

1 GENERAL

1.01 DESCRIPTION OF SYSTEMS

- .1 Provide complete plumbing system including:
 - .1 Sanitary waste, vent, storm, hot and cold water, trap primer water piping systems including fixtures, specialties and accessories.
- .2 Provide NPS ½ priming lines to floor drain traps as indicated.
- .3 Do all work in accordance with the 2010 Canadian Plumbing Code and the local authorities having jurisdiction.
- .4 All underground drains to be a minimum of NPS 2.
- .5 Confirm a minimum 50mm clearance is maintained between finished piping, including insulation.
- .6 Provide piping sleeves for piping penetrating concrete floor slabs.

1.02 RELATED SECTIONS

- .1 Submittal Procedures: Section 01 33 00
- .2 Closeout Submittals: Section 01 78 00
- .3 Fire Stopping: Section 07 84 00
- .4 Painting: Section 09 91 00

1.03 FIXTURES AND FITTINGS

- .1 In case of discrepancy between Architectural and Mechanical drawings as to the number and location of fixtures, the Architectural drawings govern.

1.04 RELATED WORK PERFORMED BY THIS SECTION

- .1 Caulking:
 - .1 Caulking is the responsibility of Section 07 92 00 - Sealants.
 - .2 Perform caulking in compliance with the requirements of Section 07 92 00 - Sealants.
- .2 Welding:
 - .1 Have welding performed by Division 22 for all mechanical

- piping and structural supports and hangers.
- .2 Perform welding by certified welders in accordance with the Provincial Labour Requirements and By-Laws of Prince Edward Island.

.3 Cutting and Patching:

- .1 Cutting of all openings in concrete floors and walls and patching for mechanical work included in Division 22 will be the responsibility of Division 22, unless otherwise indicated on the structural drawings.

1.05 FIXTURES AND FITTINGS

- .1 Equipment assemblies comprised of electro- mechanical components to be CSA approved where possible and bear the appropriate label. If the equipment in question is not CSA approved as an assembly, the manufacturer will arrange and pay for spot approval and labelling of the equipment prior to installation.

1.06 EQUIPMENT INSTALLATION

- .1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping systems without interfering with other equipment.
- .2 Provide means of access for servicing equipment including permanently lubricated lifetime bearings.
- .3 Pipe equipment drains to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.07 PIPE INSULATION

- .1 Pipe insulation to be as per Section 23 07 19.

1.08 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates as required.

1.09 TRIAL USAGE

- .1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.10 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other

foreign materials with materials appropriate to system.

1.11 EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 22.
- .2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel. Submit structural calculations with shop drawings.
- .3 Mount base mounted equipment on "Type B1" chamfered edge housekeeping pads, minimum of 100mm high and minimum 100mm larger than equipment dimensions all around. Concrete specified in a separate package.
- .4 Pipe hangers to be as specified in Division 23.

1.12 SLEEVES

- .1 Pipe sleeves:
 - .1 Through masonry, concrete or fire rated assemblies: nominal 0.912mm (20 ga.) galvanized steel.
 - .2 Through foundation walls: Schedule 40 steel pipe with annular in continuously welded at midpoint of wall.
 - .3 Provide 25mm clearance all around service piping or ducting for building settlement/movement.
- .2 Terminate pipe sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25mm above other floors.
- .3 Fill voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof, fire retardant, non-hardening mastic.
 - .2 Where sleeves pass through walls or floors, provide space for firestopping to maintain fire rating integrity.
 - .3 Where sleeves pass through interior walls not fire-rated, provide acoustic caulking.
 - .4 Allow for no contact between copper tube or pipe and ferrous sleeve.
 - .5 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .6 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB- 1.181.

1.13 PREPARATION FOR FIRESTOPPING

- .1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation:

specified in Section 07 84 00.

- .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 to move without damaging firestopping material.
- .4 Insulated pipes and ducts: cut back insulation at fire separation to allow proper firestopping.
- .5 Firestopping material for piping and duct penetrations by Section 07 84 00.

1.14 ESCUTCHEONS

- .1 On pipes passing through walls, partitions, floors and ceilings in finished areas.
- .2 Chrome or nickel plated brass or Type 302 stainless steel, one piece type with set screws.
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.

1.15 TESTS

- .1 Give 24 hour written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by the Departmental Representative.
- .3 Conduct tests in presence of the Departmental Representative.
- .4 Bear costs including retesting.
- .5 Piping:
 - .1 General: maintain test pressure without loss for two (2) hours unless otherwise specified.
 - .2 Test drainage, waste and vent piping to the National Building Code, the Canadian Plumbing Code, and the authorities having jurisdiction.
 - .3 Test domestic hot, cold, and recirculation water piping at 1-1/2 times system operating pressure or minimum 862 kPa, whichever is greater.
- .6 Equipment: test as specified in relevant sections.

- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.16 PAINTING

- .1 Finish painting as specified in Section 09 91 00 except where specified elsewhere in Division 22.
- .2 Apply at least one (1) coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.17 SPARE PARTS

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals and as follows:
 - .1 One (1) set of packing for each pump.
 - .2 One (1) casing joint gasket for each size pump.
 - .3 Six (6) gaskets for plumbing cleanout plugs (each size).
 - .4 One (1) set of seats, washers, and o-rings for all flush valves, faucets, hose bibs, etc.
 - .5 Two (2) vandal-proof screw tools.
 - .6 And as specified elsewhere.

1.18 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

1.19 ACCESS DOORS

- .1 Supply access doors to concealed plumbing equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600mm x 600mm for body entry and 300mm x 300mm for hand entry unless otherwise noted. Doors to open 180, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Provide fire-rated access doors where penetrating fire-rated construction. Maintain fire rating integrity of construction.
- .3 Material:
 - .1 Special areas only such as tiled surfaces: use stainless steel with #4 satin finish.
 - .2 Remaining areas: use prime coated steel.

- .3 Nominal 1.897mm (14 ga.) material.
- .4 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry (as applicable) is achieved.
 - .3 Installation is specified in applicable sections.
- .5 Acceptable Manufacturers: Acudor, Buensod, LeHage, Zurn.

1.20 DIELECTRIC COUPLINGS

- .1 General:
 - .1 To be compatible with and to suit pressure and temperature rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes NPS 2 and under: isolating unions.
- .3 Pipes NPS 2-1/2 and over: isolating flanges.
- .4 Acceptable Manufacturers: EBCO, Walter Valiet Co., Watts.

1.21 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum NPS 3/4 unless otherwise specified: bronze, ball valve with hose end male thread, complete with cap and chain.
- .3 No water from any drain or relief valve shall discharge on the floor. Pipe drains to hub drains or funnel floor drains.

1.22 OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Provide demonstrations and instructions in conjunction with the appropriate equipment manufacturer's representatives.
- .3 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.
- .4 Give instructions in maintenance and operating of the following equipment by factory trained personnel and for the time period specified. The time specified does not include the time for

start-up of systems and equipment:

- .1 Give instruction on the operation and maintenance of all mechanical components including but not limited to pumps, fixtures and domestic hot water system. The instruction period will be for a period of not less than two (2) working days. Review with instructors for an additional 90 days after the acceptance of the building by the Departmental Representative.
- .2 Where more detailed instructions for some equipment or systems are called for in other sections of the specifications, those sections of the specifications will take precedence over this section.

1.23 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual to be approved by and final copies deposited with Departmental Representative before final inspection.
- .3 Operation data to include:
 - .1 Description of each system and its controls.
 - .2 Operation instruction for each system and each component.
 - .3 Description of actions to be taken in event of equipment failure.
 - .4 Valve schedule and flow diagram.
 - .5 Colour coding chart; identification system.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 95.
- .6 Approvals:
 - .1 Submit three (3) copies of draft Operation and Maintenance Manual to the Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by the Departmental Representative.

- .2 Make changes as required and re-submit as directed by the Departmental Representative.
- .7 Additional data: Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.24 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings and product data to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances (e.g. access door swing spaces).
- .3 Shop drawings and product data to be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Points of operation on performance curves.
 - .3 Manufacturer to certify as to current model production.
 - .4 Certification of compliance to applicable codes.

1.25 CLEANING

- .1 Clean interior and exterior of all systems including strainers.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

1.26 RECORD DRAWINGS

- .1 Refer to Section 01 78 00 - Closeout Submittals .

1.27 WARRANTIES

- .1 Make good all defects other than normal wear and tear during the life of the warranty period. Warrant all work and installed equipment to operate quietly and satisfactorily and to accomplish the Work for which it was installed during the life of the warranty. At any time during this period, make any necessary changes and adjustments, or replacements, to accomplish this at no additional cost to the project.
- .2 Submit written extended Warranties in Maintenance Manual as specified in Section 01 78 00 - Closeout Submittals.

1.28 PERMITS AND REGULATIONS

- .1 Comply with all regulations and authorities having jurisdiction

where applicable, including but not limited to the following:

- .1 Department of Labour and Workforce Development.
 - .2 Fire Marshall.
 - .3 Plumbing Inspector.
 - .4 Provincial Board of Insurance Under-writers.
 - .5 National Building Code.
 - .6 Occupational Health & Safety Act.
 - .7 NFPA
- .2 Obtain and pay for any permits required by local codes and regulations and arrange for inspections applicable.
 - .3 Any additional materials or labour required to conform to any of these rules and regulations will be furnished under the Contract with no additional cost to the project.

1.29 REFERENCE STANDARDS

- .1 Use the following latest editions and amendment of reference standards in effect on date of tender call:
 - .1 ANSI American National Standards Institute
 - .2 ASHRAE American Society of Heating, Refrigeration & Air Conditioning Engineers
 - .3 ASME American Society of Mechanical Engineers
 - .4 AST American Society of Testing & Materials
 - .5 AWS American Welding Society
 - .6 AWWA American Water Works Association
 - .7 CEMA Canadian Electrical Manufacturers Association
 - .8 CGSB Canadian Government Specification Board
 - .9 CFUA Canadian Fire Underwriters' Association
 - .10 CHVAC Canadian Heating, Ventilation & Air Conditioning Code (NCR) Fire Underwriters
 - .11 CMB Construction Materials Board
 - .12 CSA Canadian Standards Association
 - .13 CUA Canadian Underwriters Association
 - .14 HRA Heating, Refrigeration & Air Conditioning Institute of Canada
 - .15 NBC National Building Code of Canada
 - .16 NBFU National Board of Fire Underwriters'
 - .17 NBS National Bureau of Standards
 - .18 NFPA National Fire Protection Association
 - .19 TIMA Thermal Insulation Manufacturers Association
 - .20 UL Underwriters' Laboratories
 - .21 ULC Underwriters' Laboratories of Canada

1.30 ELECTRICAL

- .1 Electrical Work to conform to Division 26 including the following:

- .1 Control wiring and conduit is specified in Division 26.
Refer also to Division 26 and for wiring associated with
control systems.

2 **PRODUCTS** **Not Applicable.**

3 **EXECUTION** **Not Applicable.**

END OF SECTION

1 GENERAL

1.01 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries.
 - .2 Wiring, schematic diagrams and electrical data.
 - .3 Dimensions and recommended installation.
 - .4 Pump curves, head and RPM.

1.02 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Data to include:
 - .1 Manufacturers name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.

2 PRODUCTS

2.01 DOMESTIC HOT WATER CIRC PUMP

- .1 Construction: Bronze or stainless steel, suitable for potable water.
- .2 Motor: ECM motor.
- .3 Performance: as indicated on the drawings.
- .4 Electrical: as indicated on the drawings.

3 EXECUTION

3.01 INSTALLATION

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Confirm pump and motor assembly do not support piping.
- .3 Confirm pump rotation is correct.

- .4 Set up and adjust controls.
- .5 Check starter protective devices.
- .6 Check power supply.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 23 05 01 - Mechanical General Requirements

1.02 REFERENCES

- .1 ASME B16.15-2013, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI B16.22-2013, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
- .4 ANSI B16.24-2016, Bronze Pipe Flanges and Fittings, Class 150 and 300.
- .5 ANSI/AWWA C111/A21.11-2012, Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- .6 ASTM A183-2014, Specification for Carbon Steel Track Bolts and Nuts.
- .7 ASTM A307-2014, Specification for Carbon Steel Bolts and Studs, 414 MPa Tensile Strength.
- .8 ASTM B32-08(R2014), Specification for Solder Metal.
- .9 ASTM B75-2011, Specification for Seamless Copper Tube.
- .10 ASTM B88M-2014, Specification for Seamless Copper Water Tube (Metric).
- .11 MSS SP-70-2011, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .12 MSS SP-71-2011, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .13 MSS SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Submit data for following: valves.

1.04 MAINTENANCE DATA

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

2 PRODUCTS

2.01 PIPING

- .1 Domestic Cold Water (DCW); Domestic Hot Water (DHW); Domestic Hot Water Recirculation (DHWR); Non-potable Water (NP), Trap Primer Piping (TP).
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Buried and embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints. "PEX", CSA approved potable water piping with no joints may be used under slab.

2.02 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI B16.18. (Lead-free).
- .4 Wrought copper and copper alloy, solder type: to ANSI B16.22.
- .5 Piping NPS 2-1/2 and over: roll groove copper fittings to ASTM B75, alloy C12200.
- .6 Mechanically formed Tee connections may be used on 25mm and above water pipe and where the branch line connection to the branch main is at least one pipe size smaller than the branch main.

2.03 JOINTS

- .1 Rubber gaskets, 3 mm thick: to ANSI/AWWA C111/A21.11.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder/brazing: tin-antimony 95-5: to ASTM B32, or tin-silver 94-6. (Lead free.)
- .4 Teflon tape: for threaded joints.

- .5 Piping NPS 2-1/2 and over: roll groove couplings with ductile or malleable iron housings, grade E EPDM flush seal gaskets and heat treated carbon steel bolts/nuts to ASTM A183.
- .6 Dielectric unions between dissimilar metals to ASTM F492, complete with thermoplastic liner.

2.04 GATE VALVES

- .1 NPS 2-1/2 and over, flanged:
 - .1 Non-rising stem: to MSS SP-70, Class 125, 125 psig, full faced, flanged ends, cast-iron body, bronze trim, bolted bonnet.

2.05 GLOBE VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS SP-80, Class 125, 862 kPa, bronze body, renewable composition disc, screwed over bonnet.
 - .2 Lockshield handles: as indicated.
- .2 NPS 2 and under, screwed:
 - .1 To MSS SP-80, Class 125, 862 kPa, bronze body, screwed over bonnet, renewable composition disc.
 - .2 Lockshield handles: as indicated.

2.06 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS SP-80, Class 125, 862 kPa, bronze body, bronze swing disc, screw in cap, re-grindable
- .2 NPS 2 and under, screwed:
 - .1 To MSS SP-80, Class 125, 862 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .3 NPS 2-1/2 and over; flanged:
 - .1 To MSS SP-71, class 125, 862 kPa, cast iron body, flat flanges faces, renewable seat, bronze disc, bolted cap.

2.07 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 To ANSI B16.18, Class 150, 1034 kPa.
 - .2 Bronze body, stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon Buna N seat, steel lever handle.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI B16.18, Class 150, 1034 kPa.
 - .2 Bronze body, chrome plated brass stainless steel ball, PTFE

Teflon adjustable packing, brass gland and PTFE Teflon Buna N seat, steel lever handle, with NPT to copper adaptors.

- .3 NPS 2-1/2 and over, roll groove:
 - .1 Bronze body, Class 150, 1034 kPa, with bronze trim, grade E EPDM coating bonded to ductile iron disc, enamelled two position detent handle.

3 EXECUTION

3.01 INSTALLATION

- .1 Install in accordance with the 2010 Canadian Plumbing Code and the local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .3 Assemble all piping using fittings manufactured to ANSI standards.
- .4 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.
- .5 Connect to fixtures and equipment in accordance with manufacturers' 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 Provide union nuts at all faucets. Do not directly solder faucets to supplies.
- .8 Test piping systems in accordance with Section 23 05 01.

3.02 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves and as indicated. Ball valves shall be used for shut-off applications on piping up to and including NPS 2.

3.03 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction. After testing, provide acceptable water quality test report to the Departmental Representative.

3.04 PRESSURE TESTS

- .1 Conform to requirements of Section 23 05 05.
- .2 Test pressure: greater of 1.5 time's maximum system operating pressure or 860 kPa.

3.05 PRE-START-UP INSPECTIONS

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

3.06 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 confirm 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 DHWS 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.

3.07 PERFORMANCE VERIFICATION

- .1 Timing:
 - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify flow rate and pressure meet Design Criteria.
 - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .3 Sterilize DHWS systems for Legionella control.

- .4 Verify performance of temperature controls.
 - .5 Verify compliance with safety and health requirements.
 - .6 Check for proper operation of water hammer arrestors. Run one (1) 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.
 - .7 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
- .1 Provide in accordance with Section 01 33 00 - Submittal Procedures and 01 78 00 - Closeout Submittals.
 - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Installation of Pipework: Section 23 05 05

1.02 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM B32-08(R2014), Specification for Solder Metal.
 - .2 ASTM B306-13, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-14, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA B70-2012, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CAN/CSA B125.3-12, Plumbing Fittings.

2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary storm and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA B125.
 - .2 Wrought copper: to CAN/CSA B125.
 - .2 Solder: tin-lead, 50:50, type 50A lead free, tin- 95:5, type TA , to ASTM B32.

2.02 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary storm and vent minimum NPS 2, to: CAN/CSA-B70, with one layer of protective coating of bituminous.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA B70.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Neoprene gasket : to CSA B70.
 - .2 Cold caulking compounds.

- .2 Above ground sanitary storm and vent: to CAN/CSA B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 EXECUTION

3.01 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with the 2010 Canadian Plumbing Code and local authority having jurisdiction.
- .3 Install piping parallel and close to walls to conserve headroom and space, and grade as indicated.
- .4 Wherever possible coordinate the exact location of underground drain pipes to avoid structural footings. Where drain pipes pass perpendicular to footings, prior to tender award, coordinate with the concrete and excavation contractor to ensure that the footings are stepped down to accommodate the pipes. Sleeve the pipes through the wall or grade beam just above the footing with a minimum of 25mm clear space around the pipe. Fill the clear space with soft insulation prior to back-fill.
- .5 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate fittings to line and grade (slope) as indicated. Backfill with minimum 150 mm of clean washed sand and upper 150 mm of rock free soil backfill.
- .6 Provide pipe firestop barriers and/or collars on the underside of fire-rated floors and both sides of fire-rated partitions that are penetrated.
 - .1 Acceptable material: 3M Firestop.
- .7 Install cast iron to CSA B70 for sanitary serving kitchen and boiler room.
- .8 Make provision for Rain Water Leader thermal expansion.

3.02 TESTING

- .1 Pressure test buried systems before backfilling.

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

3.03 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Confirm 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 confirm traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Confirm weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Confirm fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) complete with directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 ASTM D2564-2012, Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- .2 CSA B70-2012, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CSA B1800-15, Plastic Non-pressure Piping Compendium.

1.02 HANDLING AND STORAGE

- .1 Handle and store pipe and fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

1.03 APPLICATION

- .1 Buried sanitary and storm piping:
 - .1 PVC DWV with cast iron to CSA B70 on sanitary serving kitchens and boiler rooms.

2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (DWV)

- .1 Pipe, fittings and solvent cement: Polyvinyl chloride to CSA B1800.
- .2 Solvent Weld to ASTM D2564.
- .3 Storm piping below grade: PVC-SDR 35.
- .4 Sanitary piping below grade: PVC-DWV.

3 EXECUTION

3.01 PREPARATION

- .1 Carefully inspect products for defects and remove defective products from site.
- .2 Confirm pipe and fittings are clean before installation.

- .3 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate fittings to line and grade (slope) as indicated. Backfill with minimum 150 mm of clean washed sand and upper 150 mm of rock free soil backfill.

3.02 INSTALLATION

- .1 Lay and join pipe and fittings as specified in this section and according to manufacturer's published instructions.
- .2 Start laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.
- .3 Prevent entry of foreign material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .4 Install gaskets in accordance with manufacturer's published instructions. During cold weather store gaskets in heated area to assure flexibility.
- .5 Align pipe carefully before joining. Do not use excessive force to join pipe sections.
- .6 Support pipes as required to assure concentricity until joint is properly completed.
- .7 Keep pipe joints free from mud, silt, gravel or other foreign matter.
- .8 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .9 Where deflection at joint is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.
- .10 Complete each joint before laying next length of pipe.
- .11 Apply sufficient pressure in making joints to confirm joint is completed to manufacturer's recommendations. Minimize deflection after joint has been made to avoid damage.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA-B139 Series-15, Installation Code for Oil Burning Equipment.
 - .3 CAN/CSA-B140.0-03(R2013), General Requirements for Oil Burning Equipment.
 - .4 CSA B140.12-03(R2013), Oil-Fired Service Water Heaters and Swimming Pool Heaters.
 - .5 CAN/CSA C22.2 No.110-94(R2014), Construction and Test of Electric Storage Tank Water Heaters.
 - .6 CAN/CSA-C191 Series-14, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .7 CAN/CSA-C309-90(R2014), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .2 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.03 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled, installation procedures.

1.04 CLOSEOUT SUBMITTALS

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

1.05 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section

01 74 21 - Construction/Demolition Waste Management and Disposal, and with Waste Reduction Workplan.

- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by the Departmental Representative.

1.06 WARRANTY

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, warranty for 5 years from date of Substantial Completion.

2 PRODUCTS

2.01 ELECTRIC

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type elements, KW rating as indicated and surface mounted or immersion type adjustable thermostats.
- .2 Tank: glass lined steel, or stainless steel, 50 mm mineral wool or fibreglass insulation, anode, enameled steel jacket, 5 year warranty certificate, capacity and size as indicated.
- .3 Cathodic protection: magnesium anodes, number and size to provide for 20 years protection of tank material.

2.02 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: to Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems.
- .3 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

3 EXECUTION

3.01 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.

3.02 FIELD QUALITY CONTROL

- .1 Manufacturer's trained and certified Engineer to start up and commission DHW heaters, as per Section 01 91 13 - General Commissioning (Cx) Requirements.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 01 35 29.06 - Health and Safety Requirements.
- .4 Section 01 78 00 - Closeout Submittals

1.02 REFERENCES

- .1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures.
- .2 CAN/CSA-B125.3-2011, Plumbing Fittings.
- .3 CAN/CSA-B651-12(R2017), Barrier-Free Design.

1.03 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate, for all fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Factory set water consumption at recommended pressure.
 - .3 Minimum pressure required.
- .4 Closeout Submittals:
 - .1 Submit maintenance data in accordance with Section 01 78 00.
 - .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.

1.04 QUALITY ASSURANCE

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

Requirements.

1.05 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with 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 Plan.
 - .3 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.01 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: 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.

2.02 EQUIPMENT SCHEDULE

- .1 Refer to plumbing fixture Schedule on the Drawings.

2.03 FIXTURE PIPING

- .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated flexible supply pipes each with screwdriver stop, reducers, escutcheon for exposed supplies.
- .2 Waste:
 - .1 Brass P trap with cleanout on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

2.04 CHAIR CARRIERS

- .1 Factory manufactured floor- mounted carrier systems for all wall-mounted fixtures

3 EXECUTION

3.01 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: as indicated, measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651, or Provincial Buildings Accessibility Act and Regulations.

3.02 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Do adjustments prior to pre-commissioning.
- .3 Adjustments:
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .4 Checks:
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
- .5 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 CAN/CSA-B64 Series-11(R2016), Backflow Preventers and Vacuum Breakers.
- .2 CSA-B79-08(R2013), Floor Drains, Area Drains, Shower Drains, and Cleanouts for Residential Construction.
- .3 PDI-WH201-77(R2010), Water Hammer Arrestors.

1.02 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.03 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate dimensions, construction details and materials for the following: floor drains, (all types), cleanouts, non-freeze wall hydrants, water hammer arrestors, backflow preventers, hose bibbs, water make-up assemblies, strainers, traps, and trap seal primers, solenoid valves for traps, domestic cold water storage tank, domestic hot water expansion tanks and domestic cold water pressure tanks.

1.04 MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Data to include:
 - .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.

2 PRODUCTS

2.01 FLOOR DRAINS

- .1 Floor drains: to CSA-B79.
- .2 FD-1: general duty; 100 mm, cast iron body, round adjustable

head, nickel bronze strainer, integral seepage pan, clamping collar, and trap primer connection.

- .3 FD-2: combination funnel floor drain; 10 mm, cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral oval funnel, trap primer connection.

2.02 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, vandal proof screws.
 - .1 Provide acid-resisting epoxy coated finish on all cleanouts for acid resisting sanitary pipe.
- .2 Access covers:
 - .1 Wall access: face or wall type, stainless steel, square and or round cover with flush head vandal proof screws, bevelled edge frame complete with anchoring lugs.
 - .1 See also Section 22 05 00 for additional specifications regarding types and finishes of access covers.
 - .2 Provide fire rated access covers to maintain the integrity of fire rated construction.
 - .2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for unfinished concrete floors: nickel bronze, round, gasket, vandal-proof screws; cast iron, epoxy coated for lab area.
 - .3 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, epoxy coated for lab areas complete with vandal-proof locking screws:

2.03 WATER HAMMER ARRESTORS

- .1 Stainless steel or copper construction, bellows type: to Plumbing and Drainage Institute Standard PDI-WH201.

2.04 VACUUM BREAKERS

- .1 To CAN/CSA-B64 Series.
- .2 Atmospheric vacuum breaker.
- .3 Pressure vacuum breaker.
- .4 Hose connection vacuum breaker.

2.05 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.
- .2 Non-freeze wall hydrants to be complete with brass wall box.

2.06 TRAP SEAL PRIMERS

- .1 Solenoid valves complete with vacuum breakers and transformers controlled by integral timer.
- .2 Provide wall access doors where required to conceal trap primer valve. Fire rated access doors in fire rated wall construction.

2.07 STRAINERS

- .1 862 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.

2.08 DEEP SEAL TRAPS AND RUNNING TRAPS

- .1 Cast iron body, piping connections to suit piping size, minimum seal equal to 125 mm.
- .2 Use corrosion resistant type for laboratory drainage piping.

2.09 ROOF DRAINS

- .1 Standard coated roof drain with cast iron body 381 mm diameter, with aluminum dome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravel stop.

2.10 WATER METER

- .1 Displacement type to AWWA C700, Turbine type to AWWA C701, Compound type to AWWA C702. Size as indicated. 4-20mA output.

2.11 EXPANSION TANK

- .1 FDA approved butyl bladder for use with potable water, 1033 kPa max working pressure. Size and configuration as indicated.

3 EXECUTION

3.01 INSTALLATION

- .1 Install in accordance with the 2010 Canadian Plumbing Code, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.
- .3 Provide access panels where components are installed in walls partitions or inaccessible ceiling spaces.

3.02 CLEANOUTS

- .1 In addition to those required by code, and as indicated, install at base of all soil and waste stacks, and rainwater leaders and where 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.
- .4 For sinks and lavatory basins, provide cleanout in branch waste/stack or provide removable trap dip.
- .5 Provide common cleanout in stack which serves two sinks or lavatory basins by using a double sanitary tee.

3.03 ENCASED NON FREEZE WALL HYDRANTS

- .1 Install wall hydrants 300 mm above finished grade unless otherwise indicated.

3.04 WATER HAMMER ARRESTORS

- .1 Install in the following locations, sized for the number of fixtures to be served:
 - .1 Branch supplies to individual fixtures or group of fixtures.
 - .2 Branch supplies to large washroom groups.

3.05 VACUUM BEAKERS

- .1 Install on each domestic water system and where indicated.

3.06 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Install at bottom of all risers, at low points to drain systems,

and as indicated.

3.07 TRAP SEAL PRIMERS

- .1 Install NPS 1/2 soft copper tubing or PVC Pex tubing to floor drains.
- .2 Install in accordance with manufacturer's recommendations.

3.08 STRAINERS

- .1 Install with sufficient room to remove basket.

3.09 COMMISSIONING

- .1 In context of this paragraph, "verify" to include "demonstrate" to Departmental Representative.
- .2 Timing: commission only after start-up deficiencies rectified.
- .3 Access doors: verify size and location relative to items to be serviced.
- .4 Adjust to suit site conditions, including, but not necessarily limited to, following:
 - .1 Floor drains:
 - .1 Verify proper operation of trap primer, flushing features.
 - .2 Verify security and removability of strainers.
 - .2 Cleanouts:
 - .1 Verify covers are gastight, secure and easily removable.
 - .2 Verify that cleanout rods can probe as far as next cleanout.
 - .3 Non-freeze wall, hydrants:
 - .1 Verify complete drainage.
 - .2 Verify operation of vacuum breaker.
 - .4 Water hammer arrestors:
 - .1 Verify accessibility.
 - .5 Backflow preventers, vacuum breakers:
 - .1 Verify installation of correct type to suit application.
 - .2 Adjust as necessary to ensure proper operation.
 - .3 Verify visibility of discharge.
 - .6 Hose bibbs, sediment faucets:
 - .1 Verify operation.
 - .7 Water make-up assembly:
 - .1 Verify operation.
 - .8 Trap seal primers:
 - .1 Verify operation.

- .2 Adjust flow rate to suit site conditions.
- .9 Pipeline strainers:
 - .1 Verify accessibility of basket.
 - .2 Clean out during commissioning until system clean.
- .5 Commissioning reports:
 - .1 Record all results on approved report forms.
 - .2 Include signature of tester and supervisor.
- .6 Verification:
 - .1 Notify the Departmental Representative 24 hours before commencing tests.
 - .2 All tests and procedures to be witnessed by the Departmental Representative.
- .7 Training:
 - .1 Train O&M personnel in start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .8 Demonstrations:
 - .1 Demonstrate full compliance with Design Criteria.
 - .2 Demonstrations also to show completeness of O&M personnel training.
- .9 Submit plumbing test certificates to the Departmental Representative for review.

END OF SECTION