

PART 1      GENERAL1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 23 05 05 - Installation of Pipework.
- .3      Section 23 05 23.01 - Valves - Bronze.
- .4      Section 23 05 53.01 - Mechanical Identification.
- .5      Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6      Section 23 07 15 - Thermal Insulation for Piping and Equipment.
- .7      Section 23 08 01 - Performance Verification Mechanical Piping Systems.

1.2      REFERENCES

- .1      American Society of Mechanical Engineers International (ASME)
  - .1      ASME B16.15-2011, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
  - .2      ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3      ASME B16.22-2012, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4      ASME B16.24-2011, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500 and 2500.
- .2      ASTM International Inc.
  - .1      ASTM A307-12, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
  - .2      ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.
  - .3      ASTM B32-08, Standard Specification for Solder Metal.
  - .4      ASTM B88M-05 (R2011), Standard Specification for Seamless Copper Water Tube (Metric).
- .3      American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1      ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4      Canadian Standards Association (CSA International)
  - .1      CSA B242-05 (R2011), Groove-and Shoulder-Type Mechanical Pipe Couplings.

- .5 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67-2011, Butterfly Valves.
  - .2 MSS-SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-2011, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 2010.
- .9 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

### 1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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 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.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

## PART 2 PRODUCTS

### 2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
  - .2 Buried or embedded: copper tube, soft annealed, type L: to ASTM B88M, in long lengths and with no buried joints.

## 2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250.
- .3 Cast copper, solder type: to ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ASME B16.22.
- .5 NPS 1 1/2 and smaller: wrought copper to ASME B16.22 cast copper to ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

## 2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: lead free 95/5 tin copper alloy to ASTM B32.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## 2.4 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.
- .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.

## 2.5 BALL VALVES

- .1 NPS 2 and under, screwed:
  - .1 Class 150.

- .2 Forged Brass body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.
- .2 NPS 2 and under, soldered:
  - .1 To ASME B16.18, Class 150.
  - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

## 2.6 GATE VALVES

- .1 NPS 2 and under, screwed:
  - .1 NPS 2 and under, soldered:
    - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
  - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

## 2.7 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 23 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 23 05 23.01 - Valves - Bronze.
  - .2 Lockshield handles: as indicated.

## 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 and local Authority Having Jurisdiction.

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- .2 Install pipe work in accordance with Section 23 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 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.
  - .7 Insulate DCW and DHW piping per Section 23 07 15 - Thermal Insulation for Piping and Equipment.

### 3.3 VALVES

- .1 Isolate equipment, fixtures and branches with 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 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

### 3.5 FLUSHING AND CLEANING

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

### 3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

- .3 Ensure that air chambers, expansion compensators are installed properly.

### 3.7 DISINFECTION

- .1 Chlorinate water piping systems before placing into service by injection of mixture of 5% calcium hypochlorite and 95% water, thoroughly mixed from paste form.
- .2 Inject the mixture into the lines in a manner which will ensure treatment of the entire system.
- .3 Retain a dosage of 50 ppm in the line for four (4) hours, after which a residual of 5 ppm must be obtained.
- .4 When a pipeline is already filled with water, inject a concentrated chlorine mixture at intervals along the pipeline. Retention period in this case to be eight (8) hours.
- .5 Operate all valves during chlorination so that they will be sterilized in the procedure. After chlorination period, flush out the lines at the extremities until tests on water samples taken at this point prove that the chemical and bacterial contents are no greater than those of the source of supply.
- .6 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

### 3.8 START-UP

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

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### 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 HVAC.
  - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is 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 Pressure test results.
  - .2 Water test results.
  - .3 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 23 05 05 - Installation of Pipework.

### 3.11 CLEANING

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





PART 1      GENERAL1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 23 05 05 - Installation of Pipework.
- .3      Section 23 05 53.01 - Mechanical Identification.
- .4      Section 23 08 01 - Performance Verification Mechanical Piping Systems.

1.2      REFERENCES

- .1      American Society for Testing and Materials International (ASTM)
  - .1      ASTM B32-08, Standard Specification for Solder Metal.
  - .2      ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
  - .3      ASTM C564-12, 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-B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining, Includes Update No. 1 (2012).
  - .3      CAN/CSA-B125.3-12, Plumbing Fittings.

1.3      QUALITY ASSURANCE

- .1      Health and Safety:
  - .1      Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4      SUBMITTALS

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

## 1.5 DELIVERY, STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
  - .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management.
- .3 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .4 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: lead free, tin-95:5, type TA, to ASTM B32.

### 2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary and storm minimum NPS 3, to: CAN/CSA-B70.
  - .1 Joints:
    - .1 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
      - .2 Stainless steel clamps.
- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
  - .1 Joints:
    - .1 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.

- .2 Install in accordance with National Plumbing Code of Canada and local Authority Having Jurisdiction.

### 3.2 TESTING

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

### 3.3 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 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).



PART 1      GENERAL1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 23 05 05 - Installation of Pipework.
- .3      Section 23 05 53.01 - Mechanical Identification.
- .4      Section 23 08 01 - Performance Verification Mechanical Piping Systems.

1.2      REFERENCES

- .1      ASTM International Inc.
  - .1      ASTM D2564-12, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2      Canadian Standards Association (CSA International)
  - .1      CSA Series B1800-11, Thermoplastic Nonpressure Pipe Compendium (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.8, B182.11 and B182.13), Includes Update #1 (2011).
- .3      Green Seal Environmental Standards (GSES)
  - .1      Standard GS-36-11, Adhesives for Commercial Use.
- .4      Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1      Material Safety Data Sheets (MSDS).
- .5      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      Shop drawings:
  - .1      Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2      Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

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#### 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.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### PART 2 PRODUCTS

#### 2.1 PIPING AND FITTINGS

- .1 For buried DWV PVC piping to:
  - .1 CSA B1800.

#### 2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.

### 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 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code and local Authority Having Jurisdiction.

#### 3.3 TESTING

- .1 Pressure test buried systems before backfilling.

- .2      Hydraulically test to verify grades and freedom from obstructions.

### 3.4      PERFORMANCE VERIFICATION

- .1      Cleanouts:
  - .1      Ensure accessible and that access doors are correctly located.
  - .2      Open, cover with linseed oil and re-seal.
  - .3      Verify cleanout rods can probe as far as the next cleanout, at least.
- .2      Test to ensure traps are fully and permanently primed.

### 3.5      CLEANING

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





PART 1      GENERAL1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 22 11 16 - Domestic Water Piping.
- .3      Section 22 42 01 - Plumbing Specialties and Accessories.
- .4      Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems.
- .5      Section 23 05 23.01 - Valves - Bronze.
- .6      Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .7      Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- .8      Section 23 05 53.01 - Mechanical Identification.
- .9      Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

1.2      REFERENCES

- .1      Canadian Standards Association (CSA International)
  - .1      CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code, Includes Update No. 1 (2009).
  - .2      CAN/CSA-C22.2 No. 110-94 (R2009), Construction and Test of Electric Storage-Tank Water Heaters.
  - .3      CSA C191-13, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
  - .4      CAN/CSA-C309-M90 (R2009), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .2      National Building Code of Canada (NBC) - 2010.

1.3      SUBMITTALS

- .1      Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Shop drawings:
  - .1      Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

#### 1.4 CLOSEOUT SUBMITTALS

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

#### 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.
- .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 ELECTRIC WATER HEATER

- .1 To CAN/CSA C22.2 No. 110, CSA C191 and CAN/CSA-C309 for glass-lined storage tanks, with 1 immersion type elements, 3000 W each, and surface mounted or immersion type adjustable thermostats.
- .2 Tank: 75 L, polymerized fluorocarbon lined steel, 500 mm diameter x 630 mm high, 50 mm mineral wool or fiberglass insulation, enameled steel jacket.

#### 2.2 TRIM AND INSTRUMENTATION

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

- .5 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

### 2.3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation in concrete support pad.
- .2 Size anchor bolts to withstand seismic zone acceleration and velocity forces as per NBC in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

## 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 Make required piping connections as per drawing schematic.
- .2 Install all components to manufacturers' recommendations, to applicable codes and to Authority Having Jurisdiction.

### 3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work.
  - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Include for the services of water heater manufacturer's factory certified service technician in start-up and repair services to assist in start-up, performance verification, and Commissioning of the systems on the job site.
  - .4 Manufacturer's representative is to be on site with Departmental Representative for Substantial Performance review, and as required by the Contractor for Commissioning.

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- .5 Schedule site visits, to review Work, at stages listed:
    - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
    - .2 Once during progress of Work at 50% complete.
    - .3 Upon completion of the Work, after cleaning is carried out.
  - .6 Include site visits by manufacturer's representative to start-up and ensure trouble free and specified operation of the system.
  - .7 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.
  - .2 Performance Verification (PV):
    - .1 Verification for proper operation and reliability of the water heaters and the building automation system.
    - .2 Operate equipment and verify that performance criteria specified have been achieved.
    - .3 Inspect and test all sub-assemblies for conformance to Vendor's engineering and quality assurance specifications.
    - .4 Rejected Work:
      - .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Technical Documents. Replace or re-execute in accordance with Technical Documents.
      - .2 Make good other Contractor's work damaged by such removals or replacements promptly.

### 3.4 CLEANING

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

PART 1      GENERAL1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 22 11 16 - Domestic Water Piping.
- .3      Section 22 13 17 - Drainage Waste and Vent Piping - Cast Iron and Copper.
- .4      Section 22 13 18 - Drainage Waste and Vent Piping - Plastic.
- .5      Section 22 30 05 - Domestic Water Heaters.

1.2      REFERENCES

- .1      American Society of Safety Engineers (ASSE)
  - .1      ANSI/ASSE (Plumbing) 1001-2008, Performance Requirements for Atmospheric Type Vacuum Breakers.
  - .2      ASSE (Plumbing) 1010-2004, Performance Requirements of Water Hammer Arrestors.
- .2      American Society for Testing and Materials International (ASTM).
  - .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.
- .3      American National Standards Institute (ANSI)/American Water Works Association (AWWA).
  - .1      ANSI/AWWA C700-09, AWWA Standard for Cold-Water Meters-Displacement Type, Bronze Main Case, Includes Erratum.
  - .2      ANSI/AWWA C701-12, AWWA Standard for Cold Water Meters-Turbine Type for Customer Service.
  - .3      ANSI/AWWA C702-10, AWWA Standard for Cold Water Meters-Compound Type.
  - .4      ANSI/AWWA C707-10, Encoder-Type Remote-Registration Systems for Cold-Water Meters.
- .4      Canadian Standards Association (CSA International).
  - .1      CAN/CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers (Consists of B64.0, B64.1.1, B64.1.2, B64.1.3, B64.2, B64.2.1, B64.2.1.1, B64.2.2, B64.3, B64.3.1, B64.4, B64.4.1, B64.5, B64.5.1, B64.6, B64.6.1, B64.7, B64.8 and B64.9).
  - .2      CSA B79-08, Commercial and Residential Drains and Cleanouts.

- .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .6 Plumbing and Drainage Institute (PDI).
  - .1 PDI-WH201-2010, Water Hammer Arresters.
- .7 NSF International
  - .1 NSF/ANSI 61-2012, Drinking Water System Components - Health Effects.

### 1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: manufacturers' field reports specified.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:
  - .1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

### 1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.

- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Reduction Workplan.
  - .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
  - .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

## PART 2 PRODUCTS

### 2.1 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, stainless steel square or round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
  - .2 Floor Access: rectangular cast iron body and frame with adjustable secured nickel bronze top and:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
    - .3 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

### 2.2 WATER HAMMER ARRESTORS

- .1 ASSE 1010 approved shock absorbers with hard drawn copper body, designed for 1035 kPa working pressure, 1 °C to 120 °C temperature range. Size of each unit to suit number of fixture units protected.

## 2.3 VACUUM BREAKERS

- .1 Breakers: to CAN/CSA-B64 Series, vacuum breaker atmospheric, hose connection.

## 2.4 TRAP SEAL PRIMERS

- .1 Electronic trap seal primers:
  - .1 Units shall be factory assembled, pre-piped, and shall include:
    - .1 Inlet: 19 mm NPT female for multiple outlet units, 12 mm NPT male for single outlet units, manual shut-off ball valve.
    - .2 Outlet: 12 mm brass compression fittings. Number of outlets to suit specific requirements at each location.
    - .3 Manifold: 19 mm type "L" copper tubing, calibrated for equal water distribution.
    - .4 Electrical components: Circuit breaker, switch, 24 hour timer with relay and 5 second dwell function, UL listed 19 mm brass solenoid valve, manual over ride, single point power connection at 120/1/60.
    - .5 Backflow prevention: Anti-siphon atmospheric vacuum breaker to ASSE 1001.
    - .6 Metal cabinet: 1.5 mm steel, galvanized.
    - .7 Access door: Stainless steel, fire rated, ring pull latch.
    - .8 The trap primer shall supply a minimum of 60 ml of DCW per drain served at 140 kPa gauge pressure at a preset factory setting of 6 seconds.

## 2.5 STRAINERS

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

## 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 data sheet.

### 3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada and local Authority Having Jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.



### 3.3 CLEANOUTS

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

### 3.4 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures, as required by code.

### 3.5 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install soft copper tubing to floor drain.
- .3 Pressure drop primer range is 250 kPa to 500 kPa.
- .4 Allow 300 mm drop for every 6 m of distance from primer to floor drain.
- .5 Must be installed on DCW pipe of 38 mm diameter or less.
- .6 Units must be installed plum.
- .7 System must be flushed prior to installing trap primers.
- .8 Primers must be cycled on new installations to assure proper operation.

### 3.6 STRAINERS

- .1 Install with sufficient room to remove basket.

### 3.7 START-UP

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

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### 3.8 TESTING AND ADJUSTING

- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by Authority Having Jurisdiction.
- .2 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.
  - .2 Flow rate at fixtures: +/- 20%.
- .3 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Vacuum breakers:
  - .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.
- .5 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .6 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .7 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .8 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.

## PART 1      GENERAL

### 1.1      RELATED SECTIONS

- .1      Section 21 05 01 - Common Work Results for Mechanical.
- .2      Section 22 11 16 - Domestic Water Piping.
- .3      Section 22 13 17 - Drainage Waste and Vent Piping - Cast Iron and Copper.
- .4      Section 22 13 18 - Drainage Waste and Vent Piping - Plastic.
- .5      Section 23 05 05 - Installation of Pipework.

### 1.2      REFERENCES

- .1      American Society of Sanitary Engineering (ASSE)
  - .1      ASSE (Plumbing) 1016-2011/ASME A112.1016/CSA B125.16, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations, Includes Update No. 1 (2012).
  - .2      ANSI/ASSE (Plumbing) 1071-2012, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.
- .2      American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)
  - .1      ANSI/ASHRAE 90.1-2010 (SI), Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES), Errata (January 18, 2013)/Addenda a thru ds/IC 90.1-2010-02 to 14/90.1-2010-15 to 16.
- .3      Canadian Standards Association (CSA International)
  - .1      CAN/CSA-B45 Series-02 (R2013), Plumbing Fixtures (Consists of B45.0-02, B45.1-02, B45.2-02, B45.3-02, B45.4-02, B45.5-02, B45.6-02, B45.7-02, B45.8-02 and B45.9-02), Includes Updates No. 1, No. 2, No. 3, and No. 4 (2007).
  - .2      CAN/CSA-B125.3-12, Plumbing Fittings.
  - .3      CAN/CSA-B651-12, Accessible Design for the Built Environment.

### 1.3      SUBMITTALS

- .1      Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product Data/shop drawings:
  - .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.
- .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 MANUFACTURED UNITS

- .1 Mop Sink - "JAN-1":
  - .1 Basin: molded stone, 610 mm x 610 mm x 254 mm deep, molded stone, plain curbs, stainless steel drain with strainer, 76 mm outlet.
  - .2 Trim: wall mounted two handle faucet, chrome plated cast brass body, integral stops, spout with atmospheric vacuum breaker and bucket hook, lever handle, top brace.
- .2 Lavatory - "LAV-1":
  - .1 Basin: vitreous china, self-rimming, front overflow, faucet ledge, tapered edges.
  - .2 Trim: single lever faucet, brass construction, 8.3 LPM max flow aerator outlet, metal lever handle, adjustable hot limit stop.

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- .3 Mixer: point of use thermostatic water mixing valve, bronze body, temperature adjustment by using a hex wrench, 10 mm inlet compression fittings with stainless steel 508 mm flexible hose and 13 mm MNPT outlet connection, built-in checks, housed in 127 mm x 86 mm x 81 mm enclosure. Set valve temperature at 46°C.
- .4 P-trap: open grid drain, chrome plated cast brass one piece top, 1.5 mm tubular 32 mm tailpiece. P-Trap, 32 mm inlet, shallow wall flange and seamless tubular wall bend.
- .5 Supplies: chrome finish polished brass Faucet Supplies, commercial duty 1/4 turn ball valve angle stop, 13 mm I. D. Inlet x 127 mm horizontal extension tubes, combination vandal proof handle, escutcheon and flexible copper riser.
- .3 S-1: Single Bowl Sink - Countertop With Ledgeback - Standard Use - 302/304 Stainless Steel - Single Lever/Handle Faucet - Barrier-Free Design:
- .1 S.S. Sink: 3 hole, 203 mm centers, 480 mm x 460 mm x 150 mm deep, counter mounted, back ledge, 1.2 mm, grade 18-10 type 304 stainless steel, single compartment, satin finished rim and bowl, self rimming, 38 mm tailpiece, sound deadening and mounting kit, 89 mm crumb cup strainer with 38 mm tail piece.
- .2 Faucets: C.P. 203 mm C.C., below deck mounted, cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, gooseneck spout with laminar vandal-resistant, 8.3 LPM (non aerating) outlet female adaptor, single lever handle, separate side spray, and flexible copper supplies.
- .3 Provide Supplies: C.P. with metal angle stops, adaptors, escutcheons and metal flexible risers.
- .4 Provide P-Trap: cast brass 38 mm with cleanout, union and escutcheon, offset and insulate.
- .4 Water Closet - "WC-1":
- .1 400 mm high, vitreous china, elongated bowl, floor mount, low flush (6 L), two-piece, over-sized 75 mm flush valve with flapper.
- .2 Seat: elongated bowl open front, white solid plastic, open front less cover, reinforced stainless steel check hinges, metal flat washers stainless steel posts and nuts.
- .3 Supply: chrome finish polished brass Toilet Supply, commercial duty 1/4 turn ball valve angle stop.
- .5 Flip Down Eyewash:
- .1 Barrier-free sink/countertop eye/face wash c/w eye/face wash head with inverted directional laminar flow. Polished chrome brass single action pull-down valve body, barrier-free accessibility, universal sign, tempered water mixing valve (75 LPM), 12mm hot and cold water connections.
- .2 Provide local audible and visual alarm activated by unit mounted flow switch.

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## 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: as indicated, measured from finished floor.
  - .2 Wall-hung fixtures: as indicated, measured from finished floor.
  - .3 Barrier free: to most stringent NBCC and CAN/CSA-B651.

### 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 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

### 3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work.
  - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Include for the services of fixture manufacturer's factory certified service technician in start-up and repair services to assist in start-up, performance verification, and Commissioning of the systems on the job site.
  - .4 Manufacturer's representative is to be on site with Departmental Representative for Substantial Performance review, and as required by the Contractor for Commissioning.
  - .5 Schedule site visits, to review Work, at stages listed:
    - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.



