed of AISI TYPE 316L stainless steel material, and key driven. A stainless steel bolt and washer shall provide positive attachment of the impeller to the motor shaft.
- .4 Seal Housing
- The seal housing shall be constructed of AISI TYPE 316L stainless steel material and shall hold the stationary seat of the mechanical shaft seal.

- The seal housing shall be clamped in place over a machined fit on the motor adapter by the pump casing to maintain component alignment and is "O-ring" sealed to insure against leaks
 - .5 Shaft Sleeve
 - The pump shaft sleeve shall be constructed of AISI TYPE 316L stainless steel and shall be of the hook type design. Locked in place by the impeller without necessity of other mechanical locking devices. The sleeve design must allow the motor shaft to remain dry during pump operation.
- .2 Chlorine Monitor Loop Pumps:
- .1 Goulds SSH series end suction pump - 316L SS 9SH3D12B0
 - .2 Closed coupled , Size: 1 x 2 - 6 (6 7/16" imp)
 - .3 Motor (3/4 hp, 115-208-230V/1/60hz, 1750 rpm, TEFC)
 - .4 Pump Construction:
 - .1 Each pump shall be designed for clockwise rotation viewed from driven end and include the following design features.
 - .1 Casing
 - The pump casing shall be concentric volute type, back pull-out design with ANSI class 150 flanged suction and discharge connections and shall be constructed of AISI TYPE 316L stainless steel material.
 - The pump discharge nozzle shall be center line oriented to allow simplified system design and installation.
 - The complete pump unit shall be supported by the motor.
 - Pump casing drain shall be provided with stainless steel plugs.
 - .2 Wear Ring
 - A replaceable labyrinth type suction wear ring of AISI TYPE 316L stainless steel shall be provided and held securely by means of an interference fit in the casing suction.
 - .3 Impeller
 - The pump impeller shall be of enclosed design, constructed of AISI TYPE 316L stainless steel material, and key driven. A stainless steel bolt and washer shall provide positive attachment of the impeller to the motor shaft.
 - .4 Seal Housing
 - The seal housing shall be constructed of AISI TYPE 316L stainless steel material and shall hold the stationary seat of the mechanical shaft seal.
 - The seal housing shall be clamped in place over a machined fit on the motor adapter by the pump casing to maintain component alignment and is "O-ring" sealed to insure against leaks

.5 Shaft Sleeve

- The pump shaft sleeve shall be constructed of AISI TYPE 316L stainless steel and shall be of the hook type design. Locked in place by the impeller without necessity of other mechanical locking devices. The sleeve design must allow the motor shaft to remain dry during pump operation.

2.2 UV PUMP SYSTEM CONTROLLER

- .1 The pump system controller shall be a standard product developed and supported by the pump manufacturer.
- .2 The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a VGA display with a minimum screen size of 3-1/2" x 4-5/8" for easy viewing of system status parameters and for field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.
- .3 The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections. All listed alarms and values shall be available through the Ethernet connection to the SCADA panel.
- .4 The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
 - Current value of the control parameter, (typically discharge pressure).
 - Most recent existing alarm (if any).
 - System status with current operating mode.
 - Status of each pump with current operating mode and rotational speed as a percentage (%).
- .5 The controller shall have as a minimum the following hardware inputs and outputs:
 - Three analog inputs (4-20mA).
 - Three digital inputs.
 - Two digital outputs.
 - Ethernet connection.
 - Field Service connection to PC for advanced programming and data logging.
- .6 Pump system programming (field adjustable) shall include as a minimum the following:
 - Water shortage protection (analog or digital).
 - Transducer Settings (Suction and Discharge Analog supply/range).
 - PI Controller (Proportional gain and Integral time) settings.
 - High system pressure indication and shut-down.
 - Low system pressure indication and shut-down.
 - Low suction pressure/level shutdown (via digital contact).
 - Low suction pressure/level warning (via analog signal).

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- Low suction pressure/level shutdown (via analog signal).
 - Flow meter settings (if used, analog signal).
- .7 The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).
- .8 The controller shall have advanced water shortage protection. When analog sensors (level or pressure) are used for water shortage protection, there shall be two indication levels. One level is for warning indication only (indication that the water level/pressure is getting lower than expected levels) and the other level is for complete system shutdown (water or level is so low that pump damage can occur). System restart after shutdown shall be manual or automatic (user selectable).
- .9 The controller shall be capable of receiving a remote analog set-point (4-20mA) as well as a remote system on/off (digital) signal.
- .10 The pump system controller shall store up to 24 warning and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:
- | | |
|---|-------------------------|
| • High System Pressure | Low system pressure |
| • Low suction pressure (warning and/or alarm) | Individual pump failure |
| • VFD trip/failure (4-20 mA) | Loss of sensor signal |
| • Loss of remote set-point signal (4-20mA) | System power loss |
- .11 The pump system controller shall be mounted in a ULC Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire control panel shall be CSA C22.2 No.14-10 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions. Control panel options shall include, but not be limited to:
- | | |
|---------------------------------------|-------------------------------------|
| • Pump Run Lights | Pump Alarm Lights |
| • System Fault Light | Audible Alarm (80 dbA) |
| • Surge Arrestor | Control Panel Internal Illumination |
| • Emergency/Normal Operation Switches | Service Disconnect Switches |
- .12 The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).
- .13 The controller shall have a pump "Test Run" feature such that pumps are switched on during periods of inactivity (system is switched to the "off" position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of two to three (2-3) seconds every 24 hours, 48 hours or once per week (user selectable).
- .14 The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).
- .15 The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller.

- .16 The controller shall have one (1) hour meter for each pump.

2.3 SEQUENCE OF OPERATION

- .1 The system controller shall operate equal capacity variable speed pumps to maintain a constant level in the dechlorination chamber (system set-point). The system controller shall receive an analog signal 4-20mA from the level transducer located in the dechlorination tank, indicating the actual liquid level in the chamber. As flow demand increases the pump speed shall be increased to maintain the system set-point level. When the operating pump(s) reach 96% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the tank level is equal to the system set-point all pumps in operation shall reach equal operating speeds. As flow demand decreases the pump speed shall be reduced while system set-point level is maintained. When all pumps in operation are running at low speed the system controller shall switch off pumps when fewer pumps are able to maintain system demand.
- .2 The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
- .3 The pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps. The interval and actual time of the pump change-over shall be field adjustable. Controller shall alternate pumps as required to maintain approximately the same amount of hours on each pumps

2.4 LOW FLOW STOP FUNCTION

- .1 The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable.
- .2 Low Flow Stop and Energy Saving Mode:
- .1 When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the level reaches the stop low level. The pump shall remain off until the level reaches the start level. The stop and start level setting shall be field adjustable.

2.5 SYSTEM CONSTRUCTION

- .1 The suction and discharge manifolds shall be constructed of 316 stainless steel. Manifold connection sizes shall be as follows:
- 3 inch and smaller: Male NPT threaded
 - 4 inch through 8 inch: ANSI Class 150 rotating flanges
- .2 Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes smaller than 2" shall be PVC full port ball valves. Isolation valve

- sizes 2 inch and larger shall be a full lug style PVC butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be PVC.
- .3 A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of PVC with an EPDM or NBR resilient seat.
 - .4 A level transmitter shall be installed in the dechlorination chamber. Level transmitter shall be made of 316 stainless steel. Transducer accuracy shall be +/- 0.25% full scale. The output signal shall be 4-20 mA with a supply voltage range of 10-30 VDC.
 - .5 A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
 - .6 Systems requires flooded suction inlet or suction lift configuration and shall have a factory installed water shortage protection device on the suction manifold.
 - .7 The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and base frame to minimize vibration.
 - .8 The control panel shall be mounted in the electrical room.

2.6 ACCEPTABLE PRODUCT

- .1 The pumps shall be Goulds as described above

2.7 WARRANTY

- .1 The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions and reviewed shop drawings.
- .2 Align pump and motor shafts to within manufacturer's recommended clearances prior to start-up.
- .3 Install wiring in accordance with manufacturer's instructions and applicable codes.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Site Tests:
 - .1 Field test each pump, driver and controllers in accordance with specification. Testing to include:
 - .1 Verification of proper installation, system initiation, adjustment and fine tuning.
 - .2 Verification of the sequence of operations and alarms.
 - .2 Testing to be witnessed by Engineer.

3.4 MANUFACTURER'S SERVICES

- .1 Installation Inspection and Start-up: 1/2 day on site.
- .2 Commissioning and Operator training: 1/2 day on site.
- .3 Warranty service scheduling: As required during the specified warranty period.

3.5 START-UP

- .1 Follow manufacturer's recommendations.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.
 - .2 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed in accordance with Division 1.
 - .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.5 WARRANTY

- .1 Product shall be warranted by factory for a period of 12 months from installation.

Part 2 Products

2.1 COMPONENTS

2.2 ELECTRIC WATER HEATER

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191.

-
- .2 Refer to schedule on drawings and detail for product capacity requirements.

2.3 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 NSF/ANSI STANDARD 61

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit for review, engineering drawings showing the following:
 - .1 Complete description in sufficient detail to permit an item comparison with the specifications;
 - .2 Dimensions and installation requirements;
 - .3 Electrical Drawings;
 - .4 DVGW Validation Certificate documenting the dose delivered by the system;
 - .5 Company information including descriptions of quality control procedures and certifications (ex: ISO 9001 Registration).

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide maintenance data including monitoring requirements for incorporation into Operation and Maintenance manuals.
 - Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity;
 - .2 Details of operation, servicing, maintenance;
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements:

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.6 GENERAL UV DISINFECTION SYSTEM

.1 Scope

Furnish all labour, materials, equipment and appurtenances required to provide an ultraviolet (UV) disinfection system complete and operational with all control equipment and accessories as shown.

.2 Conformance of Product

UV Disinfection system to meet or exceed the Requirements of NSF/ANSI Standard 61.

.3 Water Quality and Additional Requirements

Contractor/Supplier are responsible to supply a UV Disinfection System to suit the application. Water analysis including turbidity and UVT sampling are to be completed and provided by the Owner prior to ordering the UV system.

Contractor/Supplier to take additional water sampling as required during the tendering period. Sampling to be coordinated with Departmental Representative.

.4 Guarantee

The equipment furnished under this section (excluding UV lamps) will be free of defects in materials and workmanship, including damages that may be incurred during shipping for a period of one (1) year from date of start-up or 18 months after shipment, whichever occurs first.

The UV lamps are warranted for 12,000 hours of operations (prorated at 9,000 hours) or thirty-six (36) calendar months from shipment, whichever comes first. On/off cycles are limited to an average of four (4) per day.

Part 2 Products

2.1 UV DISINFECTION SYSTEM

.1 Scope

Furnish all labour, materials, equipment and appurtenances required to provide a pressurized vessel, amalgam lamp based, ultraviolet (UV) disinfection system. The UV system to be complete and operational with all control equipment and accessories as shown on Contract Drawings and specified herein.

.2 Quality Assurance

Pre-Qualification Requirements:

Any alternate UV manufacturer that is not listed as approved equal must submit the following 7 days prior to the bid to be considered for approval:

- .1 Evidence of previous successful performance utilizing low-pressure amalgam lamp systems in similar applications. The proposed manufacturer must be able to demonstrate at least ten (10) permanent installations of this equipment type;

- .2 Submittal including Reactor Details, Control Panel, lamp and ballast descriptions, and engineering reports stating headloss;
- .3 A Validation Certificate for the proposed system from DVGW;
- .4 A statement by the equipment manufacturer listing any deviations or exceptions taken to these specifications shall be submitted. State specification reference and proposed alternative with reason for exception;
- .5 Description of manufacturer's service capabilities including local support offered for technical service.

Design Criteria:

Provide UV equipment, which shall disinfect water with the characteristics found from the water analysis (including turbidity and UVT sampling).

Each UV reactor will be configured as follows:

- .1 The UV reactor will be supplied pre-assembled and ready for installation.
- .2 The UV system will consist of 2 UV reactors. Each UV reactor will consist of a minimum of one (1) UV intensity monitor and one (1) Control Panel per reactor.
- .3 The UV system must fit within the piping footprint as stated without modification.
- .4 The UV system will be supplied with (2) sand filters capable of handling flow rate of 140 GPM @ 20 GPM/FT².

Performance Requirements:

- .1 RED at end of lamp life: 40 mJ/cm² (minimum).

.3 Manufacturer

To be acceptable, the UV system must operate in an enclosed vessel and use amalgam UV lamps. In order to maximize hydraulic efficiency, the UV reactor is to be configured such that flow enters parallel to the lamps and exits through a flange located perpendicular to the UV lamps.

The UV system must be designed to fit within the piping and footprint described, without modification.

The UV system is to be furnished with the latest components and equipment available at the time of shipment.

.4 General Requirements

Provide a UV system complete with UV reactor, control panel, and UV intensity monitoring system, as herein specified.

Each system shall be designed to allow for complete system shut down or by-pass.

UV reactor will not require draining in order to change UV lamps.

.5 Design, Construction and Materials

.1 General:

- .1 Schedule-80 Modified PVC plastic construction that is ideal for corrosive saltwater environments.
- .2 The system shall be designed for complete immersion of the UV lamps including electrodes and the full length of the lamp in the water. All lamp electrical connections shall be at one end of the UV lamp. The major axis of the UV lamps shall be parallel to flow.

.2 **UV Reactor:**

- .1 Each UV reactor shall be manufactured using SCH 80 PVC.
- .2 Each UV reactor shall have a drain port fixed to its outer wall.
- .3 Each UV reactor shall be designed to fit into the designed pipe work.
- .4 Each UV reactor shall accept its respective UV lamps and quartz sleeves through only one end of the vessel. This end of the UV reactor shall allow for complete reactor entry so internal inspection and/or service can be accomplished.
- .5 UV reactors shall be able to operate at a maximum inlet pressure of 150 PSI and be furnished with a factory certified pressure test report detailing a minimum hydrostatic pressure test of 225 PSI.
- .6 Lamp position within the reactor will be indicated using a numbering system fixed to the lamp wiring at the service end of the UV reactor.

.3 **UV Lamps:**

- .1 UV lamps will be low pressure, high output amalgam lamps.
- .2 The filament will be significantly rugged to withstand shock and vibration.
- .3 Lamp bases to be resistant to UV light.
- .4 All electrical connections to the UV lamp will be terminated at one end.
- .5 UV lamps will have a lamp base design that which prevents arcing between electrical pins.
- .6 UV lamps will have a monochromatic spectral output with the emissions peaking at 254 nanometers.

.4 **Lamp End Seal and Lamp Holder:**

- .1 The open end of the UV lamp sleeves will be sealed to the sleeve guide by a suitable compression o-ring.
- .2 The O-ring compression is made by a sleeve nut that will require no special tools for installation or removal.
- .3 Each UV lamp electrical connection will incorporate a sealing boot, which is held firmly in place by the sleeve nut to prevent emission of ultraviolet rays.

.5 **UV Lamp Sleeves:**

- .1 Sleeves will be clear fused Type 214 quartz with a minimum UV transmissibility of 89 percent.
- .2 Sleeves will be domed at one end and be accessible through the reactor service entrance.

.6 Electronic Power Supplies:

- .1 UV lamps are to be operated by an electronic power supply.
- .2 A pair of UV lamps shall be powered by one electronic power supply.
- .3 Each lamp within the pair shall operate on its own circuit within the power supply so as to provide electrical independence.

.7 UV Sensors

- .1 Each UV reactor must be supplied with a minimum of one UV Intensity Sensors. The minimum number of UV Intensity Sensors installed shall meet the requirements of DVGW W294 standard (minimum of one sensor per ten (10) lamps).
- .2 The UV Intensity Sensor must be approved by the DVGW W294 Standard.

.8 Electrical Control Panel:

- .1 Each UV reactor will be powered from a Control Panel by means of a water resistant cable and strain relief.
- .2 The Control Panel will be water tight, 508 UL listed thermoplastic construction.
- .3 Control Panel electrical rating will be a minimum of NEMA 4X.
- .4 Total power consumption of each reactor under normal operating conditions will be no greater than 660 Watts.
- .5 Electrical supply to each Control Panel shall be 208-240 Volt, 1 phase, 2 wire + ground, 1330 VA (1310 Watts).
- .6 Signal wiring interfacing the UV system and the Control Panel shall be as shown on the Engineering Drawings.

.9 Control and Instrumentation:

- .1 System Control:
 - .1 One microprocessor-based controller will be provided per reactor. Microprocessor to be located within a Control Panel with an operator interface display and is to be located indoors.
 - .2 Control Panel to be 16 inches (406 mm) high, 14 inches (356 mm) wide and 8.4 inches (213 mm) deep, and constructed of thermoplastic.
 - .3 Control Panel to Reactor cable length: to be determined on site by contractor.
 - .4 Remote ON/OFF control capabilities are to be provided.
 - .5 Five 4-20mA input signals will be available.
 - .6 A total of (7) configurable non powered discrete dry contact outputs rated at 24 VDC. Please see Part H.2 for available configurable alarm conditions.
 - .7 One (1) 4-20 mA output signal for remote monitoring of UV Intensity.
- .2 System Status Alarm List: All alarms must be displayed on the operator interface.

.3 Upon a high temperature critical alarm, the reactor shall shut down.

.10 **Spare Parts:**

.1 The following spare parts and safety equipment to be supplied.

- .1 8 UV Lamps
- .2 8 Quartz sleeves
- .3 8 Sleeve Holder Seals

Acceptable product: Safeguard SLP4030604B11.

.11 **Sand Filters:**

- .1 Sand filter to come fully assembled.
- .2 To include pressure gauge at top of filter.
- .3 Provide headloss through each unit.
- .4 The (2) filters will work in parallel the majority of the time, unless one filter is out for repair or is in backwash mode. Each filter will be required to perform under a flow of 140 GPM.
- .5 Sand filter media to be provided with sand filters.
- .6 Fiberglass construction, all fitting materials to be of PVC construction.

Acceptable product: Triton TR 140C-3.

.12 **Submersible Level Transmitter:**

- .1 316 SS
- .2 60ft (18.3m) polyurethane cable
- .3 4–20 mA DC, 2 wire output signal to PLC
- .4 To be suspended below grating below level being measured for UV pump operation.

Acceptable product: Dwyer Series SBLT2.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 The system is to be installed by the Contractor and tested and commissioned by the Manufacturer's trained Technologies Representatives, as specified in this Section.

-
- .2 Installation to be in accordance with the contract drawings, manufacturer's engineering drawings and instructions.
 - .3 Install wiring in accordance with manufacturer's instructions and applicable codes.

3.3 MANUFACTURER'S SERVICES

- .1 Installation Inspection and Start-up: 1/2 day on site.
- .2 Commissioning and Operator training: 1/2 day on site.
- .3 Warranty service scheduling: As required during the specified warranty period.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 05 - INSTALLATION OF PIPEWORK.
- .2 Section 22 11 16 - DOMESTIC WATER PIPING.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .3 Plumbing and Drainage Institute (PDI)
 - .1 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.3 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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29 - Construction Safety Requirements. Indicate VOC's.
- .3 Shop Drawings:
 - .1 Indicate on drawings: materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 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 indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Standard of acceptance for floor drains shall be ZURN. Also acceptable provided the specifications are met will be: Jay. R. Smith, Watts.
 - .1 FD (Regular Round Drain with Membrane Clamp)
 - .1 Epoxy coated cast iron body, bottom outlet, combination invertible membrane clamp and adjustable collar with weepage holes and stainless steel medium duty strainer, and traps primer tapping
 - .2 Acceptable Material:
 - .1 ZURN ZS-415-5BS
 - .2 FFD (Regular Floor Drain c/w Funnel)
 - .1 Epoxy coated cast iron body, 6mm (1/4") thick adjustable stainless steel round strainer, no hub size 100mm (4") unless noted with funnel, trap primer tapping. Drain shall be complete with oval drain top and polished stainless steel open throat funnel grate.
 - .2 Acceptable Material:
 - .1 ZURN ZS-415BS-6S.

2.2 CLEANOUTS

- .1 Cleanout Plugs: heavy epoxy-coated cast iron male ferrule with stainless steel screws and threaded stainless steel plug. Sealing-caulked lead seat or neoprene gasket.

- .2 Access Covers:
 - .1 Wall Access: face or wall type, stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: round epoxy-coated cast iron body and frame with adjustable secured stainless steel top:
 - .1 Plugs: bolted stainless steel with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: epoxy-coated cast iron.
 - .3 Type I: soil & waste stacks and rainwater leaders: Standard of Acceptance: Zurn Z1445
 - .4 Access door to be 7" x 7" or 9" x 9". Standard of Acceptance: Zurn ZANB 1460-10.
 - .5 Type II: Standard of Acceptance: Zurn
 - .1 Floor Type: Cleanout:
 - .2 Finished Concrete ZN1400
 - .3 Finished Concrete Heavy Traffic ZN1400-HD
 - .4 Finished Carpeted ZN1400-CM
 - .5 Finished Terrazzo ZN1400-Z
 - .6 Finished Tiled ZN1400-X

2.3 WATER HAMMER ARRESTORS

- .1 Stainless steel construction, bellows type: to PDI-WH201.
- .2 Acceptable Material:
 - .1 Zurn Z1700 Sized for equipment flow.
 - .2 Amtrol Diatrol 536.
 - .3 Precision Plumbing Products.
 - .4 Jay R. Smith.
 - .5 Approved equal.

2.4 BACK FLOW PREVENTERS

- .1 To CSA-B64, application as indicated. Reduced pressure principle type, double check valve assembly, and back flow preventer with intermediate atmospheric vent or vacuum breaker. Material shall be stainless steel.
- .2 Acceptable Material (or approved equal):
 - .1 Watts.
 - .2 Wilkins
 - .3 Apollo

2.5 VACUUM BREAKERS

- .1 Breakers: to CSA-B64 Series, vacuum breaker.

- .2 Materials to be body and cap - stainless steel; spring - stainless steel stem and seat - stainless steel.

- .1 Standard of Acceptance: Watts

- .1 Watts
- .2 APOLLO
- .3 Wilkins
- .4 Approved Equal

2.6 PRESSURE REGULATORS

- .1 Capacity: 70 PSI.
- .2 Up to NPS 3 stainless steel bodies, screwed: to ASTM B62.
- .3 Lead-free construction, adjustable pressure testing and built-in by-pass for thermal expansion.
- .4 Acceptable material:
 - .1 Watts
 - .2 Wilkins
 - .3 Zurn

2.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.
- .2 See Plumbing Fixture Schedule on drawings.

2.8 TRAP SEAL PRIMERS

- .1 Trap primer unit shall consist of a 120 volt solenoid valve and copper manifold header for multiple pipes. System must be connected to nearest ½" DCW service with ball type service valve and strainer. System must introduce a regulated equal amount of water to each floor drain and shall be c/w a test switch, built-in timer and in-line replaceable fuse. Entire assembly must be contained within a cabinet with an access door by manufacturer. Strainer shall be mounted external to cabinet in a serviceable location.
- .2 Acceptable Material (or approved equal):
 - .1 Refer to schedule on drawings.
- .3 Site Fabricated assemblies will not be accepted in lieu of unit specified. No exceptions.

2.9 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, stainless steel body, screwed ends, with cap.

2.10 EXPANSION TANK

- .1 Refer to detail on drawing for capacity/model. Set expansion tank pressure 3 psi lower than system operating pressure. Contractor shall submit commissioning report verifying tank precharge pressure and system pressure, with pumps off, has been tested.

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 plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

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 data sheet.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada, provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.6 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Mount in between 750mm-1500 mm above finish floor in accessible location as per code

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install plastic tubing to floor drain.

3.9 STRAINERS

- .1 Install with sufficient room to remove basket for maintenance.

3.10 START-UP

- .1 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.

3.11 TESTING AND ADJUSTING

- .1 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .2 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
- .3 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
- .5 Vacuum breakers, backflow preventers, backwater valves:
 - .1 Test tightness, accessibility for O M of cover and of valve.

- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.
- .6 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .7 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .8 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .9 Wall, ground hydrants:
 - .1 Verify complete drainage, freeze protection.
 - .2 Verify operation of vacuum breakers.
- .10 Pressure regulators, PRV assemblies:
 - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .11 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .12 Hose bibbs, sediment faucets:
 - .1 Verify that flow and pressure meet design criteria.
 - .2 Check for leaks, replace compression washer if required.

3.12 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.

3.13 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 221116 - DOMESTIC WATER PIPING.
- .2 Section 221318 - DRAINAGE WASTE AND VENT PIPING - PLASTIC.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.
 - .2 CAN/CSA-B125.3-05, Plumbing Fittings.
 - .3 CAN/CSA-B651-12, Accessible Design for the Built Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Factory-set water consumption per flush at recommended pressure.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 PLUMBING FIXTURE SCHEDULE

- .1 See drawings.
- .2 Emergency shower / eyewash:
 - .1 Provide test kit for one year's worth of testing.
 - .2 Assembly shall be c/w shower, eyewash, valve, pull cord, mixing valve (c/w cabinet).

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to manufacturer's recommendations.
 - .2 Wall-hung fixtures: as per architectural.
 - .3 Barrier free: to most stringent NBCC, CAN/CSA B651.
 - .4 Coordinate all with Architect.

3.3 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
 - .3 Adjust flush valves to suit actual site conditions.
 - .4 Adjust urinal flush timing mechanisms.
 - .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.
- .3 Checks:
 - .1 Water closets, urinals: flushing action.
 - .2 Aerators: operation, cleanliness.
 - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION