

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 COMMON WORK RESULTS FOR MECHANICAL
- .2 Section 22 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
- .3 Section 20 05 53 MECHANICAL IDENTIFICATION
- .4 Section 22 07 15 THERMAL INSULATION FOR PIPING
- .5 Section 22 08 01 PERFORMANCE VERIFICATION MECHANICAL PIPING SYSTEMS
- .6 Section 22 11 16 DOMESTIC WATER PIPING
- .7 Section 22 13 17 DRAINAGE WASTE AND VENT PIPING - CAST IRON AND COPPER
- .8 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 Canadian Standards Association (CSA International)
  - .1 CSA B139-04, Installation Code for Oil Burning Equipment.
- .3 National Fire Code of Canada (NFCC 2005)

**1.3 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 QUALITY ASSURANCE**

- .1 Sustainability Standards Certification:
  - .1 Low-Emitting Materials: provide listing of sealants used in building, comply with VOC and chemical component limits or restriction requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .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 Section 07 92 00 - Joint Sealants.
  - .1 Sealants: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.
- .2 Sealants: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.
- .3 Adhesives: maximum VOC limit to SCAQMD Rule 1168 to GSES GS-36.

**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 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 and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer as indicated without interrupting operation of other system, equipment, and 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 CSA B139.
- .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, and 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 and as indicated.
- .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 gate, ball, or butterfly valves at branch take-offs for isolating purposes except where specified.
  - .7 Install butterfly valves on chilled water and related condenser water systems only.
  - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
  - .9 Install plug cocks ball valves for glycol service.
  - .10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .16 Check Valves:

- .1 Install silent check valves on discharge of pumps and 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 black steel pipes.
- .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, and 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 fire stopping.
    - .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 General contractor shall install fire stopping within annular space between pipes, ducts, insulation and adjacent fire separation.
- .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 fires topping 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.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning, supplemented as specified in relevant mechanical sections.
- .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 Pipework: 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 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 Sections:
  - .1 Section 22 05 05 - Installation of Pipework.

**1.2 REFERENCES**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-2007, Power Piping.
  - .2 ANSI/ASME B31.3-2006, Process Piping.
  - .3 ANSI/ASME Boiler and Pressure Vessel Code-2007:
    - .1 BPVC 2007 Section I: Power Boilers.
    - .2 BPVC 2007 Section V: Nondestructive Examination.
    - .3 BPVC 2007 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS C1.1M/C1.1-2000(R2006), Recommended Practices for Resistance Welding.
  - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
  - .3 AWS W1-2000, Welding Inspection Handbook..
- .4 Canadian Standards Association (CSA International)
  - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-2008, Certification of Welding Inspectors.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

**1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Welders:
    - .1 Welding qualifications in accordance with CSA B51.
    - .2 Use qualified and licensed welders possessing certificate from the province of Nova Scotia for each procedure performed from authority having jurisdiction.

- .3 Submit welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors:
  - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
  - .1 Registration of welding procedures in accordance with CSA B51.
  - .2 Copy of welding procedures available for inspection.
  - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.
  - .4 Welder and Mechanical Contractor shall have a valid Nova Scotia provincial welding licence.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 ELECTRODES**

- .1 Electrodes: in accordance with CSA W48 Series.

## **Part 3 Executions**

### **3.1 APPLICATIONS**

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

### **3.2 QUALITY OF WORK**

- .1 Welding: in accordance with ANSI/ASME B31.1 and B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, special procedures specified elsewhere in Division 22 and applicable requirements of provincial authority having jurisdiction.

### **3.3 INSTALLATION REQUIREMENTS**

- .1 Identify each weld with welder's identification symbol.

- .2 Backing rings:
  - .1 Where used, fit to minimize gaps between ring and pipe bore.
  - .2 Do not install at orifice flanges.
- .3 Fittings:
  - .1 NPS 2 and smaller: install welding type sockets.
  - .2 Branch connections: install welding tees or forged branch outlet fittings.

### **3.4 INSPECTION AND TEST - GENERAL REQUIREMENTS**

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

### **3.5 SPECIALIST EXAMINATIONS AND TESTS**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 Inspect and test 100 % of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

### **3.6 DEFECTS CAUSING REJECTION**

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

### **3.7 REPAIRS OF WELDS WHICH FAILED TESTS**

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**



**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and components for metering waste water including installation.
- .2 Related Sections:
  - .1 Section 01 33 00 – Submittal Procedures.
  - .2 Section 22 05 17 – Pipe Welding.

**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 Configuration and sizing.
  - .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.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 AIR FLOW METER**

- .1 Part 1 – Flow Meter Tube
  - .1 The flow meters system are to be mounted and connected to the blower air discharge pipelines at the location shown on the drawings, and consists of a flow sensor, a differential pressure transmitter and a flow recorder.
  - .2 The flow element shall be of two-piece construction (Formed Cones) or on single solid machined piece, a V-shape inlet and outlet, with two pressure chambers or taps completely isolated and independent of each other.
  - .3 An identification tag shall be supplied with the element and flow direction arrow shall be stamped with high and low pressure connections properly identified.
  - .4 The flow sensor is to be inserted into the carbon steel air discharge pipe, and sized as shown on the drawings.
  - .5 The Flow sensors shall be stainless steel, standard thread mounting with forged brass body valve, stainless steel stem and 6mm (1/4") NPT instrument valve male connection.
  - .6 The accuracy of the flow meter shall be within  $\pm 1\%$  with a repeatability of  $\pm 0.1\%$ .
  - .7 The flow meters will be furnished with the inner V-Cone shape and isolated low pressure chamber.
  - .8 This unit shall be CSA approved rated for an input range of 0-76.2 mm (0-3") to 0-508 mm (0-20" H2O), and static pressure rated for 1034 kPa (150 psi).
  - .9 The diaphragm material shall be 316 stainless steel, and the body and connection block material shall be cadmium plated carbon steel, and the flange bolts are to be steel SAE Grade 8.
  - .10 The blower air meter system shall be complete with the necessary length required of 6 mm (1/4") diameter Stainless Steel tubing between the flow sensor and the DP transmitter, with required adaptors and fittings for the connection layout shown on the drawings.

- .11 The Air Flow Meter system is to be supplied with all required stainless steel fittings and piping for a complete installation, incidental to the work.
- .2 Part 2 – Differential Pressure Gauge
  - .1 Gauge installations shall be complete with 3-Valve Manifold.
  - .2 Supply Power: 24 V DC loop power with 4-20 mA HART output.
  - .3 Electronic pressure gauge shall filled with silicon oil.
  - .4 Accuracy:  $\pm 0.075\%$  of measured value.
  - .5 Local LCD display of measured value in engineering units, programmable via hermetically sealed buttons.
  - .6 Process Connection: 1/2-inch NPT connection.
  - .7 Rating: NEMA 4X enclosure.
  - .8 Span to meet air flow meter supplier's recommendations.
  - .9 Local sealed magnetic pushbuttons for adjustment and programming of transmitter without the need of a hand held programmer or laptop computer.
  - .10 Display and analogue output shall be Flow in CFM..
  - .11 Unit to be approved by CSA for service in Class I, Zone 1, Groups C or D hazardous locations.
  - .12 Supplied with mounting bracket as per air flow meter supplier's recommendations.
  - .13 Warranty: 5 year warranty, based on operating time.
  - .14 Approved product: Siemens P320 Pressure Transmitter, p/n 7MF0340 or approved equal.

## **2.2 AIR PIPING PRESSURE GAUGES**

- .1 Pressure gauges will be installed as shown on the drawings to monitor the air discharge pressure. Gauges shall meet the following specifications:
  - .1 Dual indication dial range: 270°, 0 to 15 psi (0 to 100 kPa) to be white with black figures and graduations c/w clear glass window;
  - .2 NPT brass socket: 6 mm (1/4");
  - .3 Tube type: bronze bourdon with silicone dampened;
  - .4 Gauge cock: 6 mm (1/4");
  - .5 Dial size: 88.9 mm (3 1/2");
  - .6 Case, ring and pointer: Stainless steel;
  - .7 Accuracy: 1% accuracy over middle half of scale, 2% over balance to conform to ANSI B40.1, Grade A;
  - .8 Pressure gauges to be quipped with a bottom outlet.

## **2.3 AIR PIPING VACUUM GAUGES**

- .1 Vacuum gauges will be installed as shown on the drawings. Vacuum gauges shall meet the following specifications:

- .1 Back inlet and outlet: 90°, 0 to –15” H<sub>2</sub>O (0 to – 4kPa) to be white with black figures and graduations c/w clear glass window;
- .2 Dual indication dial range: 6mm (1/4”) NPT outlet, with snubber and needle valve, or approved equal.
- .3 Dial size: 88.9 mm (3 ½”);
- .4 Case, ring and pointer: Stainless steel;
- .5 Accuracy: 1% accuracy over middle half of scale, 2% over balance to conform to ANSI B40.1, Grade A;

## **2.4 ELECTRONIC PRESSURE GAUGES FOR AIR PIPING**

- .1 Electronic pressure gauges to be installed as shown on the drawings.
- .2 Electronic pressure gauge shall have at least the following:
  - .1 Supply Power: 24 V DC loop power with 4-20 mA HART output.
  - .2 Accuracy: ± 0.075% of measured value.
  - .3 Local LCD display of measured value in engineering units, programmable via hermetically sealed buttons.
  - .4 Process Connection: ½-inch NPT connection.
  - .5 Rating: Explosion-Proof.
  - .6 Local sealed magnetic pushbuttons for adjustment and programming of transmitter without the need of a hand held programmer or laptop computer.
  - .7 Span: (0-20 PSI).
  - .8 Warranty: 5 year warranty, based on operating time.

## **2.5 PARSHALL FLUME – FLOW METERING SYSTEM**

- .1 Parshall Flume
  - .1 A total of three (3) complete flow metering systems shall be installed. Flow Metering system shall be installed as shown on the drawings. Each system will consist of one (1) Parshall Flume Flow Metering System installed inside the concrete UV channel, inside the Headworks channel and inside the By-Pass Metering Chamber (CH-02) . The UV channel, Headworks channel and By-pass metering pre-cast structure shall be constructed in accordance with the drawings and the structural specifications.
  - .2 All three (3) Parshall Flume Flow Meters shall have a throat width of 76.2 mm (3.0 inches), sidewall height at the inlet end of 600 mm (24 inches) and a maximum length of 914 mm (36 inches) not including inlet and outlet adaptors. Each flume shall have a minimum flow rate range of 0 – 25 L/s (0 - 400 US gpm). Each flume to be molded in one (1) piece of reinforced polyester fibreglass with a minimum 6.35 mm wall thickness. Wetted surfaces shall have smooth white gel-coated finish, exterior surfaces shall have gel-coated finish and “V” shaped reinforcing ribs to prevent distortion during shipment, installation and operation. Each flume shall be self supporting and require no external supporting structure during installation, except bracing to prevent flotation or movement during the concrete placement process for the UV channel and headworks channel.

- .3 Internal dimensions shall conform to the latest revision of the Water Measurement Manual, as issued by the US Department of the Interior, Water and Power Resources Group.
  - .4 Head gauges shall be flush moulded into the flume sidewall at time of manufacture. Gauge markings shall be protected by a 1.6 mm thick clear fibreglass laminate. Gauges at the Ha position shall have markings in both depth and flow. Gauges at Hb position shall have markings in depth only. Depth and Flow markings shall be done in metric system units (cm and L/s). Anchor clips shall be made of fibreglass and be permanently attached to flume exterior. Clips shall have a 12 mm diameter hole for wire-tying the flume to reinforcing bars embedded in concrete.
  - .5 An ultrasonic transducer mounting bracket shall be supplied with each flume as well as an elevation adjustable bracket; both fabricated from 304 SS piping and alloy fittings with a female NPT connection to the transducer. All fasteners shall be stainless steel.
  - .6 A flush mounted bubbler tubes ( $\frac{1}{2}$ " O.D.) (quantity as required by the Manufacturer) shall be provided at the measuring station. Bubbler tube opening shall be set in each flume wall such that water depths down to zero flow may be measured.
  - .7 A sensor cavity and "Z" bracket shall be provided to allow flush mount installation and easy removal of the submerged pressure sensor. The bracket cavity and sidewall track shall allow routing the cable out of the flume with the bracket sensor and cable all flush with the flume wall and floor.
  - .8 For the Parshall Flume of both the UV Building and Headworks Building, the inlet will be equipped with wing walls as shown on the drawings, for installation in the concrete channel and shall be supplied with the Flumes. Outlets shall be equipped with adaptors as shown on the drawings and shall be supplied with the Flumes.
  - .9 On all three (3) flumes outlet, including the By-Pass Metering Chamber (CH-02) inlet, an adapter of the same materials of construction and finish as the flume shall be provided with each Parshall Flume System. Neoprene couplings with stainless steel band clamps and pipe stubs to connect to the outside pipe, as shown on the drawings.
  - .10 Flumes and adapters shall be covered to prevent debris from entering the channel, except at  $\frac{2}{3}$  of measuring point. Stainless steel trims shall be used to form a water tight, corrosion resistant assembly. All Parshall Flume Systems shall be constructed for the intent and shall be supplied and installed as per the manufacturer's instruction.
- .2 Ultrasonic Transducer and Controller
- .1 The exact location to install the ultrasonic transducers on the Parshall Flumes for flow monitoring will be provided by the Engineer. The scope of the mechanical work shall include supports, anchoring to the concrete wall with stainless steel chemical anchors sized as per the Manufacturer's recommendations and all related work for a complete flow meter installation. The facility start-up shall include the calibration and commissioning of this unit by a trained factory representative.
  - .2 A total of three (3) ultrasonic transducers and controllers shall be installed: inside the UV Building Parshall Flume, inside Headworks Building Parshall Flume, in By-Pass Metering Chamber (CH-02) Parshall Flume , as shown on the drawings.
  - .3 The transducer shall be mounted on bridge channel.
- .3 High Water Float Switch

- .1 Float type level controller shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations and supplied with required length of control cable. Support bracket to be installed to allow for manual adjustments as required. Cable run shall be long enough to allow for additional loops.
- .2 One (1) float switch for UV room, one (1) float switch for Headworks room and one (1) float switch for the Security Chamber (SAMH-B).
  - .1 Spare parts: Three (3) complete float switch.

## 2.6 COMPOSITE SAMPLER

### .1 SYSTEM DESCRIPTION:

- .1 Composite Samplers will be installed as shown on the drawings. A total of two (2) Composite Samplers shall be required, one (1) in the non-explosion proof room within the headworks room and one (1) in the UV room as shown on drawings;
- .2 One (1) Composite Sampler shall be required to sample the influent downstream of the screen system in the Headworks room.
- .3 One (1) Composite Sampler shall be required to sample the effluent from the UV room. Composite Samplers shall be refrigerated and meet the following specifications:

### .2 SAMPLING FEATURES

- .1 Dual Program:

The sampler shall have the capability of running up to two (2) sample programs sequentially, in parallel, or according to day of week scheduling; enabling a single sampler to function like multiple samplers;
- .2 Sampling Modes
  - Pacing: Time Weighted, Flow Weighted, Time Table, Flow Table, Event
  - Distribution: Single bottle composite, multi-bottle composite, multi-bottle discrete, bottles per sample, samples per bottle or a combination of bottles per sample and samples per bottle
- .3 Run Modes:

Continuous or non-continuous;
- .4 Status Screen:

Communicates what program is running, if there are any missed samples, when the next sample will be taken, how many samples remain, number of logged channels, time of last measurement, memory available, number of active channels, if alarms were triggered, when alarms were triggered, active sensors and cabinet temperature.
- .5 Alarms:

Configurable alarms that show on status screen and are recorded in diagnostics alarm logs. Alarms can be set for system diagnostics and logging such as program end, sample complete, missed samples and full bottle. Channel alarms are setpoint alarms for the recorded measurements (channels), such as pH, level and power supply voltage.
- .6 Manual Sample

Initiates a sample collection independent of program in progress

- .7 Automatic Shutdown:
  - Multiple Bottle Mode: After complete revolution of distributor arm (unless Continuous Mode is selected)
  - Composite Mode: After preset number of samples have been delivered to composite container, from 1 to 999 samples, or upon full container
- .8 Sample Volume:

Programmable in 10 mL increments from 10 to 10,000 mL;
- .9 Interval Between Samples:

Selectable in single increments from 1 to 9,999 flow pulses (momentary contact closure 25ms or 5 to 12 Vdc pulse; 4-20mA interface optional), or 1-9,999 minutes in one (1) minute increments;
- .10 Set Point Sample Trigger

When equipped with flow sensor or pH/temperature sensor or peripheral monitoring options, sampling can be triggered upon an upset condition when field selectable limits are exceeded
- .11 Data Logging:
  - .1 Sample History:
    - .1 Capable of storing up to 4,000 entries, includes sample time stamp, bottle number and status of sample (success, bottle full, rinse error, user abort, distributor error, pump fault, purge fail, sample timeout, power fail and low maintain battery);
  - .2 Measurements:
    - .1 Stores up to 325,000 entries for selected measurement channels in accordance with the selected logging interval;
  - .3 Event Log:
    - .1 Capable of storing up to 2,000 entries, includes power on, power fail, firmware updated, pump fault, distributor arm error, low memory battery, low maintain battery, user on, user off, program started, program resumed, program halted, program completed, grab sample, pump tube change required, sensor communication errors, cooling failed, heating failed, thermal error corrected;
- .12 Diagnostics:

View event and alarm logs as well as maintenance diagnostics
- .3 REFRIGERATED SAMPLER
  - .1 Refrigerator

22 gauge stainless steel with vinyl laminate over-coating
  - .2 Refrigeration Components and Copper Plumbing

Corrosion protected with conformal coating; all exposed copper tubing is to be insulated to avoid sweating and condensation.
  - .3 Sample Cooling
    - 1/7 hp, 75 Watt, 400 BTU/h compressor

- 120 CFM condenser fan
- Three-sided wraparound plate type evaporator
- Rigid foam insulation
- Air sensing thermostat capable of maintaining sample liquid 4°C (39°F) in ambient temperature to 49°C (120°F) maximum; accurate to  $\pm 0.8^{\circ}\text{C}$  (1.5°F).
- Magnetic Door seal
- .4 Sample Containers:  
A total of twenty-four (24) 1L Polyethylene sample containers (per sampler);
- .5 Temperature:
  - Operating: 0 to 50°C (32 to 122°F)
  - Liquid Crystal Display (LCD): -10 to 70°C (-14 to 158°F)
  - Storage: -40 to 60°C (-40 to 140°F)
- .6 Power Requirements
  - 115 VAC, 60Hz
  - Compressor Current: 1.5 to 2.0 amps running
  - Locked rotor current: 12 amps
  - Overload Protection: 5 amps DC line fuse for pump, 1 amp DC line fuse (AC power converter)
  - Compressor: Thermal overload relay opens at 110°C (230°F)
- .7 AC Power Backup (Pump Controller Only)
  - Rechargeable 6 amp-hour gel lead acid battery takes over automatically with AC line power failure
  - Integral trickle charger maintains battery as full charge
- .8 Dimensions: 61cm wide x 61cm deep x 112cm high
- .9 Weight: 63kg (140lb.)  
Certifications: CE, UL, CSA
- .4 CONTROLLER
  - .1 All electromechanical components shall be protected within a totally sealed housing conforming to NEMA 4X;
  - .2 Housing: PC/ABS blend, NEMA 4X, 6, IP68, corrosion and ice resistant;
  - .3 Graphic Display: ¼ VGA, Color; self-prompting/menu-driven program;
  - .4 User Interface: Membrane switch keypad with two (2) multiple function soft keys;
  - .5 Program Language: English;
  - .6 Program Lock: Access code protection prevents tampering of program and system settings;
  - .7 The sampler controller shall be programmable for single bottle and multiple bottle operation. For multiple bottle operation, the controller shall be programmable for 2, 4, 8 and 24 bottle configuration;



- .8 Communications: USB and Optional RS485 (Modbus). One (1) 0/4-20 mA AUX. input for flow pacing.
- .9 Certified CE, UL
- .5 **SAMPLE PUMP AND STRAINER**
  - .1 Each sampler shall incorporate a high-speed peristaltic pump for collection of the sample liquid;
  - .2 Each sampler pump body shall be constructed of corrosion resistant materials;
  - .3 Vertical lift: 8.5m using 8.8m of 9mm (3/8 in.) I.D. intake line;
  - .4 Pump tubing shall consist of 9.5mm I.D x 15.9O.D. (3/8 in. I.D. x 5/8 in. O.D. silicone
  - .5 Intake tubing shall consist of 9.5mm I.D. vinyl or PTFE-lined polyethylene with protective outer cover (black or clear).
  - .6 Both sampler shall be provided with two (2) - 10m long of intake tubing. For each sampler, one (1) intake tube line shall be considered spare, and shall be coiled and capped at each end.
  - .7 Each intake tubing lines shall be installed underground inside a 38mm dia. Rigid PVC conduit. Extremities of both conduits shall be spray foamed and sealed.
  - .8 Intake:
    - Strainer: 316 stainless steel
    - Purge: The sampler shall purge the intake line automatically before and after each sample. The duration of the purge shall be automatically adjusted for varying intake line lengths;
    - Rinse: The sampler shall rinse the intake line with source liquid automatically before each sample, from 1-3 rinses;
    - Retries of Fault: In the event that sample liquid is not obtained on the initial attempt, the sampler shall optionally purge and repeat the collection cycle;

### **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.
- .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 01 COMMON WORK RESULTS FOR MECHANICAL
- .2 Section 22 05 05 INSTALLATION OF PIPEWORK
- .3 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 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 01 78 00 - Closeout Submittals.

## **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
  - .1 Furnish following spare parts:
    - .1 Valve seats: one for every 10 valves each size, minimum 1.
    - .2 Discs: one for every 10 valves, each size. Minimum 1.
    - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
    - .4 Gaskets for flanges: one for every 10 flanged joints.
  - .2 Tools:
    - .1 Furnish special tools for maintenance of systems and equipment.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .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 Products to have CRN registration numbers where necessary.
- .2 End Connections:
  - .1 Connection into adjacent piping/tubing:
    - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
    - .2 Copper tube systems: solder ends or grooved ends to ANSI/ASME B16.18.
- .3 Lockshield Keys:
  - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Globe Valves:
  - .1 Requirements common to globe valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.

- .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
- .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
- .6 Handwheel: non-ferrous.
- .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, composition disc, Class 125:
  - .1 Body and bonnet: screwed bonnet.
  - .2 Disc and seat: renewable rotating PTFE disc composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  - .3 Operator: handwheel.
- .3 NPS 2 and under, composition disc, Class 150:
  - .1 Body and bonnet: union bonnet.
  - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  - .3 Operator: handwheel.
- .4 NPS 2 and under, plug disc, Class 150, screwed ends:
  - .1 Body and bonnet: union bonnet.
  - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
  - .3 Operator: handwheel.
- .5 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 125:
    - .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 NPS 2 and under, swing type, bronze disc:
    - .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.
  - .4 NPS 2 and under, swing type, composition disc, Class 200:
    - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
    - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
  - .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
    - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

- .2 Disc: renewable PTFE no. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
  - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .6 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 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class125 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.
    - .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.

### **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.

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SEWAGE TREATMENT  
UPGRADES  
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SPRINGHILL, NS  
PROJECT NO. R.061876.001

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VALVES - BRONZE

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**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.

**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.

**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.
- .2 Packaging Waste Management: remove of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.



**Part 2 Products**

**2.1 MATERIALS**

**2.2 STAINLESS STEEL BALL VALVES:**

- .1 Working pressure: 1500 PSI
- .2 Body and Ball: Stainless Steel 316
- .3 Handle and nut: Stainless Steel 304
- .4 Long cycle life.
- .5 Blow-out proof stem.
- .6 Locking device.
- .7 ANSI B16.34 Class 900

**2.3 AIR PIPING BUTTERFLY VALVES:**

- .1 The valves for the air piping shall be sized in accordance with the drawings. Valves shall be butterfly valve type with the following specifications:
  - .1 Body: Ductile Iron to ASTM A536;
  - .2 Type: Lug or Wafer Type;
  - .3 Seat Material: EPDM;
  - .4 Disc Material: 316 Stainless Steel;
  - .5 Shaft Material: stainless steel 18-8 type 304;
  - .6 Taper pin Disc shall not be pinned to shaft;
  - .7 Key: 316 Stainless Steel;
  - .8 Coating: Fused bonded epoxy coating;
  - .9 Nuts and Bolts: Stainless Steel 316;
  - .10 Operator: Gear operator;
  - .11 Valves shall come complete with all connections and flange adapters if required.

It should be noted that the Contractor shall be responsible for touch-ups or repainting to correct damages to the finish from shipping or installation.

**Part 3 Execution**

**3.1 INSTALLATION**

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

**3.2 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 – Common Work results for Mechanical
- .2 Section 22 05 05 - Installation of Pipework
- .3 Section 22 11 16 – Domestic Water Piping
- .4 Section 22 13 17 – Drainage Waste and Vent Piping – Cast Iron and Copper
- .5 Section 22 13 18 – Drainage Waste and Vent Piping – Plastic
- .6 Section 23 31 13 – Metal Ducts – Low Pressure to 500Pa
- .7 Section 23 34 00 – HVAC Fans
- .8 Section 10 80 00 – Supply and Installation of UV System

**1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International
  - .1 ASTM A125-2007, Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .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 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 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 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 or vibration 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, and ANSI B31.1.

## 2.3 PIPE HANGERS

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized.
  - .2 Use electro-plating galvanizing process.
  - .3 Steel hangers, for copper piping shall be copper plated.
  - .4 **Note: All hangers/rods/accessories in headworks and UV rooms shall be stainless steel.**
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp to MSS-SP-58, type 19. ULC listed with hardened steel cup point setscrew, locknut carbon steel retaining clip.
    - .1 Rod: 13 mm.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, type 28 or 29 UL listed to MSS-SP58, or MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, type 19, UL listed to MSS-SP58 or to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut, type 25 UL listed to MSS-SP58.
- .4 Upper attachment to steel joist:
  - .1 Piping NPS 2 and under: steel washer plate with double locking nuts.
  - .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.
- .5 Upper attachment to steel channel or angle (top):
  - .1 Piping NPS 2 and under; malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed  
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.
- .6 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.
- .7 Pipe attachments: material to MSS SP58:

- .1 Cold piping, steel or cast iron: 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.
- .2 Cold copper piping, steel or cast iron: hot piping steel, with less than 25 mm horizontal movement; hot copper piping, steel, with more than 300 mm middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1 Copper plated. ULC listed.
- .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.
- .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
- .5 Use insulation shields for hot pipework.
- .6 Oversize pipe hangers and supports.
- .8 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

#### **2.4 RISER CLAMPS**

- .1 Steel or cast iron pipe: carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

#### **2.5 INSULATION PROTECTION SHIELDS**

- .1 Insulated hot and cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield with uninterrupted vapor barrier to: MSS SP69, galvanized sheet carbon steel.
  - .2 For hot piping, NPS 2.5 and greater, use 300mm long rigid calcium silicate block under shield.
  - .3 Length: Minimum 300mm.

#### **2.6 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications. Submit calculations with shop drawings. Stamped by New Brunswick professional engineer.

#### **2.7 HOUSE-KEEPING PADS**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

#### **2.8 UV MODULE STORAGE RACK**

- .1 Contractor shall supply and install four (4) support brackets to support the UV Modules as shown on drawings. Refer to Section 10 80 00 for Supply and Installation of UV System.

- .2 Installation shall be as per UV System manufacturer's recommendations.

### **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, boilers 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, or authority having jurisdiction
  - .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	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .7 Pipework greater than NPS 12: to MSS SP69.

### 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 RELATED REQUIREMENTS**

- .1 Section 20 05 01 – Common Work Results for Mechanical
- .2 Section 22 05 05 – Installation of pipework.
- .3 Section 22 11 16 – Domestic Water Piping

**1.2 SUMMARY**

- .1 This section applies to all piping for this project including plumbing and hydronic systems.
- .2 Fire protection piping is an exception.

**1.3 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE Standard 90.1-01, 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-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
  - .7 ASTM C921-03a, 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) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .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.

#### **1.4 DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces. This shall include work above T-bar and drywall ceilings, in chases, shafts, tunnels, and plenums.
  - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

#### **1.5 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.
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

#### **1.6 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, qualified to standards member of TIAC.
- .3 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

#### **1.7 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 ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

### **2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, reinforced, 50mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.

- .4 Tie wire: 1.5mm diameter stainless steel.
- .5 Bands: stainless steel, 19mm wide, 0.5mm thick.

## **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting 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 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: to match adjacent finish paint by Departmental Representative.
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Thickness: 0.5mm.
  - .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 0.5mm 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 manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.
- .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 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: aluminum.

### **3.5 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.
- .3 Provide aluminum protective jacket.

### **3.6 PIPING INSULATION SCHEDULES**

- .1 Includes all valves, all valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: Tape at 300mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: Tape at 300mm on centre.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: C-2 with vapour retarder jacket.
  - .1 Insulation securements: Glue for coed/wet service.
  - .2 Seals: lap seal adhesive, lagging adhesive.

- .3 Installation: TIAC Code: 1501-C.
- .5 Thickness of insulation as listed in following table.
- .1 Run-outs to individual units and equipment not exceeding 4000mm long.
- .2 Do not insulate exposed run outs to plumbing fixtures, chrome plated piping, valves, and 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
Domestic HWS		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Domestic HWR		A-1	25	25	25	38	38	38

- .6 Finishes:
- .1 Exposed indoors: PVC.
- .2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .3 Finish attachments: SS bands, at 300mm on centre.
- .4 Installation: to appropriate TIAC code CRF/1 through CPF/5.

### 3.7 FIELD QUALITY CONTROL

- .1 Verification requirements:
- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified wood.
- .8 Low-emitting materials.

### 3.8 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 20 05 01 – Common Work Results for Mechanical
- .2 Section 22 05 05 – Installation of pipework.
- .3 Section 22 11 16 - Domestic Water Piping
- .4 Section 22 13 17 – Drainage Waste and Vent Piping – Cast Iron & Copper
- .5 Section 22 13 18 – Drainage Waste and Vent Piping - Plastic

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

**1.3 SANITARY AND STORM DRAINAGE SYSTEMS**

- .1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
- .2 Ensure that traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system.
- .4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.
- .5 Cleanouts: refer to Section 22 42 00 – Commercial Plumbing Fixtures.
- .6 Roof drains:
  - .1 Refer to Section 22 42 00 – Commercial Plumbing Fixtures.
  - .2 Remove caps as required.

**1.4 POTABLE WATER SYSTEMS**

- .1 When cleaning is completed and system filled:
  - .1 Verify performance of equipment and systems as specified elsewhere in Division 22.
  - .2 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 recharge air chambers. Repeat for each outlet and flush valve.
  - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

**1.5 REPORTS**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

**1.6 TRAINING**

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O.M. Personnel, supplemented as specified herein.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 Performance Verification**

- .1 All work in this section shall be completed by plumbing and heating testing and balancing contractor.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 – Common Work Results for Mechanical
- .2 Section 20 05 53 – Mechanical Identification
- .3 Section 22 05 23.01 – Valves – Bronze
- .4 Section 22 05 05 – Installation of pipework
- .5 Section 22 07 15 – Thermal Insulation for Pipework

**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.
  - .5 Shall comply with NSF/ANSI 61 Annex G. for lead requirements. This applies to all wetted components for drinking water.
- .2 ASTM International Inc.
  - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A312-12a, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .3 ASTM A536-84(2004) e1, Standard Specification for Ductile Iron Castings.
  - .4 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67-02a, Butterfly Valves.
  - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

- .6 National Research Council (NRC)/Institute for Research in Construction
- .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

### 1.3 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.
  - .2 Grooved joint couplings and fittings shall be referred to on shop drawings and product submittals and shall be identified by the manufacturer's style or series designation. Trade names and abbreviations are not acceptable.
- .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 Place materials defined as hazardous or toxic in designated containers.
- .2 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. **Note: All piping in headworks/UV rooms shall be either stainless steel or PEX – copper shall only be suitable for use within blower room/lab/washroom/utility room.**
  - .1 Above ground:
    - .1 Copper tube, hard drawn, type L: to ASTM B88M.
    - .2 Stainless steel pipe, Type 304/304L, Schedule 10S to ASTM A312M.
  - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
  - .3 Crosslinked polyethylene (PEX) to CSA B137.10 or CSA B137-9 or CSA B137.5, ASTM F1281 and NSF may be used above and below grade, above grade in non return air plenum ceilings only.
    - .1 When PEX piping is used in exposed applications fit entire length of exposed pipe with metal snap on pipe cover and fastened to Unistrut support with pipe clips. Use rubber guards between clip and pipe
    - .2 Use copper long sleeve 90° supports for PEX piping leaving walls for fixture supplies so that all piping leaving walls is copper

- .2 Pressure Washer Distribution Piping: All piping between pressure washer outlet and hose-reels shall be Sched. 80 stainless steel to ASTM A312. All fittings shall be threaded and rated for 3000PSI operating pressure. Brace piping at each change in direction. Provide 3000PSI rated braided stainless steel flexible connection between pressure washer outlet and distribution piping, and at each hose-reel connection.

## **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242. Manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)
- .6 NPS 1 and smaller: wrought copper to ANSI/ASME B16.22 cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.
- .7 NPS 2 and smaller: Precision, cold drawn, stainless steel with elastomer O-ring seals, suitable for working pressure to 3450-kPa. Standard of Acceptance: Victaulic Vic-Press for Schedule 10S Pipe.
- .8 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 1.6mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint at copper-tube dimensions, complete with EPDM-HP gasket. Installation-ready, suitable for direct stab installation without field disassembly. Standard of Acceptance: Victaulic Style 607H.
- .6 Dielectric connections between dissimilar metals:
  - .1 Dielectric fitting, complete with thermoplastic liner.
  - .2 Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. Basis of Design: Victaulic Series 647.
  - .3 UL classified in accordance with NSF-61 for potable water service, and shall meet the low-lead requirements of NSF-372.
- .7 All pipe joints for Pex piping to be jointing systems as supplied by pipe manufacturer. Do not join Pex piping below floor.

## **2.4 GLOBE VALVES**

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 22 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 22 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles: as indicated.

## **2.5 SWING CHECK VALVES**

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 22 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 22 05 23.01 - Valves - Bronze.
- .3 NPS 2½ and over flanged:
  - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind renewable seat, bronze disc, bolted cap specified Section 22 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

## **2.6 BALL VALVES**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 Forged Brass body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 22 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, Vic-Press:
  - .1 2750 kPa.
  - .2 Grade CF8M stainless steel body, full port stainless steel ball, stainless steel, stem, PTFE seats, and stainless steel handle. Standard of Acceptance: Victaulic Series P569.
- .3 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 22 05 23.01 - Valves - Bronze.

- .4 UL classified in accordance with NSF-61 for potable water service, and shall meet the low-lead requirements of NSF-372.

### **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.
- .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 Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
- .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.
- .8 System sizing shown on drawings and details. Small ½" size pipe may not be sized. All runouts ½" unless noted.

#### **3.3 VALVES**

- .1 Isolate equipment, fixtures and branches with gate, butterfly, or ball valves.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

#### **3.4 PRESSURE TESTS**

- .1 Conform to requirements of Section 20 05 01 - Common Work Results for Mechanical.

- .2 Test pressure: greater of 1 time's 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, and then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Provincial potable water guidelines (paid for at contractor's expense). 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 or approval of Departmental Representative.
- .2 Coordinate with Section 33 11 16- Site Water Utility Distribution Piping and Section 33 11 16.01 - Incoming Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval (paid for at contractor's expense).

### **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, and safety devices for normal and safe operation.
- .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 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for Air Distribution Systems.
  - .3 Adjust pressure regulating valves while withdrawals are at maximum and inlet pressure is at minimum.
  - .4 Sterilize HWS and HWC systems for Legionella control.
  - .5 Verify performance of temperature controls.
  - .6 Verify compliance with safety and health requirements.
  - .7 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.
  - .8 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.
- .2 Operational requirements:
  - .1 Cleaning materials and schedules.
  - .2 Repair and maintenance materials and instructions.

### **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 20 05 01 – Common Work Results for Mechanical
- .2 Section 22 05 05 – Installation of pipework.

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM B32-08, Standard Specification for Solder Metal.
  - .2 ASTM B306-02, Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .3 CAN/CSA-B125.3-05, Plumbing Fittings.

**1.3 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 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.

**Part 2 Products**

**2.1 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary and vent Type DWV to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CAN/CSA-B125.3.
    - .2 Wrought copper: to CAN/CSA-B125.3.
  - .2 Solder: 95:5, type TA to ASTM B32.



## **2.2 CAST IRON PIPING AND FITTINGS**

- .1 Buried sanitary, storm, and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
      - .2 Cold caulking compounds.
- .2 Above ground storm and vent: to CAN/CSA-B70.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
    - .2 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

## **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 In accordance with Section 22 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code.

### **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 that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Ensure weirs are correctly sized and installed correctly.

- .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) 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.

### **3.6 UNDERGROUND REQUIREMENTS**

- .1 Floor drains piping shown for clarity on drawings. A minimum 600 mm offset shall be provided on all floor drains to sanitary piping for coordination.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 – COMMON WORK RESULTS FOR MECHANICAL
- .2 Section 22 05 05 - INSTALATION OF PIPEWORK.
- .3 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 MATERIAL**

- .1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

## 2.2 PIPING AND FITTINGS

- .1 PVC-DWV
  - .1 Certified to **CSA B181.2**, made to Schedule 40 thickness
  - .2 Exhibits a Flame Spread Rating of not greater than 25 as per ULC S102.2 test methods.
  - .3 Size range 38 -600mm.
  - .4 Permitted inside a building; above ground, underground and part of the building sewer system. Not permitted for use in Air Plenum, Vertical Service Spaces and High-Rise Buildings.
  - .5 To ensure the full integrity of the completed system, all components shall be supplied by one manufacturer.
- .2 XFR DWV
  - .1 Certified to **CSA B181.2** and made to Schedule 40 thickness.
  - .2 System XFR is listed to ULC S102.2 to exhibit a Flame Spread Rating of not greater than 25 as well as a Smoke Developed Classification of not greater than 50. Permissible for use in High-Rise Buildings and Air Plenums as per NBCC.
  - .3 System XFR DWV is not permitted in Vertical Service Space.
  - .4 To ensure the full integrity of the completed system, all components shall be supplied by one manufacturer. The use of any other brand of pipe and fittings as substitutes would make the Flame and Smoke listings invalid
- .3 PVC SDR-35/28
  - .1 Pipe certified to CSA B182.2
  - .2 Conform to ASTM D3034, ASTM F679, BNQ 3624-130 and BNQ 3624-135 standards.
  - .3 Pipe stiffness must be 320kpa (46psi) for DR35 and 625kpa (90psi) for DR28.
  - .4 Permitted buried inside a building.
- .4 ABS-DWV
  - .1 Pipe to be certified to CSA B181.1
  - .2 Available in nominal sizes from 32 – 150mm.
  - .3 Permitted inside building above and underground and is not permitted for use in non-combustible buildings.
- .5 BDS PVC
  - .1 BDS manufactured to B182.1 WILL NOT BE ACCEPTED.

## 2.3 JOINTS

- .1 Solvent Cementing
  - .1 Cements shall be CSA certified and meet the requirements of ASTM D2564 for PVC and ASTM D2235 for ABS.
  - .2 Clean all joints with ABS or PVC - Cleaner

- .3 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
- .4 One-Step Cement may be used for sizes 38 – 150mm only.
- .5 For sizes 200 – 600mm, PVC-DWV and XFR -Two-Step cement must be used in conjunction with PVC-DWV and XFR primer.
- .6 Consideration may also be given to the use of pressure cement for sizes over 300mm.
- .7 Proper solvent cementing procedures must be followed at all times.
- .2 PVC-DWV & XFR DWV
  - .1 MJ Grey™ Couplings
    - .1 MJ Grey Couplings are a mechanical joint assembly suitable for use on PVC-DWV or System XFR DWV piping sizes 200mm through 300mm, are certified to CSA B602 and are listed to ULC S102.2 to exhibit a Flame/Smoke rating of 25/50
- .3 PVC SDR-35/28
  - .1 Gaskets certified to CSA B182.2 and conform to ASTM D3034, ASTM F679, BNQ 3624-130 and BNQ 3624-135 standards Injection-mold gasketed PVC fittings shall be certified to CSA B182.1 or CSA B182.2. Fabricated fittings must conform to CSA B182.2 and ASTM F679. Sealing gaskets shall meet the requirements of CSA B182.2 and ASTM F477 and pipe joints shall withstand 345kpa (50psi) hydrostatic pressure.
- .4 ABS-DWV
  - .1 Fittings to be certified to CSA B181.1 and is available in nominal sizes from 32 – 150mm. Permitted inside building above and underground and is not permitted for use in non-combustible buildings.

## **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 In accordance with Section 22 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code.
- .3 Solvent Cementing
  - .1 To make consistently good joints, the following points should be clearly understood.
    - .1 The joining surfaces must be softened and made semi-fluid.
    - .2 Sufficient cement must be applied to fill the gap between pipe and fitting.
    - .3 Assembly of pipe and fittings must be made while the surfaces are still wet and cement is still fluid.

- .4 Joint strength develops as the cement dries. In the tight part of the joint the surfaces will tend to fuse together; in the loose part, the cement will bond to both surfaces.
- .5 It is recommended that installers verify for themselves that they can make satisfactory joints under varying conditions.
- .6 It is recommended that the installers received personal instruction from trained instructor or experienced installers. Contact your local manufacture or supplier for additional information and or instruction.

### **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 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Verify provisions for movement of roof system.
- .4 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .5 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 22 05 17 - Pipe Welding.
- .3 Section 22 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .4 Section 20 05 53 - Mechanical Identification.

**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 74 21 - Construction/Demolition Waste Management and Disposal.

### **Part 2 Products**

#### **2.1 PIPE AND FITTINGS FOR AIR TREATMENT PIPING**

- .1 Piping and fittings:
  - .1 Blower mechanical piping will be Schedule 10 steel pipe with welded schedule 10 steel flanges and fittings.
  - .2 Bolts will be hex head heavy machine bolts and nuts, to be high strength low alloy steel for steel fittings and 304 stainless steel on stainless steel fittings. Gaskets will be 3 mm thick minimum, EPDM (printed), flat ring.
  - .3 Steel piping may also be roll-grooved for Victaulic flanges and Victaulic couplings and fittings. Victaulic Style 107 installation ready coupling with EHP gaskets rated for - 30oF to + 250oF . Victaulic Style 177 installation ready couplings to be utilized where noted on the drawings.
  - .4 Bolts and nuts for Victaulic couplings shall be heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.



- .2 Transition Piping (interior piping to exterior piping)
  - .1 A shown on the drawings, transition from Sch. 10 Steel to Stainless Steel Schedule 40 piping will be done inside the building.
  - .2 The Stainless Steel piping and fittings to the buried connection point shall be welded and include a 25 MPa concrete thrust block, properly sized.
- .3 Painting of Air Piping
  - .1 In order to ensure corrosion protection for the carbon steel Schedule 10 blower air piping, the air inlet and air discharge piping shall be protected with a heavy duty, high temperature resistant coating with a long lasting resistance to salts, water, alkalis and weathering.
  - .2 All valves inside the blower building will remain factory painted.
  - .3 Surface preparation – Steel pipe shall be dry, free of any oil or grease, abrasive, blasted to a Steel Structures Painting Council SSPC-SP-6 standard for a commercial finish.
  - .4 Primer – the primer shall consist of one (1) coat of epoxy gray colour high solids corrosion resistant primer and intermediate applied by spray to a dry film thickness of 75 microns (3mils).
  - .5 Topcoat – the topcoat shall consist on one (1) coat of green colour high solids corrosion resistant primer and intermediate applied by spray to a dry film thickness of 75 microns (3mils). Colour to be “Air Piping Green”.
  - .6 Epoxy primer and topcoat will be applied on the carbon steel Schedule 40 pipeline from the flanges of the inlet filter/silencers to all piping inside the blower building.
  - .7 Pipe supports will be painted the same as specified above.
  - .8 All stainless steel piping shall remain unpainted, but cleaned and polished with an acid wash cleaner, all in accordance with the stainless steel Manufacturer’s recommendations. Buffing of pipes with rotary equipment and steel brush (grinder, buffer) will not be permitted.
- .4 Pipe Hangers
  - .1 Pipe hangers shall be adjustable type clevis pipe hangers. Hangers will be supported by steel rods screwed into chemical resistant concrete anchors. Size of the rods is determined as required by the hanger. The pipe supports shall be fabricated as shown on the drawings and be hot-dipped galvanized finish.
- .5 Pipe Supports
  - .1 Refer to mechanical drawings

## **2.2 VALVES**

- .1 Refer to Section 22 05 23.06 – Wastewater Valves.

## **2.3 PRESSURE GAUGES**

- .1 Refer to Section 22 05 20 – Meters and Gauges for Wastewater System.

## **2.4 FABRICATION**

- .1 Do work in accordance with ASME B31.1.

- .2 Joints:
  - .1 Accessible locations: screwed, flanged or welded to match piping specification.
  - .2 Elsewhere: welded throughout, except at flanged components.
  - .3 Grooved joints on applicable systems in lieu of welded, flanged, or screwed joints and components.
- .3 Branch connections:
  - .1 Use butt or socket-weld fittings.
  - .2 Mains NPS 2-1/2 and smaller: use weldolets, threadolets, or 2 Mpa half couplings as reinforcements.
  - .3 Mains NPS 3 and larger: welded branch connections can be used.
  - .4 In grooved systems: tees and reducing tees can be used.

### **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 Departmental Representative and obtain written instruction.
- .3 When required by Departmental Representative, provide drawings showing relative locations of various services.

#### **3.2 WELDING**

- .1 Perform welding as specified herein.
- .2 Notwithstanding the requirements of referenced section, the following shall apply:
  - .1 Welding to be in accordance with ASME B31.1.
  - .2 Welding to be executed by certified pipe welders.
  - .3 Pipe fitting to be executed by certified pipe fitters.

#### **3.3 GROOVED JOINTS**

- .1 Install grooved joints in accordance with manufacturer's latest published installation instructions.
- .2 Ensure grooved ends are: clean, free from indentations, projections, and roll marks in the area from pipe end to groove.
- .3 Select gaskets with elastomer grade suitable for service and produced by coupling manufacturer.

#### **3.4 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 Butterfly valves: install between weld-neck flanges.
- .6 Branch take-offs:
  - .1 Use welding tees.
  - .2 Where reducing tees of proper size are unavailable, use available tees with reducers. Tees with increasers not acceptable.
- .7 Cap open ends of piping during installation. Remove foreign material from inside piping.
- .8 Grade nominally horizontal piping at 0.4% slope to high point for air removal.
- .9 Flanges: tighten bolts evenly with torque wrench.
- .10 Revisions to location of piping require written approval of Departmental Representative.
- .11 Connections to equipment:
  - .1 Use flanged valves for isolation and ease of maintenance and assembly.

### **3.5 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.

### **3.6 VALVES**

- .1 Install isolating valves at branch take-offs, at pieces of equipment and elsewhere as indicated.
- .2 Install in accordance with manufacturer's recommendations.
- .3 Install butterfly valves, where specified, between weld neck flanges to ensure full compression of liner.
- .4 Install in accessible locations.
- .5 Valves to be accessible for maintenance without removing adjacent piping.

### **3.7 FIELD QUALITY CONTROL**

- .1 Inspections:
  - .1 Leave joints in piping systems uncovered until tests are completed and system inspected as directed by Departmental Representative.
  - .2 Departmental Representative to inspect new piping prior to hydrostatic pressure tests for compliance with approved drawings and specifications.

- .3 Obtain from Departmental Representative requirements for inspection and testing of system modifications, design changes and repairs performed in-house.
- .4 Pay costs for inspections.

**3.8 PRESSURE TESTS:**

- .1 Refer to Section 10 90 00 – Air Piping System.

**3.9 FLUSHING AND CLEANING**

- .1 Refer to Section 10 90 00 – Air Piping System.

**3.10 COMMISSIONING**

- .1 Instrumentation: verify accuracy of pressure gauges by comparison with calibrated test instruments.
- .2 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.

**3.11 IDENTIFICATION**

- .1 In accordance with Section 23 05 53 - Mechanical Identification, supplemented as specified herein.
- .2 In addition, identify piping at building entries.

**3.12 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 20 05 01 – COMMON WORK RESULTS FOR MECHANICAL
- .2 Section 22 05 05 - INSTALATION OF PIPEWORK
- .3 Section 22 11 16 – DOMESTIC WATER PIPING

**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.
- .2 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-00, Commercial Adhesives.
- .3 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

**1.3 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.
  - .3 (For water closets, urinals): minimum pressure required for flushing.

**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 GENERAL**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass and escutcheons to be chrome plated.
- .4 Number, locations and mounting heights: architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.
- .7 Bring hot and cold piping to each fixture as required min. 12mm (1/2") copper unless noted.
- .8 Each fixture shall have heavy chrome plated copper flexible supply riser's c/w screw driver stop, reducer, and escutcheon.
- .9 All fixtures shall be capable of working in pressure range of 20 psi (137Kpa), to 80 psi (550Kpa)

### **2.2 PLUMBING FIXTURES**

#### **.1 P-1 Water Closet – Barrier Free**

- .1 Bowl:
  - .1 Elongated bowl "Low Consumption" Toilet, floor-mounted, vitreous white china with antimicrobial surface, minimum 1000 gram map rating siphon jet flush action bowl, power-wash rim, metal shank fill valve, 54mm (2-1/8") fully glazed internal trapway, 229mm (9") x 203mm (8") large water surface, 4.8 L (1.28 gal.) per flush, bolted, lined tank, 75mm (3") flush valve flapper.
- .2 Seat:
  - .1 Heavy duty white plastic elongated propylene seat, open front less cover, anti-microbial, SS hinges, reinforced hinge posts, install kit.

#### **.2 P-2 Lavatory – Wall Mount (Barrier-Free)**

- .1 Bowl:
  - .1 Stainless steel, center-back waste location, rear vertical deck, 18 gauge type 304 stainless steel. Radius coved bowl corners. One piece wall hanger, with 32mm (1 1/2") waste outlet, nominal dimensions 432mm (17") wide x 419mm (16-1/2") front to back, 235mm (9-1/4") high, and 356mm (14") x 305mm (12") x 152mm (6") bowl, weighing 16.3 kg (36 lb). Drilling to match faucet below.
- .2 Carrier:

- .1 Wall-mounted concealed-arm type where required to suit fixture above. Coordinate carrier type requirements with installed wall-type.
- .3 Faucet:
  - .1 Manually-operated, two handle, 100mm (4") centered with base, base-mounted deck orientation, chrome plated lead-free solid brass body with ceramic cartridges ¼ turn, 102mm (3") lever handles, 133mm (5 ¼") rigid spout with vandal resistant non-aerating, multi-laminar flow spray outlet, color (red and blue) indexed. Must meet barrier-free requirements.
- .4 Waste and Trap:
  - .1 P-traps, chrome-plated, heavy cast-brass adjustable body with slip-nut, offset tailpipe, 38mm (1 ½") with cleanout, box flange, seamless tubular wall bend and escutcheon. Provide complete with stainless steel protective shroud to meet barrier free protection requirements.
- .5 Mixing Valve:
  - .1 In-line, point-of-use, temperature limiting mixing valve to be plumbed under counter. Installed to limit high water temperature to 48°C (120°F). Provide tees, adaptors, copper to be installed.
  - .2 Bronze body with temperature adjusting dial to thermostatically limit flow of water, 10mm (3/8") in and out compression fittings. Adjustable between full cold and 48°C (120°F). Auto-shut-off and auto-reset.
- .3 P-2a Sink – Stainless Steel – Single Bowl (Barrier Free)**
  - .1 Bowl:
    - .1 Stainless steel type 304, 18 GA, single bowl self-rimming topmount sink for counter top mount with drilling to specified faucet, satin finish bowl and rim, undercoated, rim seal, crumb-cup waste assembly with 38mm (1 ½") waste and mounting kit for bowl. Dimensions: Bowl: 23" (584mm) W x 17" (432mm) x 12" (300mm) deep.
  - .2 Faucet:
    - .1 Manually-operated, two handle, 100mm (4") centered with base, chrome plated lead-free solid brass body with ceramic cartridges ¼ turn, 89mm (4.0") long wrist blade handles, 160mm (6") rigid/swivel gooseneck spout with vandal resistant non-aerating, multi-laminar flow spray outlet, color (red and blue) indexed.
  - .3 Waste and Trap:
    - .1 P-traps, chrome-plated, heavy cast-brass adjustable body with slip-nut, 38mm (1 ½") with cleanout, box flange, seamless tubular wall bend and escutcheon. Provide offset tailpipe as required; coordinate with casework installation for barrier-free compliance.
  - .4 Mixing Valve:
    - .1 In-line, point-of-use, temperature limiting mixing valve to be plumbed under counter. Installed to limit high water temperature to 48°C (120°F). Provide tees, adaptors, copper to be installed.

- .2 Bronze body with temperature adjusting dial to thermostatically limit flow of water, 10mm (3/8") in and out compression fittings. Adjustable between full cold and 48°C (120°F). Auto-shut-off and auto-reset.
- .5 Supplies:
  - .1 Chrome-plated polished brass ¼-turn ball valve angle stops with vandal-proof loose key handle, 13mm (1/2") ID inlet and 127mm (5") horizontal extension tubes, flexible chrome-plated solid copper risers, and escutcheon.
- .4 P-3 Emergency Eyewash/Shower – ABS Plastic**
  - .1 Bowl:
    - .1 ABS plastic 298mm (11 ¾") bowl for wall-mount ABS yellow anti-microbial plastic heads with integral flip dust covers, internal flow controls and filters – stainless steel push stem with push handle, 13mm (1/2") NPT water connector, strainer, 10 lpm (2.6 GPM) flow rate, universal sign and test tag.
  - .2 Mixing Valve:
    - .1 Temperature limiting water mixing valve to ANSI Z-358.1 piped in-line on concealed supply to emergency fixture. Brass body with tamper resistant adjustment control, cold water bypass, integral checks, screens, thermal actuator, with 13mm (1/2") NPT inlet and outlet, 860 kPa maximum pressure, 27 lpm (9.8 GPM) flow at 207 kPa pressure shop, factory set to 15°C (59°F). Supply c/w stainless steel wall cabinet by unit manufacturer.

### **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, for barrier free, or for child height, Refer to Architectural elevations measured from finished floor.
- .2 Wall-hung fixtures: as indicated, measured from finished floor.
- .3 Barrier free: to most stringent NBCC CAN/CSA B651.
- .4 Water Closets:
  - .1 Provide and install floor flange same material as connecting pipe drain with all brass bolts, rubber gasket, boltcaps.
  - .2 Install all gooseneck faucets as follows: for single bowl sinks – rigid, for double bowl sinks-swivel.
  - .3 All under counter piping between components of trim and fixtures to be chrome-plated flexible copper. No braided ss hoses permitted.



- .4 Pipe all eye washes, back flow discharge, etc. with copper DWV to nearest janitor's sink or floor drain, or coordinate with LAV drop.
- .5 Install for laundry waste box accessible service stops, 50mm concealed copper standing waste and P-trap c/w access door and cover.
- .5 Vents: All vents 38mm with exceptions: 32mm for lavatories, 50mm for washer box
- .6 Waste: Lavatories size 32mm, sinks size 38mm, urinal 50mm, water closet 75mm
- .7 Shower heads: provide wall backing to reinforce installation
- .8 Tubs: Provide inner wall support to reinforce inner ledge.
- .9 .Interceptors: Coordinate clearances to architectural and other for basket removal.
- .10 Fixtures with electronic faucets or two recessed boxes in wall with stainless steel trim cover.

### **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.
- .2 Remove surplus or excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 – Common Work results for Mechanical
- .2 Section 22 11 16 – Domestic Water piping
- .3 Section 22 05 05 – Installation of pipework.

**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 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.
- .3 Shop Drawings:
  - .1 Indicate on drawings: materials, finishes, method of anchorage, and number of anchors, dimensions construction and assembly details accessories.
- .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 off ground 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: to CSA B79.
- .2 Standard of acceptance:
  - .1 FD (Regular Round Drain with Membrane Clamp for floor and showers)
    - .1 Epoxy coated cast iron body, bottom outlet, combination invertible membrane clamp and adjustable collar with weepage holes, heavy duty stainless steel strainer, and trap primer tapping.
  - .2 FFD (Regular Floor Drain c/w Funnel)
    - .1 Epoxy coated cast iron body, bottom outlet, combination invertible membrane clamp and adjustable collar with weepage holes, heavy duty stainless steel strainer, and trap primer tapping. Funnel floor drain shall be complete with round drain top and polished nickel bronze open throat oval funnel grate.

### **2.2 CATCH BASIN with heavy duty frame.**

- .1 Catch basin formed of HDPE with ribs and rebar clips to provide mechanical locking in to surrounding concrete nominal 24" square.
- .2 Ductile iron grate for vehicle traffic to ASTM A536-84 with 1 1/16" wide slots and 2 1/2" bearing depth. Minimum total open area 164" <sup>2</sup> powder coated finish, all welds to ASTM AWS D1.1.
- .3 Options: Galvanized Ductile Grate - Class F and sediment Bucket

## **2.3 CLEANOUTS**

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
  - .1 Wall Access: face or wall type, polished nickel bronze round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .2 Floor Access: round cast iron body and frame with adjustable secured stainless steel top:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for Unfinished Concrete Floors: stainless steel

## **2.4 WATER HAMMER ARRESTORS**

- .1 Stainless steel construction, bellows type: to PDI-WH201.

## **2.5 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.

## **2.6 PRESSURE REGULATORS AT EQUIPMENT**

- .1 Capacity: as indicated.
  - .1 Inlet pressure: 517 kPa (75 psi)
  - .2 Outlet pressure: 137 kPa (20 psi)
- .2 Up to NPS 1-1/2 bronze bodies, screwed: to ASTM B62.
- .3 Semi-steel spring chambers with bronze trim.
- .4 Lead free construction & adjustable pressure testing and built-in bypass for thermal expansion.

## **2.7 TRAP SEAL PRIMERS**

- .1 Provide priming device with R.P. type BFP c/w drain to nearest services in conjunction with electric trap primer unit. Trap primer unit shall consist of a 120 volt solenoid valve and copper manifold header for multiple pipes. System must be connected to nearest 1/2" 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 recessed cabinet with an access door by manufacturer. Strainer and BFP shall be mounted external to cabinet in a serviceable location. Site Fabricated assemblies will not be accepted in lieu of unit specified. No exceptions.

## **2.8 STRAINERS**

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS 2 1/2 and over, cast iron body, flanged ends, with bolted cap.

## **2.9 DOMESTIC WATER HEATERS - ELECTRIC**

- .1 Domestic water heater shall be glass-lined, commercial rated tank c/w high-density fibreglass insulation, electric immersion-type elements, factory installed terminal wiring block, single-point power connection, internal automatic temperature control/adjustment, drain valve, T&P Relief valve and di-electric pipe nipples. Minimum performance shall be as follows: 27kW elements, 600V/3ph power supply, 102USG storage capacity, and 109 USG recovery rate based on 100F temperature rise.

## **2.10 WATER METERS**

- .1 Water meters shall be transmitting type c/w 4-20mA output for metering trend logging through controls system. Meter shall utilize dual-optical switch, have stainless steel ball bearings, have tamper-proof seal pins to prevent unauthorized access and in-line adaptability to allow meter by-pass when servicing meter to ensure continued water service. Meter shall be capable for measuring flow rates up to 50 USGPM at max flow, minimum 50mmDia. In size.

## **2.11 BACKWATER VALVES**

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
- .2 Access:
  - .1 Access pipe with cover: maximum 300 mm depth.

## **2.12 PRESSURE WASHERS**

- .1 Pressure washer shall be industrial rated electric type, rated for 4 USGPM flow rate at 3000 PSI.
- .2 Motor shall be belt-driven type, full-frame TEFC design c/w thermal overload protection, rated for continuous duty, 7.5 HP w/ 575V/3PH power feed. Max motor RPM 1750.
- .3 Unit shall come c/w rigid powder-coated floor-stand c/w vibration isolation for isolation.
- .4 Pumps shall be of the heavy-duty triplex plunger style c/w oil-bath crank case, stainless steel valves, brass manifold and thermo pump protector
- .5 Unit shall be c/w electrical control panel rated for NEMA 4 water tight, c/w heavy-duty on/off cam-style switch.
- .6 Unit frame shall be all-welded powder coated design.
- .7 Accessories shall include: Liquid-filled pressure gauge, adjustable pressure regulator, gun and wand assembly and quick-coupler system, 0/15/25/40 deg. Nozzles, two (2) externally mounted hose-reels (50' each).

## **2.13 DHW RECIRCULATE BALANCE VALVES**

- .1 Venturi-style circuit balancing valves factory set at 0.016 l/s (0.26 GPM) .

## **2.14 DHW EXPANSION TANKS**

- .1 Potable water expansion tanks with field-adjustable carbon steel outer tank, FDA approved and fixed Butyl rubber diaphragm, stainless steel fittings; pre-charged.

- .2 Air pre-charge: 20PSI
- .3 Max working pressure: 150PSI  
Maximum Design temperature: 200°F
- .4 Performance:

Tank #	Tank Volume	Tank Acceptance
ET 1	17l 4.5 gal	13l 3.42gal

### **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 General Contractor 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, 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 100.

#### **3.5 WATER HAMMER ARRESTORS**

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

### **3.6 BACK FLOW PREVENTERS**

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
  - .1 Drains
  - .2 Backwater Valves
  - .3 Water Make-up Assembly
  - .4 Grease Interceptors.
- .2 Pipe discharge to terminate over nearest drain or service sinks.

### **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 on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.
- .3 Install soft copper plastic tubing to floor drain.

### **3.9 STRAINERS**

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

### **3.10 WATER METERS**

- .1 Install water meter provided by local water authority.
- .2 Install water meter as indicated.

### **3.11 WATER MAKE-UP ASSEMBLY**

- .1 Install on valved bypass.
- .2 Pipe discharge from relief valve to nearest floor drain.

### **3.12 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.
- .2 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.

- .3 Provide continuous supervision during start-up.

### **3.13 TESTING AND ADJUSTING**

- .1 General:
  - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13- General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.
  - .2 Flow rate at fixtures: +/- 20%.
  - .3 Adjust building domestic water pressure to be 75 psi or less.
- .4 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.
- .5 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.
- .6 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.
- .7 Roof drains:
  - .1 Check location at low points in roof.
  - .2 Check security, removability of dome.
  - .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
  - .4 Clean out sumps.
  - .5 Verify provisions for movement of roof systems.
- .8 Access doors:



- .1 Verify size and location relative to items to be accessed.
- .9 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .10 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .11 Wall, ground hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .12 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .13 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
- .14 Grease interceptors:
  - .1 Activate, using manufacturer's recommended procedures and materials.
- .15 Hose bibbs, sediment faucets:
  - .1 Verify that flow and pressure meet design criteria.
  - .2 Check for leaks, replace compression washer if required.

### **3.14 CLOSEOUT ACTIVITIES**

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

### **3.15 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.

### **3.16 PROTECTION**

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

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SEWAGE TREATMENT  
UPGRADES  
SPRINGHILL INSTITUTION  
SPRINGHILL, NS  
PROJECT NO. R.061876.001

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PLUMBING SPECIALTIES  
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