

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual reviewed by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .3 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.
 - .4 Performance data to include:

- .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
- .2 Equipment performance verification test results.
- .3 Special performance data as specified.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for review. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Departmental Representative will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed. Maintain at least one (1) copy at the site trailer for review by Departmental Representative.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for review and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Furnish spare parts as follows:
 - .1 One set of packing for each pump.

- .2 One casing joint gasket for each size pump.
- .3 One glass for each gauge glass.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 Supplier Requirements

- .1 Supplier Service and Support
 - .1 The supplier must have existing factory trained sales force locally available for applications assistance and to answer maintenance questions.
 - .2 The Supplier is to provide a 24 hour, seven (7) day a week, assistance call line for maintenance and troubleshooting requirements with the equipment operation.
 - .3 Supplier is to be capable of providing factory trained on-site technical support of the within a four (4) hour time period from notification.
- .2 Supplier Spare Parts Availability
 - .1 The supplier is to have a distributor organization, which locally stocks standard parts, modification kits, and spare parts.
 - .2 Components not regularly stocked are to be capable of being provided to the site in less than 36 hours.
- .3 Supplier Organization
 - .1 The supplier must have been in operation within the local Edmonton area for at least 5 years with product installed within the local area.
 - .2 The local supplier must have at least 5 years of representation history of the equipment brand.

- .3 The supplier must have factory trained service representatives within the local Edmonton area. The factory representatives must be trained in the maintenance and troubleshooting of the equipment as specified herein.
- .4 The factory representative is to be conversant in the requirements of the specific equipment.
- .4 Supplier Maintenance and Training Schools
 - .1 Supplier must offer maintenance and training in North America on the equipment supplied.
 - .2 Training programs are to be offered by the supplier on a yearly cycle (minimum).

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 material installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 00 – Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Delco Controls.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.6 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Approved: 2016-10-26

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-13, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-11, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .5 ASME B16.26-13, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .6 ASME B31.9-14, Building Services Piping.
 - .7 ASME B36.19M-04, Stainless Steel Pipe.
- .2 ASTM International
 - .1 ASTM A182/A 182M-16, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - .2 ASTM A269-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A312/A312M-16, Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .5 ASTM A351/A351M-16, Castings, Austenitic, for Pressure Containing Parts.
 - .6 ASTM A403/A403M-16, Wrought Austenitic Stainless Steel Piping Fittings.
 - .7 ASTM A536-84(2014), Standard Specification for Ductile Iron Castings.
 - .8 ASTM B32-08(2014), Standard Specification for Solder Metal.
 - .9 ASTM B42-15a, Seamless Copper Tube, Standard Sizes.
 - .10 ASTM B88M-14, 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.
 - .2 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast, for Water.
 - .3 AWWA C904-06, Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.

- .4 CSA Group
 - .1 CSA B137.5-13, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
 - .2 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S101-07, Fire Endurance Tests of Buildings Construction and Materials.
 - .2 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
 - .3 CAN/ULC S115-11, Standard Method of Fire Tests of Firestop.
- .6 National Sanitation foundation (NSF)
 - .1 NSF/ANSI 61-13, Drinking Water System Components-Health Effects.
 - .2 NSF 372-11, Drinking Water System Components - Lead Content.
- .7 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .9 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02a, Butterfly Valves.
 - .2 MSS-SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .10 National Research Council (NRC)
 - .1 National Plumbing Code of Canada (NPC) 2015.
- .11 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets. Include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 K: 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 ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: 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.
- .6 NPS 1 and smaller: cast copper to ANSI/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: 95/5 tin copper alloy. (LEAD Free)
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket. Gasket to be classified in accordance with ANSI/NSF 61 for

potable water service. Couplings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.

- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

- .1 NPS2 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 NPS2 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.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

2.5 GLOBE VALVES

- .1 NPS2 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 NPS2 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.

2.6 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 23 05 23.01 – Valves - Bronze.
- .2 NPS2 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 23 05 23.01 – Valves - Bronze.
- .3 NPS 2 and under, push-to-connect, lift-disc type:
 - .1 To MSS-SP-80, 1380 kPa CWP, bronze body, stainless steel disc, spring, and shaft, suitable for installation in horizontal or vertical lines.

- .4 NPS2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, or renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 – Valves – Cast Iron.

2.7 BALL VALVES

- .1 NPS2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B16 or ASTM B62.
 - .2 Pressure rating: Class 150, 860 MPa steam.
 - .3 Connections: Screwed ends to ANSI B1.20.1 and with hex. shoulders. Push-to-connect, Pressfit ends.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel or hard chrome, plated brass solid ball and Teflon seats.
 - .7 Stem seal: TFE, EPDM, Nitrile, Fluoroelastomer with external packing nut.
 - .8 Operator: removable lever handle with extension for insulated pipe.
 - .9 Cap and drain for drain service.

2.8 BUTTERFLY VALVES

- .1 NPS 2-1/2 and over, lug:
 - .1 To MSS-SP-67, Class 200, 1.4 MPa.
 - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
 - .3 Lever operated,
- .2 NPS 2-1/2 and over, grooved ends:
 - .1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
 - .2 Operator:
 - .1 NPS 4 and under: lever handle.
 - .2 NPS 6 and over: gear operated.

Part 3 Execution

3.1 PREPARATION

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

3.2 INSTALLATION

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

- .2 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework and by certified journey person 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.

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 22 05 00 - Common Work Results for Plumbing.
- .2 Application of Tests
 - .1 After a section of a potable water system has been completed, and before it is placed in operation, a water pressure test shall be conducted, except that an air pressure test may be used in freezing conditions.
 - .2 A pressure test may be applied to each section of the system or to the system as a whole.
 - .3 Where a prefabricated system is installed as part of a water system,
 - .1 all other plumbing work shall be tested and inspected, and
 - .2 the complete system shall be pressure tested when requested.
- .3 Pressure Tests of Potable Water Systems
 - .1 The potable water system shall be able to withstand
 - .1 without leaking, a water pressure that is at least equal to the maximum in-service pressure, or
 - .2 an air pressure of not less than 700 kPa for at least 2 h without a drop in pressure.
 - .2 If a manufacturer states that an air pressure test is not recommended, a water pressure test shall be performed.
- .4 Water Pressure Tests
 - .1 Where a water pressure test is made, all air shall be expelled from the system before fixture control valves or faucets are closed.
 - .1 Potable water shall be used to test a potable water system.

3.5 FLUSHING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory for bacteriological testing to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 h, 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 pressure booster systems are operating properly.
- .4 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 and approval of the Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.8 START-UP

- .1 Timing: start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring DHW storage tank up to design temperature slowly.
 - .4 Monitor DHW and DHWR 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.

3.9 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 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 23 05 05 - Installation of Pipework.

3.11 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American Iron and Steel Institute (AISI)
 - .1 AISI 304, Stainless Steel.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B32, Specification for Solder Metal.
 - .2 ASTM B306, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CAN/CSA- B125.3, Plumbing Fittings.
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 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 or tin-antimony only 95:5, type TA to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm and vent minimum NPS2, to: CAN/CSA-B70, with one layer of protective coating of Bitumous.
 - .1 Joints
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 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 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 STAINLESS STEEL PIPE AND FITTINGS

- .1 Above ground and buried sanitary, storm and vent, NPS 2 to NPS 10, stainless steel, type AISI 304.
 - .1 Mechanical Joints: Push-fit socket joint with EPDM sealing ring.

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 and by certified journey person.
- .2 Install in accordance with National Plumbing Code of Canada 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 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 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36, Commercial Adhesives.
- .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, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for 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 43 - Environmental Procedures and Section 01 35 29.06 - Health and Safety Requirements.

1.3 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling 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 piping to:
 - .1 CSA-B181.1.
 - .2 CSA-B181.2.
 - .3 CSA-B182.1.
- .2 For aboveground DWV piping for non-combustible construction:
 - .1 Flame spread rating less than 25 and smoke developed classification less than 50.
 - .2 CSA B181.2

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.
 - .1 NPS 1½ to 6: one step or two step cement.
 - .2 NPS 8 and above: two step cement.
- .2 Solvent weld for ABS: to ASTM D2235.

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 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 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 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
 - .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA-B139-04, Installation Code for Oil Burning Equipment.
 - .3 CAN/CSA-B140.0-03, Oil Burning Equipment: General Requirements.
 - .4 CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.
 - .5 CAN/CSA-B149.2-05, Propane Storage and Handling Code.
 - .6 CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
 - .7 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.
 - .8 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .9 CAN/CSA-C309-M90(R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .3 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015(NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

- .1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months' warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.
- .2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

Part 2 Products

2.1 COMPONENTS

- .1 Refer to Equipment schedule on drawings.

2.1 CONDENSING WATER HEATER (TANK)

- .1 Natural gas water heater(s) shall be modulating condensing water heater with a minimum 95% thermal efficiency and a maximum hydrostatic working pressure of 160 psi.
 - .1 Provide 3-year warranty certificate.
- .2 Water heater(s) shall:
 - .1 Modulating gas burner that automatically adjusts the input based on demand.
 - .2 Powered anodes that are non-sacrificial and maintenance free.
 - .3 Have seamless glass-lined steel tank construction, with glass lining applied to all waterside surfaces after the tank has been assembled and welded;

- .4 Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1;
- .5 Have foam insulation and a CSA Certified and ASME rated T&P relief valve;
- .6 Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up;
- .7 Be approved for 0" clearance to combustibles.
- .3 The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.
 - .1 All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters;
 - .2 Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.
 - .3 System to include BMS Gateway for connection to EMCS for monitoring.
- .4 Venting: The flue shall be manufacturers approved Stainless Steel sealed vent material/system size per the model requirements. Terminations shall be with the manufacturers specified vent termination.
- .5 Provide Room air vent kits where combustion air is from the room.
- .6 Provide Condensate Neutralization Kit.

2.2 DHW HEATER (DHWH)

- .1 The DHWH shall be capable of full modulation firing down to 20% of rated input with a turn down ratio of 5:1.
- .2 General: packaged unit to ASME standards, stamped for 1100 kPa WP. Provide CGA certification. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a five (5) year limited warranty.
- .3 The DHWH shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US and Canada The DHWH shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The DHWH shall be AHRI certified to 96% thermal efficiency. The DHWH shall be certified for indoor installation.
- .4 The DHWH shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The DHWH shall be supplied with a gas valve designed with negative pressure regulation and be equipped

with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating DHWH firing rates for maximum efficiency. The DHWH shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column.

- .5 Venting: The flue shall be manufacturers approved Stainless Steel sealed vent material/system size per the model requirements. Terminations shall be with the manufacturers specified vent termination.
- .6 Controls:
 - .1 The DHWH shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for DHWH set-up, DHWH status, and DHWH diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The DHWH shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
 - .2 The DHWH shall include a factory installed digital control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys, password security, pump delay with freeze protection, pump exercise, and USB PC port connection. The DHWH shall feature night setback for the domestic hot water tank and shall be capable of controlling a building recirculation pump while utilizing the night setback schedule for the building recirculation pump. The DHWH shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the DHWH, and a 0-10VDC output of DHWH modulation rate. The DHWH shall have a built-in cascading sequencer with modulation logic options of "lead lag" or "efficiency optimized". Both modulation logic options should be capable of rotation while maintaining modulation of up to eight DHWHs without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.
 - .3 The DHWH shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent control of the Domestic Hot Water Pump and Building Re-circulation Pump.
 - .4 System to include BMS Gateway for connection to EMCS.
- .7 Provide Room air vent kits where combustion air is from the room.
- .8 Provide High and low gas pressure switches
- .9 Provide Condensate Neutralization Kit.

2.3 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.

3.3 FIELD QUALITY CONTROL

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

3.4 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after pressure and leakage tests and disinfection are completed.
- .2 Procedures:
 - .1 Sterilize HWS and HWC systems for Legionella control.
 - .2 Verify performance of temperature controls.
 - .3 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.

3.5 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American National Standards Institute (ANSI)/American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.
- .3 American National Standards Institute (ANSI)
 - .1 ANSI Z358.1 Emergency eyewash and shower equipment.
- .4 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ASNSI/ASME A112.6.3, Floor and Trench Drains
- .5 CSA International
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .6 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP).
 - .1 IPMVP Version.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .8 National Research Council of Canada (NRC)
 - .1 2015 National Plumbing Code
- .9 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201, Water Hammer Arresters Standard.

1.2 ADMINISTRATIVE REQUIREMENTS

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Environmental Procedures. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details, and accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Start-Up: submit manufacturers pre-start up and Start-up procedure and check sheets.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Manufacturers' Field Reports: submit manufacturers' field reports.

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 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 in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and/or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the Department Representative, against defective materials and workmanship for a period of one (1) year from the date of Substantial Completion.

Part 2 Products

2.1 FLOOR DRAINS

- .1 Not used.

2.2 ROOF DRAINS

- .1 Not used.

2.3 CLEANOUTS

- .1 Not used.

2.4 NON-FREEZE WALL HYDRANTS

- .1 Not used.

2.5 NON-FREEZE GROUND HYDRANT

- .1 Not used.

2.6 WATER HAMMER ARRESTORS

- .1 Stainless steel or copper construction, piston type: to PDI-WH201.
- .2 Design Standard: Zurn
- .3 Acceptable Manufacturers: Mifab, Wade, Watts, Zurn

2.7 BACK FLOW PREVENTERS

- .1 Back Flow Preventers: to CSA-B64 Series.
- .2 Fire Protection Service: FM and ULC approved for fire protection service.
- .3 Acceptable Manufacturers: Watts, Wilkins, Zurn

2.8 VACUUM BREAKERS

- .1 Vacuum Breakers: to CSA-B64 Series.
- .2 Atmospheric vacuum breaker, where indicated:
 - .1 Plain brass body with silicone disc.
 - .2 Suitable for temperatures up to 82°C.
 - .3 Maximum operating pressure: 860 kPa.
 - .4 Size: as indicated.
- .3 Hose connection vacuum breaker:
 - .1 female hose threaded inlet, male hose threaded outlet, brass finish.
 - .2 Size: as indicated.
- .4 Acceptable Manufacturers: Mifab, Watts, Wilkins, Zurn

2.9 PRESSURE REGULATORS

- .1 Capacity: as indicated.
 - .1 Inlet pressure: 1,034 kPa.
 - .2 Outlet pressure: 413 kPa.
- .2 Up to DN 40 (NPS 1 ½) bronze bodies, screwed, with strainer and stainless steel screen: to ASTM B62.
- .3 DN 50 (NPS 2) and over, semi-steel bodies, Class 125, flanged with strainer: to ASTM A126, Class B.
- .4 Semi-steel spring chambers with bronze trim.
- .5 Acceptable Manufacturers: Watts

2.10 BACKWATER VALVES

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
- .2 Access:
 - .1 Surface access.
 - .2 Access pipe with cover: maximum 300 mm depth.
 - .3 Concrete access pit with steel cover, as indicated.

2.11 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 HB-2: Bronze construction complete with integral back flow preventer, DN 20 (NPS ¾) hose thread spout, replaceable composition disc, and chrome plated in finished areas.
- .2 Acceptable Manufacturers: Acorn, Watts, Zurn

2.12 HOSE REEL AND HOSE

- .1 Not used.

2.13 WATER MAKE-UP ASSEMBLY

- .1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CAN/CSA-B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.14 WATER METERS

- .1 Not used.

2.15 TRAP SEAL PRIMERS

- .1 Pressure drop actuated:
 - .1 Brass body construction with inlet opening of DN 15 (½ NPT) and outlet opening of female DN 15 (½ NPT).
 - .2 Provide complete with four-hole view built-in air gap to prevent any backflow from trap being fed into the water supply.
 - .3 Provide removable inlet filter screen.
 - .4 Provide complete with trap seal primer distribution unit as follows:
 - .1 Brass body construction.
 - .2 DN 15 (½ NPT) inlet connection.
 - .3 DN 10 (3/8 FPT) brass nipple outlet connections.
 - .4 6 mm diameter vent holes in lid to provide air gap and backflow protection.
 - .5 Up to 12 floor drains: Electronic trap priming manifold with:
 - .1 Vacuum breaker
 - .2 Pre-set 24-hour time clock
 - .3 Manual override switch
 - .4 120V solenoid valve
 - .5 120V or 3 wire connection.
 - .6 DN 20 (NPS ¾) inlet connection.
 - .7 Calibrated manifold.
 - .8 Water hammer arrestor
 - .9 Mounted in steel cabinet
 - .10 Compression outlet fittings
 - .11 Inlet shut off valve
 - .12 Supplies minimum 59 ml @ 138 kPa.
- .2 Trap guard:
 - .1 All elastomeric normally closed trap guard device utilizes a normally closed seal to prevent evaporation of the trap seal and to protect against sewer gases from backing up into habitable areas. It opens with fluid flow and allows liquid drainage to flow through into the building drain.

- .2 Waterless trap guards shall be tested in accordance with ASSE 1072 test standard for ANSI/ASME A112.6.3 drain and by Warnock Hersey for CSA B19.
- .3 Acceptable Manufacturers: JR Smith, Mifab, ProVent, Watts, Zurn

2.16 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 DN 50 (NPS 2) and under, bronze body, screwed ends, with brass cap, tapped blow off and plug.
- .3 DN 65 (NPS 2 ½) and over, cast iron body, flanged ends, with bolted cap, tapped blow off connection and bronze ball valve.

2.17 POTABLE WATER THERMAL EXPANSION TANK

- .1 Quantity: as indicated.
- .2 Application: absorb expanded water from domestic hot water tanks because of the inability to expand back into the Town potable water system due to the presence of a backflow preventer on the incoming water supply to the building.
- .3 ASME Section VIII construction and label.
- .4 FDA approved butyl bladder.
- .5 DN 25 (1 NPT) stainless steel system connection.
- .6 Standard tire air charging valve connection.
- .7 1,033 kPa maximum working pressure.
- .8 Vertical tank, floor mounted.
- .9 Dimensions: as indicated.
- .10 Tank volume: as indicated.
- .11 Acceptance volume: as indicated.
- .12 Red primer exterior finish.
- .13 Air pre-charge to be adjusted in field by the Mechanical Contractor to equal the residual cold water pressure on the discharge side of the pressure reducing valve on the domestic water service entrance by the Mechanical Contractor.
- .14 Acceptable Product: ExpanFlex, Amtrol, Taco, S. A. Armstrong, Bell and Gossett, Zurn, Wilkins, Watts.

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 material installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

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 Alberta Plumbing Code and Authority having Jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

- .1 Not Used

3.5 NON-FREEZE WALL HYDRANTS

- .1 Not Used

3.6 WATER HAMMER ARRESTORS

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

3.7 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Application:
 - .1 Reduced pressure type where backflow would constitute a health hazard.
 - .2 Double check type where backflow would constitute a nuisance or be aesthetically objectionable or material which would not constitute a health hazard.
 - .3 Domestic water premise isolation:
 - .1 Type of Facility: Buildings with low hazard classification
 - .1 Back Flow Preventer: As required by Authority having Jurisdiction but no less than a double check valve assembly (DCVA).

- .2 Type of Facility: Buildings with moderate to high hazard classification
 - .1 Back Flow Preventer: Reduced pressure principle type double check valve assembly (RP-DVCA).
- .4 Non-potable water system:
 - .1 Water Supply:
 - .1 Domestic water source
 - .1 Reduced pressure principle type double check valve assembly (RP-DVCA).
 - .5 Fire protection system:
 - .1 With FM and ULC approval for fire protection service.
 - .2 Water Supply:
 - .1 Dedicated fire water source
 - .1 Not required.
 - .2 Domestic water source
 - .1 Double check valve assembly (DCVA) where water treatment, including anti-freeze, IS NOT added to the fire water.
 - .2 Reduced pressure principle type double check valve assembly (RP-DVCA) where water treatment, including anti-freeze, IS added to the fire water.
- .3 Pipe discharge to terminate over nearest floor drain, indirect drain, or service sink.

3.8 BACKWATER VALVES

- .1 Install in main sewer lines where indicated.
- .2 Install in access pit as indicated.

3.9 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Not Used.

3.10 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 Department Representative.
- .3 Install Type K soft copper tubing to floor drain.

3.11 STRAINERS

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

3.12 GREASE INTERCEPTORS

- .1 Install with sufficient space, as indicated, for ease of maintenance.

3.13 WATER METERS

- .1 Not Used.

3.14 WATER MAKE-UP ASSEMBLY

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

3.15 ACID DILUTION DEVICES

- .1 Install with sufficient space, as indicated, for ease of maintenance.

3.16 START-UP AND COMMISSIONING

- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, supplemented as specified herein.
- .2 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

3.17 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning (Cx) 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%.
- .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 operation.
 - .2 Check for leaks, replace compression washer if required.
- .16 Hydronic system water Make-up Assembly:
 - .1 Verify flow, pressure, and connection.
- .17 Water meters:
 - .1 Verify location and accessibility.
 - .2 Verify calibration certificate.
 - .3 Test meter reading accuracy.
- .18 Dilution Tank:

- .1 Install as per manufacturer's instructions.
- .2 Fill with limestone chips.
- .19 Tempered water assemblies:
 - .1 Verify operation of Hi/Lo tempered water assemblies at both high and low flow conditions.
 - .2 Verify proper discharge temperature setpoint for all tempered water assemblies including those serving emergency fixtures.
 - .3 Test alarms on emergency fixtures.

3.18 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, supplemented as specified.
- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, supplemented as specified.
 - .1 Demonstrate full compliance with Design Criteria.

3.19 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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.20 PROTECTION

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

END OF SECTION