

Part 1 General

1.1 RELATED SECTIONS

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 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.
- .4 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.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with Contract Administrator before final inspection.
 - .3 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.
 - .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 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.

- .6 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.
 - .2 Make changes as required and re-submit as directed by Contract Administrator.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Contract Administrator will provide 1 set of mechanical drawings in PDF format. Provide sets of white prints as required for each phase of Work. Mark changes as Work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducible, revising reproducible to show Work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 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 Contract Administrator for approval 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals 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.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 Not used

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers.

3.3 FIELD QUALITY CONTROL

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

3.4 DEMONSTRATION

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

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing pumps.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .3 Shop Drawings.
 - .1 Submit shop drawings to indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
 - .2 Wiring and schematic diagrams.
 - .3 Dimensions and recommended installation.
 - .4 Pump performance and efficiency curves.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, 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.

Part 2 Products

2.1 DOMESTIC HOT WATER PUMP, DWBPU-1

- .1 Capacity: 2.52 L/s (40 usgpm) against total differential head of 9.1 m (30 ft) W.C.
- .2 All bronze body and one piece cast bronze impeller suitable for use with potable water.
- .3 Centrifugal, close coupled direct drive, inline connections, stainless steel shaft, 38mm (1.5") flanged connections, maximum operating pressure of 12 bar (175 psi) and maximum operating temperature of 65.6°C (250°F). EPR/carbon/silicon carbide seal.
- .4 Dimensions: 343mm (13-1/2") flange-to-flange, 438mm (17-1/4") length, 241mm (9-1/2") width. Weight: 38 kg (84 lbs).
- .5 Motor: 1 hp at 575V/3/60, 1800 RPM, permanently lubricated ball bearings.
- .6 Acceptable product: "Bell & Gossett" model 1.5AB Series e-90 or approved equivalent in accordance with B7.

2.2 DOMESTIC HOT WATER PUMP, DWBPU-2

- .1 Capacity: 0.63 L/s (10 usgpm) against total differential head of 12.2 m (40 ft) W.C.
- .2 All bronze body and one piece cast bronze impeller suitable for use with potable water.

- .3 Centrifugal, close coupled direct drive, inline connections, stainless steel shaft, 38mm (1.5") flanged connections, maximum operating pressure of 12 bar (175 psi) and maximum operating temperature of 65.6°C (250°F). EPR/carbon/silicon carbide seal.
- .4 Dimensions: 343mm (13-1/2") flange-to-flange, 451mm (17-3/4") length, 241mm (9-1/2") width. Weight: 40.4 kg (89 lbs).
- .5 Motor: 1.5 hp at 575V/3/60, 1800 RPM, permanently lubricated ball bearings.
- .6 Acceptable product: "Bell & Gossett" model 1.5AB Series e-90 or approved equivalent in accordance with B7.

2.3 DOMESTIC HOT WATER PUMP, DWPU-3 & DWPU-4

- .1 Capacity: 0.63 L/s (10 usgpm) against total differential head of 12.2 m (40 ft) W.C.
- .2 Lead-free bronze body, stainless steel faceplate, 30% glass filled Noryl impeller, stainless steel shaft, and shaft sleeve, suitable for use with potable water.
- .3 Centrifugal, close coupled direct drive, inline connections, 25mm (1") flanged connections, maximum operating pressure of 10 Bar (150 psi) and maximum operating temperature of 107°C (225°F). Mechanical, carbon on silicon carbide seal.
- .4 Dimensions: 162mm (6-3/8") flange-to-flange, 243mm (9-9/16") length, 121mm (4-3/4") width. Weight: 6 kg (13.1 lbs).
- .5 Motor: 2/5 hp at 115V/1/60, 3250 RPM, ODP, sealed precision steel ball bearing, permanently lubricated.
- .6 Acceptable product: "Bell & Gossett" model PL-55B or approved equivalent in accordance with B7.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Check power supply.
 - .2 Check starter protective devices.
- .2 Start-up, check for proper and safe operation.
- .3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .4 Adjust flow from water-cooled bearings.
- .5 Adjust impeller shaft stuffing boxes, packing glands.

3.4 START-UP

- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.
 - .2 Procedures:
 - .1 Check power supply.
 - .2 Check starter O/L heater sizes.
 - .3 Start pumps, check impeller rotation.
 - .4 Check for safe and proper operation.
 - .5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
 - .6 Test operation of hands-on-auto switch.
 - .7 Test operation of alternator.
 - .8 Adjust leakage through water-cooled bearings.
 - .9 Adjust shaft stuffing boxes.
 - .10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
 - .11 Check base for free-floating, no obstructions under base.
 - .12 Run-in pumps for 12 continuous hours.
 - .13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
 - .14 Adjust alignment of piping and conduit to ensure full flexibility.
 - .15 Eliminate causes of cavitation, flashing, air entrainment.
 - .16 Measure pressure drop across strainer when clean and with flow rates as finally set.
 - .17 Replace seals if pump used to degrease system or if pump used for temporary heat.
 - .18 Verify lubricating oil levels.

3.5 REPORTS

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.
- .2 Include:
 - .1 PV results on approved PV Report Forms.
 - .2 Product Information report forms.
 - .3 Pump performance curves (family of curves) with final point of actual performance.

3.6 TRAINING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
 - .1 MSS-SP-67-02a, Butterfly Valves.
 - .2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 10.

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 insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:

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

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.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: 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 (50mm) and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 ½ (38mm) and smaller : wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

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: tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 SWING CHECK VALVES

- .1 NPS 2 (50mm) and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, lead free bronze body, lead free brass plug, screw in bronze cap, PTFE seat, suitable for installation in vertical upflow, NPT ends. Approvals: CSA, NSF 61
 - .2 Acceptable Product: "Apollo" Series 163T LF or approved equivalent in accordance with B7.

2.5 BALL VALVES

- .1 NPS 2 (50mm) and under, screwed:
 - .1 Class 150.
 - .2 Lead free brass body, RPTFE seat, stainless steel ball, RPTFE stem packing, corrosion resistant plated steel nut, stainless steel stem, lead free brass retainer,
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plated steel / insulated polyvinyl handle, brass gland ASTM b16, Approvals: CSA, NSF 61, MSS-SP-110

- .3 Acceptable Product: "Apollo" Series 77FLF140 or approved equivalent in accordance with B7.
- .2 NPS 2 ½ (63mm) and over, screwed:
 - .1 Class 150.
 - .2 Lead free brass body, RPTFE seat, stainless steel ball, RPTFE stem packing, corrosion resistant plated steel nut, stainless steel stem, lead free brass retainer, plated steel / insulated polyvinyl handle, brass gland ASTM b16, Approvals: CSA, NSF 61, MSS-SP-110
 - .3 Acceptable Product: "Apollo" Series 77FLF140 or approved equivalent in accordance with B7.

2.6 **BALANCING VALVE**

- .1 NPS 2 (50mm) and under, screwed:
 - .1 Lead-Free Brass body/SS ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts/ check valves. Valve bodies to have 6mm (1/4" NPT) tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off.
 - .2 Design Pressure/Temperature
 - .1 2758 kPa at 121°C
- .2 Acceptable Product: "Xylem B&G" CB-2 LF or approved equivalent in accordance with B7.

2.7 **STRAINER**

- .1 NPS 2 (50mm) and under, screwed:
 - .1 Class 125
 - .2 Lead free cast copper silicon alloy body, lead free copper silicon alloy retainer cap, EPDM O-Ring cap seal, 1.2mm 304 stainless steel perforated screen, Approvals: CSA, NSF 61
 - .3 Acceptable Product: "Watts" Series LF777 or approved equivalent in accordance with B7.

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 Provincial Plumbing Code and local Authority Having Jurisdiction.

- .2 Install pipework in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

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 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

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

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that 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.
- .2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.8 START-UP

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

- .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

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 Verify performance of temperature controls.
 - .3 Verify compliance with safety and health requirements.
 - .4 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.
 - .5 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
- .1 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D2235-04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564-04e1, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800-06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, 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-A2005, 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.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 Buried and above ground PVC-DWV piping to:
 - .1 CAN/CSA B1800.

2.2 JOINTS

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

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

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

- .2 Install in accordance with Manitoba 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).

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Heating boilers and vents:
 - .1 Supply, Installation, and Commissioning.
 - .2 Provide on-Site boiler start-up and commissioning by manufacturer.
 - .2 Hot Water Storage Tanks:
 - .1 Supply, Installation, and Commissioning.
 - .3 Delivery Lead times:
 - .1 The delivery lead time of the boilers, venting and storage tanks shall be four (4) weeks or less.
 - .2 The vendors are required to deliver equipment to Site on time to meet the critical stage dates stated in D14. Failure to do so will result in substantial Liquidated Damages as per D17.
 - .3 Physical size restrictions apply. See Item 1.6 Delivery, Storage, and Handling.

1.2 RELATED SECTIONS:

- .1 01 33 00 - Submittal Procedures
- .2 01 74 11 - Cleaning.
- .3 01 78 00 - Closeout Submittals
- .4 23 09 33 - Electric and Electronic Control for HVAC

1.3 REFERENCES

- .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-B149.1-05, Natural Gas and Propane Installation Code.
 - .3 CAN/CSA-C309-M90(R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.4 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.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions.
 - .2 All boilers shall be taken to the basement boiler room via existing elevator without disassembly. Disassembly of the trim would be accepted provided the cUL or other listings remain valid. Any disassembly that invalidates the listings will not be allowed.
 - .3 Load capacity of the elevator is 2040kg (4500 lbs). Elevator door is 1219mm (4ft) wide x 2133mm (7ft) high. The depth of the elevator is 2337mm (7ft 8in). **Bidders are required to go to Site confirm these dimensions** and ensure the selected boilers can be taken to the basement boiler room prior to submitting their bid.
 - .4 Protect finished flooring/walls and other finishes of the main floor reception area during delivery. Any damaged to the floors or other parts of the building shall be corrected at the Contractors expense to the satisfaction of the Contract Administrator.
 - .5 Removal/and reinstallation of the doors/frames, if required, to facilitate delivery is the responsibility of the Contractor. Site verify door dimensions prior to bidding.

Part 2 Products

2.1 DOMESTIC HOT WATER BOILERS, DWB-1 & DWB-2

- .1 Factory assembled, forced draft natural gas fired, two pass gas flow, fire tube design, condensing water heater. The heater shall have an input of 395 kW (1350 mbh) with a net output of 384 kW (1310 mbh) at a minimum ASHRAE 118.1 efficiency of 97% at full input.
- .2 The boilers shall have the capability to be interlocked with the mechanical combustion air system to as required by CSA B149.1 Natural Gas and Propane Installation Code.
- .3 Water heater efficiency shall increase with decreasing output while maintaining set point to an accuracy of 2.2 °C (+/- 4°F) at all load conditions with an operational internal set point capability of 10°C to 88°C (50°F to 190°F) without the use of external storage.
- .4 The factory fabricated heater package shall carry CUL/CSD-1/ASME approval and be approved for operation in the Province of Manitoba.
- .5 The heat exchanger shall be constructed with electroless nickel plated 316L stainless steel helical fire tubes, combustion chamber and dished tube sheet. The shell assembly

pressure vessel shall be constructed of electroless nickel plated 304 stainless steel. The heat exchanger, pressure vessel shell assembly shall be ASME Sect IV (HLW) stamped for a working pressure of 1100 kPa (160 psig) and carry a Canadian Registration Number for the Province of Manitoba.

- .6 The shell assembly pressure vessel shall have a water volume of 76 L (20.6 gallons). Water pressure drop through the heaters shall not exceed 13 kPa @ 1.9 L/s (2 psig @ 30 gpm). The shell assembly pressure vessel shall be equipped with an ASME approved temperature/pressure relief valve having a setting of 1034 kPa and 99 °C (150 psig and 210°F).
- .7 The burner shall be full modulation and be capable of providing a 30 to 1 turndown. The burner shall be a metal-fiber mesh covering a stainless steel with spark ignition and flame rectification. Air and fuel input shall be metered through a modulating air/fuel valve having a single point linkage to the servo motor. Optimum fuel air mixing shall be controlled through a cast aluminum pre-mix blower with a variable frequency drive. The burner shall produce less than 12.5 ppm of NOx corrected to 3% oxygen.
- .8 The exhaust manifold shall be corrosion resistant cast aluminum with a 150mm (6 inch) diameter flue connection and collecting reservoir with gravity drain for the elimination of condensate. The water heater shall be capable of discharging into a positive pressure flue gas vent. Venting shall be CUL Listed of CPVC, Polypropylene or AL29-4C stainless steel, compatible with positive pressure, for use with Category III and IV appliances.
- .9 Boiler shall be capable of maximum equivalent length venting pressure drop of 42.7m (140 ft). Vendors are required to provide vent pressure drop calculations according to vent size and lengths shown on the drawings.
- .10 The heater control panel shall incorporate the functions of temperature control, combustion safeguard control, message annunciation, and fault diagnostic display, on individual field replaceable circuit boards, mounted within a single housing. The control panel hardware shall support both RS-232 and RS-485 remote communications.
- .11 The heater control system shall be segregated into three components: C-More Control Panel, Power Box and Input/Output Connection Box, mounted and wired on each Unit.
 - .1 The C-More controls shall include the following features:
 - .1 Six (6) surface mount, individually replaceable, circuit boards:
 - .1 LED temperature display
 - .2 VFD module for all message annunciation
 - .3 CPU, housing all control functions
 - .4 Electric low water cut off with test and manual reset functions
 - .5 Power supply board
 - .6 Ignition, stepper and flame safeguard control
 - .2 The combustion safeguard/flame monitoring system shall utilize spark ignition and rectification type flame sensor.
 - .3 The controller shall annunciate boiler & sensor status and include 8 separate status and 34 separate fault, self diagnostic messages.
 - .4 The C-More control will incorporate:
 - .1 PID set point, high limit
 - .2 Set point low limit
 - .3 Fail safe change over to internal signal, on loss of external signal.

- .5 The two boilers shall be capable of operating as a single boiler plant on master/member configuration.
- .12 The gas train shall be furnished in accordance with CGA requirements for a 34 (5 psig) natural gas supply pressure, including manual main lubricated gas shut off valve, gas pressure regulators, air/fuel control valve, high and low gas pressure switches and electro-hydraulic double seated safety shut off valve.
- .13 The heater shall operate on a 120/1/60 20AMP, (9 Aamp FLA) service.
- .14 Upon notification of completion of the installation, the heater manufacturer's representative shall provide the services of a field technician to:
 - .1 Provide a "dry run" of the water heater control sequences.
 - .2 Fire the heaters and adjust control and fuel/air ratio settings to optimum operating conditions and record combustion performance and efficiencies over the operating range.
 - .3 Provide combustion analysis and commissioning report.
 - .4 Furnish instruction and training to The City's operating personnel.
- .15 Dimensions: 1051mm (L) x 711 mm (W) x 1911 mm (H). (41.36" x 28" x 75.26"). Dimensions shall not be exceeded.
- .16 Acceptable Product: "Aerco" model INN 1350 or approved equal in accordance with B7.

2.2 BOILER VENT PIPES

- .1 From the Boiler to Underside of Roof Deck:
 - .1 Single wall rigid flue gas venting system approved for use with ANSI Category II and Category IV gas burning appliances.
 - .2 The Components shall be listed to the ULC S636 standard in Canada as a Class IIA, IIB, and IIC vent system rated for exhaust gas temperatures up to 110°C (230°F) and a maximum positive pressure of 5000 Pa (20" w.c.).
 - .3 The rigid pipe shall be constructed with a minimum of 2.2mm thick polypropylene and carry a cETLus, cULus or CUL certification label.
 - .4 A copy of the boiler manufacturer's vent sizing calculation for the system shall be provided with the approval review data for each venting system.
 - .5 Acceptable Product: "DuraVent" or approved equal in accordance with B7.
- .2 Underside of Roof Deck to Vent Termination:
 - .1 The boiler supplier shall furnish factory designed and pre-fabricated, air insulated, double wall breeching. EZ Seal chimney single wall components, with supports and terminations tested and Listed by Underwriters Laboratories to UL 1738 / ULC S636, for use with condensing boilers that will produce continuous flue-gas temperatures not above 550°F.
 - .2 The Contractor shall field confirm vent routing prior to ordering the vent.
 - .3 The venting system components shall be furnished in accordance with the boiler manufacturer's Gas Fired Vent System Design Program.
 - .4 The inner flue-gas conduit or single wall stack liner, shall be fabricated from AL 29-C stainless steel. The outer jacket of the system shall be type 430 stainless steel with a space of 25mm (1") between the flue-gas conduit and the jacket.

- .5 The breeching and stack system joints shall be sealed with a tapered end closure system with tabs, sealant and locking containment bands each band locked from a single point for a pressure tight assembly.
- .6 The breeching and stack system shall maintain air tight integrity at pressures up to 8" w.c. The complete system, installed as per the manufacturer's instructions, may be utilized in either interior or exterior installations and shall be capable of withstanding reasonable wind and incidental loads as required by UL standards.
- .7 The manufacturer of the system must furnish complete CAD system drawings of the assembly to be furnished. A copy of the boiler manufacturer's vent sizing calculation shall be provided with the submittal package.
- .8 Acceptable Product: "SCI" SecureSeal or approved equal in accordance with B7

2.3 DOMESTIC HOT WATER BOILER CONDENSATE NEUTRALIZER

- .1 155 litre/hr (41 gal/hr) capacity. Made of corrosion resistant materials. Suitable for natural gas appliances. Includes baffles designed to channel flow thoroughly for complete neutralization and integral bypass to prevent condensate backflow into appliance. NPT connections with unions. Can be used for multiple appliance installation. 18 kg (40lb) of neutralization media included. Dimensions (WxLxH): 343x445x203mm (13.5"x17.5"x8").
- .2 Acceptable Product: "Aerco" model 89030 or approved equivalent in accordance with B7.

2.4 DOMESTIC HOT WATER STORAGE TANK, ST-1 TO ST-4

- .1 Vertical construction having a storage capacity of 1635 Litres (432 gallons). The tank shall be constructed with an inner chamber baffle designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature, regardless of rate of draw.
- .2 The storage tank shall be constructed in accordance with ASME Boiler and Pressure Vessel Code requirements, "HLW" stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. The tank shall be furnished with the following connections: two 75mm (3") NPT dielectric circulating connections, one 50mm (2") NPT dielectric hot water outlet, one 32mm (1-1/4") NPT relief valve connection, one 19mm (3/4") NPT aquastat opening and one 25mm (1") NPT drain connection
- .3 The storage tank shall have a working pressure of 8.6 Bar (125 PSI). The interior of the storage tank shall be glass lined and fired to 870°C (1600° F) to ensure a molecular fusing of glass and steel, furnished with magnesium anodes and carry a five (5) year limited warranty.
- .4 The storage tank shall be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides. The storage tank shall be completely encased in a minimum of 50mm (2") thick, high density polyurethane foam insulation to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard.
- .5 Dimensions: 1168mm (46") diameter, and 2032mm (80") high. The dimensions shall not be exceeded.
- .6 Accessories: Provide T&P relief valve for each tank sized for the total input of the boilers DWB-1 & DWB-2.
- .7 Acceptable Product: "Lochinvar" model RGA0432 c/w Accessories or approved equivalent in accordance with B7.

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 installation instructions and authority having jurisdiction.
- .2 Provide external low water cut off per requirements of the authority having jurisdiction.
- .3 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1. Provide natural gas piping per Section 231123.
- .4 Provide controls as per manufacturer's instructions and Section 230933.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedure.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings to indicate materials, finishes, dimensions, construction and assembly details, and accessories.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

Part 2 Products

2.1 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, polished nickel bronze square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: rectangular cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: nickel bronze square, gasket, vandal-proof screws.
 - .3 Cover for Terrazzo Finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
 - .4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
 - .5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.2 WATER HAMMER ARRESTORS

- .1 Copper construction, piston type: to PDI-WH201.

2.3 TRAP SEAL PRIMERS

- .1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

3.3 CLEANOUTS

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

3.4 WATER HAMMER ARRESTORS

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

3.5 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

3.6 HOSE BIBBS AND SEDIMENT FAUCETS

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

3.7 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 Contract Administrator.
- .3 Install soft copper tubing to floor drain.

3.8 STRAINERS

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

3.9 WATER METERS

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

3.10 START-UP

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

3.11 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13- General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:

- .1 Pressure at fixtures: +/- 70 kPa.
- .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
- .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 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .13 Hose bibbs, sediment faucets:
 - .1 Verify that flow and pressure meet design criteria.
 - .2 Check for leaks, replace compression washer if required.
- .14 Hydronic system water Make-up Assembly:
 - .1 Verify flow, pressure, and connection.

- .15 Water meters:
 - .1 Verify location and accessibility.
 - .2 Test meter reading accuracy.

3.12 CLOSEOUT ACTIVITIES

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

3.13 PROTECTION

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

END OF SECTION