

**Part 1            General**

**1.1            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
- .3      Shop Drawings:
  - .1          Submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan, Canada.
  - .2          Indicate on drawings:
    - .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.

**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
  - .1          Operation and maintenance manual approved 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 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. 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 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. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
  - .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 Departmental Representative 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.
- .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 indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect. Nicks, scratches, and blemishes
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of padding, packaging materials, pallets, crates, as specified in Construction Waste Management Plan in accordance with Section 01 74 19- Waste Management and Disposal.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable.
  - .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 Prime and touch up marred finished paintwork to match original.
- .2 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 Site Tests: conduct following tests in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS.
- .2 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 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 00- 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 00- Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- 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**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 This Section includes requirements for selective demolition and removal of plumbing, and related mechanical components and incidentals required to complete work described in this Section.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 02 41 13 - Selective Site Demolition
- .2 Section 02 41 16 - Structure Demolition
- .3 Section 02 41 00.08– Demolition - Minor Works
- .4 Section 02 42 00– Removal and Salvage of Construction Materials
- .5 Section 02 82 00.01– Asbestos abatement – minimum precautions

### **1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA S350, Code of Practice for Safety in Demolition of Structures.

### **1.4 DEFINITIONS**

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:

- .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19– Construction Waste Management and Disposal.
- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## **1.6 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for Representative's continued occupancy requirements during selective demolition with Section 02 41 16 and schedule staged occupancy and worksite activities as a defined Critical Path item in accordance with Section 01 32 16.16 - Construction Progress Schedule.

## **1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:
  - .1 Federal Workers' Compensation Service
  - .2 Government of Canada, Labour Program: Workplace Safety

## **1.8 SITE CONDITIONS**

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished is based on their observed condition at time of site examination before tendering.
- .2 Existing Hazardous Substances: Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:
  - .1 Hazardous substances are as defined in the Hazardous Products Act.
  - .2 Hazardous substances will be removed by the Contractor as a part of the Contract before starting Work in accordance with work results described in Related Requirements listed above.
- .3 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify Representative if materials suspected of containing hazardous substances are encountered and perform the following activities:
  - .1 Refer to Section 01 41 00– Regulatory Requirements for directives associated with specific material types.
  - .2 Hazardous substances will be as defined in the Hazardous Products Act.
  - .3 Stop work in the area of the suspected hazardous substances.
  - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
  - .5 Hazardous substances will be removed by Representative under a separate contract or as a change to the Work.
  - .6 Proceed only after written instructions have been received from Representative.

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**Part 2            Products**

**2.1               REPAIR MATERIALS**

- .1      Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .2      Fire-stopping Repair Materials: Use fire-stopping materials compatible with existing fire-stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

**2.2               (SALVAGE AND) DEBRIS MATERIALS**

- .1      Material Ownership: Demolished materials become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Representative's property.
- .2      Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials in accordance with Section 02 42 00 - Removal and Salvage of Construction Materials.

**Part 3            Execution**

**3.1               EXAMINATION**

- .1      Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

**3.2               PREPARATION**

- .1      Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
  - .1          Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
  - .2          Notify Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
  - .3          Prevent debris from blocking drainage inlets.
  - .4          Protect mechanical systems that must remain in operation.
- .2      Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Representative and users is minimized and as follows:
  - .1          Prevent debris from endangering the safe access to and egress from occupied buildings.



- .2 Notify Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

### **3.3 EXECUTION**

- .1 Demolition: Coordinate requirements of this Section with information contained in and as follows:
  - .1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.
  - .2 Do not disrupt active or energized utilities without approval of the Representative.
  - .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
  - .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
  - .5 At end of each day's work, leave worksite in safe condition.
  - .6 Perform demolition work in a neat and workmanlike manner:
    - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
    - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

### **3.4 CLOSEOUT ACTIVITIES**

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction in accordance with Section 02 42 00.
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with requirements of Section 02 81 00.1.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 Materials and installation for plumbing pumps.

**1.2 REFERENCE STANDARDS**

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

.2 Coordinate submittal requirements and provide submittals required by Section 01 47 15- Sustainable Requirements: Construction.

.3 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .2 Submit WHMIS MSDS in accordance with Section 01 47 15- Sustainable Requirements: Construction. Indicate VOC's for adhesive and solvents during application and curing.

.4 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.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturers' Field Reports: manufacturers' field reports specified.

.8 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.

## **1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting one week prior to beginning on-site installations in accordance with Section 01 32 16.16- Construction Progress Schedules.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building sub-trades.
    - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06- Health and Safety Requirements.

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

- .1 Waste Management and Disposal:
  - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .2 Collect and separate for disposal plastic, paper, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  - .3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
  - .4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
  - .5 Fold up metal, plastic banding, flatten and place in designated area for recycling.

## **Part 2 Products**

### **2.1 DOMESTIC HOT WATER CIRCULATING PUMPS**

- .1 Capacity: as indicated.
- .2 Construction: closed-coupled, in-line centrifugal, all bronze construction, stainless steel shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 105 degrees C continuous service.
- .3 Motor: W, drip-proof, with thermal overload protection.
- .4 Supports: provide as recommended by manufacturer.

### **2.2 DOMESTIC WATER BOOSTER SYSTEM**

- .1 Packaged duplex system, factory assembled, tested and adjusted, ready for site piping and electrical connections.

- .2 Total Capacity:
  - .1 Flow rate: as indicated
  - .2 System pressure: as indicated
  - .3 Available pressure at metre outlet: as indicated
  - .4 Duplex system with 25% on lead pump and 75 % on lag pump.
- .3 Construction: horizontal, end suction, closed coupled centrifugal, cast-iron casing, bronze impeller, stainless steel shaft sleeve, mechanical shaft seal, designed for 850 kPa suction pressure.
- .4 Valves: to Section 22 11 16- Domestic Water Piping. Suction and discharge gate or butterfly valves and pressure reducing and check valve for each pump connected to common suction and discharge headers.
- .5 Motor: duplex, lead pump W.
- .6 Supports: install complete package on factory fabricated structural steelwork.
- .7 Anchor Bolts and Templates:
  - .1 Supply for installation by other Divisions.
- .8 Control Panel: CSA 1 enclosure complete with:
  - .1 Externally operated disconnect switch.
  - .2 Magnetic across-the-line fused starters.
  - .3 Overload protection for each phase.
  - .4 Adjustable pressure switches .
  - .5 Low pressure safety cut-out.
  - .6 Control circuit transformer with fused secondary.
  - .7 Adjustable time delay relay.
  - .8 Hand-off-automatic selector switch for pumps.
  - .9 Pressure and suction gauges, 90 mm nominal dia.
  - .10 Pilot lights; power on, low suction pressure.
  - .11 Lead/lag selector switch.
  - .12 Alarm: visual and audible with silencing switch for abnormal conditions.
- .9 Operation:
  - .1 Lead pump to operate continuously during demand.
  - .2 Should operating pump fail, next pump in sequence to start automatically.
  - .3 Should system demand exceed capacity of operating pump or pumps, next pump in sequence automatically starts.
  - .4 Adjustable 90 time delay to maintain starting pump operation and avoid "on-off " cycling.
  - .5 Constant pressure control, pressure switch to cycle pump.
  - .6 Low suction pressure switch to stop pumps.
  - .7 Temperature control for low or no system demand to bleed to drain.

## **2.3 SUMP PUMP SUBMERSIBLE**

- .1 Capacity: as indicated.
- .2 Construction: simplex CSA approved, housing epoxy coated cast iron, bronze fitted stainless steel shaft, non-clog bronze impeller, mechanical shaft seal.
- .3 Motor: as indicated, hermetically sealed, with automatic overload protection.
- .4 Control: integral diaphragm type level control.

## **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 Align vertical pit mounted pump assembly after mounting and securing cover plate.
- .4 Place 150 mm sand under sump pit tank.

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

### **3.4 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13- GENERAL COMMISSIONING 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 PERFORMANCE VERIFICATION (PV) PRESSURE BOOSTER PUMPS**

- .1 General:
  - .1 In accordance with Section 01 91 13- GENERAL COMMISSIONING REQUIREMENTS : General Requirements, supplemented as specified.
- .2 Obtain manufacturer's approval, before performing PV, to ensure warranties remain intact.
- .3 Application tolerances:
  - .1 Flow: +/- 10 %.
  - .2 Pressure: Plus 20 %, minus 5 %.
- .4 PV procedures:
  - .1 Open pump balancing valve fully.

- .2 Measure differential pressure (DP) across pump.
- .3 Measure amperage and voltage and compare with manufacturer's data sheets and motor nameplate data.
- .4 If suction is different size than discharge connection, add velocity head correction factor to DP.
- .5 Mark this DP on manufacturer's pump curve.
- .6 If flow rate is higher than specified, slow close balancing valve until specified DP is reached.
- .7 Repeat measurements of amps and volts. Compare with manufacturer's data sheets.
- .8 Calculate BHP and compare with nameplate data.

### **3.6 PERFORMANCE VERIFICATION (PV) - TANKLESS PRESSURE BOOSTER SYSTEM**

- .1 Pumps: as specified above.
- .2 PV of complete unit:
  - .1 Test performance of pumps in lead and in lag position.
  - .2 Test operation of alternator.
  - .3 Simulate failure of pumps in possible combinations such as:
    - .1 Failure of each "lead" pump.
    - .2 Failure of first "lag" pump, then 2nd "lag" pump, etc.
  - .4 Test operation by simulating 0%, 10%, 25%, 50%, 75%, 100% and 110% of design load and for one hour. Record pressure at:
    - .1 Which lead and lag pump cut in and cut out.
    - .2 Water metre outlet.
    - .3 "Worst" plumbing fixture.
  - .5 Verify operation and control of over-temperature protection devices.

### **3.7 REPORTS**

- .1 In accordance with Section 01 91 13- GENERAL COMMISSIONING 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.

### **3.8 TRAINING**

- .1 In accordance with Section 01 91 13- GENERAL COMMISSIONING REQUIREMENTS: Training of O&M Personnel, supplemented as specified.

**END OF SECTION**



## **Part 1           General**

### **1.1           REFERENCE STANDARDS**

- .1 American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
  - .5 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .6 ASME B31.9, Building Services Piping.
  - .7 ASME B36.19M, Stainless Steel Pipe.
- .2 ASTM International (ASTM)
  - .1 ASTM A182/A 182M, 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, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A312/A312M, Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .5 ASTM A351/A351M, Castings, Austenitic, for Pressure Containing Parts.
  - .6 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings.
  - .7 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .8 ASTM B32, Standard Specification for Solder Metal.
  - .9 ASTM B42, Seamless Copper Tube, Standard Sizes.
  - .10 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
  - .11 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - .12 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .2 ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.

- .3 AWWA C904, Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.
- .4 CSA Group (CSA)
  - .1 CSA B137.5, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
  - .2 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S101, Fire Endurance Tests of Buildings Construction and Materials.
  - .2 CAN/ULC S102.2, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
  - .3 CAN/ULC S115, Standard Method of Fire Tests of Firestop.
- .6 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Grey Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .9 National Research Council (NRC)
  - .1 National Plumbing Code of Canada (NPC) 2015.
- .10 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

## **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.

## **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Store and manage hazardous materials in accordance with Section 01 47 15- Sustainable Requirements: Construction.

- .2 Packaging Waste Management: remove for reuse of crates, padding, packaging materials, pallets in accordance with Section 01 74 19- Waste Management and Disposal.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with CEPA, and Municipal regulations.

## **Part 2 Products**

### **2.1 PIPING**

- .1 Domestic hot water return only.
  - .1 Above ground:
    - .1 Copper tube, hard drawn, type L: to ASTM B88M.
    - .2 PEX Piping to CSA B137.5.
  - .2 Buried or embedded:
    - .1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
    - .2 PEX Piping to CSA B137.5.
- .2 Domestic hot water, domestic cold water, pumped condensate, softened domestic cold water.
  - .1 Above ground:
    - .1 Grooved mechanical-joint fittings and couplings
      - .1 Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A53/A53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A234, Grade WP wrought steel fittings with grooved ends or shoulders constructed to accept grooved-end couplings of same manufacturer; with nuts and bolts to secure grooved pipe and fittings
      - .2 Couplings: Two ductile-iron housing segments conforming with ASTM A536, and EPDM gasket of central cavity pressure-responsive design conforming with ASTM D2000; with ASTM A449 electroplated steel nuts and bolts to secure grooved pipe and fittings. Couplings shall comply with ASTM F1476.
        - .1 Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging per ANSI B31.1 and B31.9. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
          - .1 Installation: Suitable for direct stab without field disassembly.
          - .2 Gasket: Grade EHP, suitable for water service of 250 deg F (121 deg C) maximum.

- .2 Flexible Type Couplings: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors.
  - .1 Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Installation Ready Style 177 or comparable product by one of the following:
  - .2 Installation: Suitable for direct stab without field disassembly.
  - .3 Gasket: Grade EHP, suitable for water service of 250 deg F (121 deg C) maximum. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
- .3 Flexible Type Couplings: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors.
- .3 Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 77 or comparable product by one of the following:

## **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger:
  - .1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
  - .2 PEX fittings to CSA B137.5 and F1960.
- .6 NPS 1 ½ and smaller:
  - .1 Cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.
  - .2 PEX fittings to CSA B137.5.

## **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.
- .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.
- .7 NPS 1 ½ and smaller: PEX fittings to CSA B137.5.
- .8 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves.

## **2.4 GATE VALVES**

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

## **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.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01- Valves - Bronze .
  - .2 Lockshield handles.

## **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 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01- Valves - Bronze .
- .3 NPS 2 1/2 and over, flanged:

- .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02- Valves - Cast Iron: Gate, Globe, Check .

**2.7 BALL VALVES (required for all Domestic hot/hot return/cold and domestic softened water. )**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01- Valves - Bronze.
- .2 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01- Valves - Bronze .
- .3 NPS 2 and under, mechanical:
  - .1 To CSA B137.5 and ASTM F1960.
  - .2 Lead free brass body.

**2.8 BUTTERFLY VALVES**

- .1 NPS 2-1/2 and over, wafer:
  - .1 To MSS-SP-67, Class 200.
  - .2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
  - .3 Lever operated, NPS8 and over, gear 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.

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**Part 3            Execution**

**3.1                APPLICATION**

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

**3.2                INSTALLATION**

- .1      Install in accordance with NPC and local authority having jurisdiction.
- .2      Install pipe work in accordance with Section 23 05 15- Common Installation Requirements for HVAC Pipework, supplemented as specified herein.
- .3      Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4      Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5      Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6      Buried tubing:
  - .1          Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2          Bend tubing without crimping or constriction. Minimize use of fittings.
- .7      Valves
  - .1          Isolate equipment, fixtures and branches with gate valves.
  - .2          Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

**3.3                PRESSURE TESTS**

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

**3.4                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 to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

**3.5                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.

### **3.6 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Coordinate with Section 33 11 16- Site Water Utility Distribution Piping.
- .3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

### **3.7 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.

### **3.8 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.

### **3.9 OPERATION REQUIREMENTS**

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 15- Common Installation Requirements for HVAC Pipework.
- .2 Operational requirements in accordance with Section 01 47 19- Sustainable Requirements: Operation, include:
  - .1 Cleaning materials and schedules.
  - .2 Repair and maintenance materials and instructions.

### **3.10 CLEANING**

- .1 Clean in accordance with Section 01 74 01- Cleaning.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International (ASTM)
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 CSA Group (CSA)
  - .1 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .2 CAN/CSA-B125.3, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .4 National Research Council Canada (NRC)
  - .1 National Plumbing Code of Canada 2015 (NPC).
- .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 adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with Section 01 74 19 - Waste Management and Disposal.

**Part 2 Products**

**2.1 CAST IRON PIPING AND FITTINGS**

- .1 Buried sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.

- .1 Joints:
  - .1 Mechanical joints:
    - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.ASTM C564 or
    - .2 Stainless steel clamps.
  - .2 Hub and spigot:
    - .1 Caulking lead: to CSA B67.
    - .2 Cold caulking compounds.
- .2 Above ground storm, sanitary and vent: to CAN/CSA-B70.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
    - .2 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

### **Part 3 Execution**

#### **3.1 APPLICATION**

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

#### **3.2 INSTALLATION**

- .1 In accordance with Section 23 05 15- Common installation requirements for HVAC pipework.
- .2 Install in accordance with National Plumbing Code, local authority having jurisdiction and Provincial Plumbing Regulations.

#### **3.3 TESTING**

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

#### **3.4 PERFORMANCE VERIFICATION**

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

- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International (ASTM)
  - .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 CSA Group (CSA)
  - .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 National Research Council Canada (NRC)
  - .1 National Plumbing Code of Canada 2015 (NPC).
- .6 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 electronic copy of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43- Environmental Procedures.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00- Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for recycle in accordance with Section 01 74 19- Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIAL**

- .1 Adhesives and Sealants: 07 92 00- Joint Sealants
  - .1 Maximum VOC limit 250 g/L GSES GS-36.

**2.2 PIPING AND FITTINGS**

- .1 For buried and above ground DWV piping to:
  - .1 CAN/CSA B1800.

**2.3 JOINTS**

- .1 Solvent weld for PVC: to ASTM D2564.
- .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 15- Common installation requirements for HVAC pipework.
- .2 Install in accordance with National Plumbing Code.

**3.3 TESTING**

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

**3.4 PERFORMANCE VERIFICATION**

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify 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 Clean in accordance with Section 01 74 00- Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

**END OF SECTION**