

**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 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 weekly 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.
- .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. Vacuum interior of ductwork and air handling units.

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

**1.2 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 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 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.
- .7 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 Work of this Section and on-site installations in accordance with Construction Progress Schedule.
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## Part 2 PRODUCTS

### 2.1 DOMESTIC TEMPERED WATER CIRCULATING PUMP (PU-2)

- .1 General: Close coupled inline circulating pump specifically designed for operation in domestic potable water systems. Bronze body construction with flanged suction and discharge connections.
- .2 Impeller: 30% glass filled Noryl.
- .3 Shaft: High strength alloy steel.
- .4 Seal assembly: Carbon / Silicon Carbide.
- .5 Flange Size: 1".
- .6 Bearings: Permanently lubricated sealed precision bearings.
- .7 Motor: 1/12 HP ODP, 120/1/60, 2650 RPM.
- .8 Capacity: 8 usgpm @ 20 ft. of Head.
- .9 Maximum operating pressure: 150 psi.
- .10 Maximum fluid temperature: 225 °F.
- .11 Acceptable Product: "Bell & Gossett" Series PL-30B.

### 2.2 DOMESTIC HOT WATER CIRCULATING PUMP (PU-3)

- .1 Capacity: 5 gpm against total differential head of 11 ft.
- .2 Construction: closed-coupled, in-line centrifugal, all bronze construction, shaft, stainless steel or bronze shaft sleeve, two oil lubricated bronze sleeves or ball bearings. Design for 1034 kPa and 107 degrees C continuous service.

- .3 Flange: 3/4"
- .4 Motor: 125 W, 115/1/60, drip-proof, with thermal overload protection. Motor shall be non-overloading.
- .5 Supports: provide as recommended by manufacturer.
- .6 Acceptable Product: "Bell & Gossett" Model: LR-15WBR

### **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.

#### **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 RELATED SECTIONS**

- .1 01 33 00 - Submittal Procedures
- .2 01 74 11 - Cleaning
- .3 01 78 00 - Closeout Submittals.
- .4 23 05 05 - Installation of Pipework.

**1.2 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 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
  - .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2009.
  - .3 LEED Canada-CI Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .5 Canadian Standards Association (CSA International)

- .1 CSA B242-[05], Groove and Shoulder Type Mechanical Pipe Couplings.
- .6 Department of Justice Canada (Jus)
  - .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-[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.
- .9 National Research Council (NRC)/Institute for Research in Construction
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 10.
- .10 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

### **1.3 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 Buried or embedded: copper tube, soft annealed, type L: to ASTM B88M, in long lengths and with no buried joints.

### **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 1/2 and smaller : wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301stainless 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 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.
- .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.

### **2.5 SWING CHECK VALVES**

- .1 NPS 2 and under, soldered:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

**2.6 BALL VALVES**

- .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.
- .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.

**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 with Section 23 05 05 - Installation of Pipework.

### **3.11 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 01 33 00 - Submittal Procedures
- .2 01 74 11 - Cleaning
- .3 01 78 00 - Closeout Submittals.
- .4 23 05 05 - Installation of Pipework

**1.2 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM D2564-04e1, Standard Specification for Solvent Cements for Poly Vinyl-Chloride (PVC) Plastic Piping Systems.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
  - .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-[Addendum 2007].
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-Series B1800-[06], Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-[00], Commercial Adhesives.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.

**1.3 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.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Store at temperatures and conditions recommended by manufacturer.

#### **Part 2 Products**

##### **2.1 PIPING AND FITTINGS**

- .1 For 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 Provincial Plumbing Code and local authority having jurisdiction.

##### **3.3 TESTING**

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

##### **3.4 PERFORMANCE VERIFICATION**

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

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

### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for plumbing specialties and accessories.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 78 00 - Closeout Submittals.
  - .3 Section 01 91 13 - General Commissioning (Cx) Requirements.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A126-[95(2001)], Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B62-[02], Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA).
  - .1 AWWA C700-[02], Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 AWWA C701-[02], Cold Water Meters-Turbine Type for Customer Service.
  - .3 AWWA C702-1-[01], Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA-B64 Series-[01], Backflow Preventers and Vacuum Breakers.
  - .2 CSA-B79-[94(R2000)], Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
  - .3 CSA-B356-[00], Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 Plumbing and Drainage Institute (PDI).
  - .1 PDI-G101-[96], Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
  - .2 PDI-WH201-[92], Water Hammer Arresters Standard.

**1.3 SUBMITTALS**

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

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

## **PART 2 PRODUCTS**

### **2.1 FLOOR DRAINS**

- .1 Floor Drains: to CSA B79.
- .2 Floor Drain (FD): Epoxy coated cast iron body, square adjustable stainless steel grate, trap primer connection, integral seepage pan, and clamping collar.  
  
Acceptable Product: "Watts" Model: FD-1103NH-C-L6
- .3 Shower Drain (SD): Epoxy coated cast iron body, square adjustable stainless steel grate, trap primer connection, integral seepage pan, and clamping collar.  
  
Acceptable Product: "Watts" Model: FD-1103NH-C-L6

### **2.2 TEMPERED WATER MIXING VALVE**

- .1 Large Type TM Thermostatic water mixing valve, adjustable high temperature limit stop, inlet checkstops, wall support, outlet ball valve
- .2 Small Type TM Thermostatic water mixing valve, adjustable high temperature limit stop, integral checkstops, outlet ball valve

- .3 3/4 " inlets, 1" outlet (19mm X 25mm)
- .4 1 GPM minimum flow capacity, 19 gpm flow at 5 psi pressure drop.
- .5 Inlet manifold piping
- .6 Dura-trol® solid bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations. Dura-trol® is highly responsive and cannot be damaged by extremes in temperature.
- .7 Adjustable high temperature limit stop set for 120°F (49°C)
- .8 Combination checkstops, unions, strainers on inlets wall support, plastic handle.
- .9 Dial thermometer and pressure gauge on outlet
- .10 3/4" Return loop with dial thermometer
- .11 Ball valve
- .12 3/4" Leonard ARV automatic return valve, parafin-based
- .13 Check valves on either side of ARV
- .14 Complete unit mounted on heavy duty strut, for ease of installation
- .15 Valve assembly rough bronze finish
- .16 Factory assembled and tested
- .17 Acceptable Product: "Leonard" Model: TM-520-DT-RF-R34

## **2.3 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.

## **2.4 WATER HAMMER ARRESTORS**

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

## **2.5 TRAP SEAL PRIMERS**

- .1 Brass, with integral vacuum breaker, NPS1/2 solder ends, NPS1/2 drip line connection.

## **2.6 STRAINERS**

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

## **PART 3 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with Provincial Plumbing Code, 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 NPS4.

### **3.4 WATER HAMMER ARRESTORS**

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

### **3.5 BACK FLOW PREVENTORS**

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain.

### **3.6 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.

### **3.7 STRAINERS**

- .1 Install with sufficient room to remove basket.

### **3.8 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.

### **3.9 TESTING AND ADJUSTING**

- .1 General:
  - .1 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.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removeability 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 Access doors:
  - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Wall, Ground hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .11 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .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 Commissioning Reports:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: Reports, supplemented as specified.
- .14 Training:
  - .1 In accordance with Section 01 91 13 - General Commissioning (Cx)  
Requirements: Training of O&M Personnel, supplemented as specified.
  - .2 Demonstrate full compliance with Design Criteria.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 01 33 00 - Submittal Procedures
- .2 01 78 00 - Closeout Submittals
- .3 01 74 11 - Cleaning

**1.2 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
  - .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2009.
  - .3 LEED Canada-CI Version 1.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-B45 Series-[02(R2008)], Plumbing Fixtures.
  - .2 CAN/CSA-B125.3-[05], Plumbing Fittings.
  - .3 CAN/CSA-B651-[04], Accessible Design for the Built Environment.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-[00], Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-[A2005], Adhesive and Sealant Applications.

**1.3 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 washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Indicate fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.

#### 1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURED UNITS

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

#### 2.2 Water closets (P-1):

- .1 Wall-mounted flushometer valve toilet, Vitreous china, Meets definition for HET (High Efficiency Toilet), High Efficiency (4.8 Lpf/1.28 gpf), Will also function at 1.1 gpf and 1.6gpf with a properly set dual flush valve, EverClean® surface inhibits the growth of stain- and odor-causing bacteria, mold, and mildew on the surface, Condensation channel, Elongated bowl, Powerful direct-fed siphon jet action, 1-1/2" inlet spud, Fully-glazed 2-1/8" trapway, 10" x 12" water surface area, c/w extra heavy duty open front cover seat. Meets ASME A112.19.2-2008/CSA B45.1-08 for Vitreous China Fixtures. ADA Compliant.
- .2 Acceptable Product: "American Standard - AFWALL" Model: **3351.128 c/w Extra heavy duty open front less cover**
- .3 **Accessories:** Flush valve - quiet action, exposed diaphragm flush valve, polished chrome plated finish, vandal resistant cover screw, metal "non hold open" ADA Compliant oscillating handle, vacuum breaker, renewable seat, chloramine resistant diaphragm attached to guide with forged metal retainer, spud flange and concealed spud nut, for Water Closets with 1-1/2" top spud, maximum 1 1/2" from centerline of valve inlet to top of water, closet, except -1 trap seal models which are maximum 11 3/4", 1" FIP/Copper sweat inlet adaptor for angle check stop with protecting cap, Adjustable 4.75" plus or minus 7/16" inlet/valve outlet centers, cover tube and S/S wall flange, External water conserving flush adjustment: 1.6 US Gal. Factory set

Flush - Field Adjustable from 1.27 to 6.6 US Gal. Contractor to field adjust to match the water closet. CSA Certified. ADA Compliant.

- .4 Acceptable Product: "Delta" Model: 81T201

### 2.3 Barrier Free Water Closet (P-2):

- .1 Wall-mounted flushometer valve toilet, Vitreous china, Meets definition for HET (High Efficiency Toilet), High Efficiency (4.8 Lpf/1.28 gpf), Will also function at 1.1gpf and 1.6gpf with a properly set dual flush valve, EverClean® surface inhibits the growth of stain- and odor-causing bacteria, mold, and mildew on the surface, Condensation channel, Elongated bowl, Powerful direct-fed siphon jet action, 1-1/2" inlet spud, Fully-glazed 2-1/8" trapway, 10" x 12" water surface area, c/w extra heavy duty open front cover seat. Meets ASME A112.19.2-2008/CSA B45.1-08 for Vitreous China Fixtures. ADA Compliant. Install to meet ADA height requirements.

- .2 Acceptable Product: "American Standard - AFWALL" Model: **3351.128 c/w Extra heavy duty open front with cover.**

- .3 **Accessories:** Flush valve - quiet action, exposed diaphragm flush valve, polished chrome plated finish, vandal resistant cover screw, metal "non hold open" ADA Compliant oscillating handle, vacuum breaker, renewable seat, chloramine resistant diaphragm attached to guide with forged metal retainer, spud flange and concealed spud nut, for Water Closets with 1-1/2" top spud, maximum 1 1/2" from centerline of valve inlet to top of water, closet, except -1 trap seal models which are maximum 11 3/4", 1" FIP/Copper sweat inlet adaptor for angle check stop with protecting cap, Adjustable 4.75" plus or minus 7/16" inlet/valve outlet centers, cover tube and S/S wall flange, External water conserving flush adjustment: 1.6 US Gal. Factory set Flush - Field Adjustable from 1.27 to 6.6 US Gal. Contractor to field adjust to match the water closet. CSA Certified. ADA Compliant.

- .4 Acceptable Product: "Delta" Model: 81T201

### 2.4 Counter Top Lavatory – P-3

- .1 Drop in vanity basin with a 1 1/4" (32mm) waste opening, 18 gauge, 18-10 stainless steel, silk finished rim and radiant silk finished bowl with front overflow, fully undercoated, c/w front overflow assembly. Provide waste fitting and chrome trap and drain.

- .2 Acceptable Product: "Franke Kindred" Model: KSOV1821/7

- .3 Lavatory Trim:

- .1 ADA compliant single lever handle mixing faucet, 102 mm (4") centerset, 127 mm (5") long spout, 3/8" O.D. straight, staggered pex supply tubes - 889 mm (35") and 914 mm (36") long, Lever handles c/w red/blue button. Complies with ASME A112.18.1 / CSA B125.1, ASME A112.18.2 / CSA B125.2, and ICC/ANSI A117.1.

- .2 Acceptable Product: "Delta" Model: 500-DST c/w vandal proof aerator.

## **2.5 Barrier Free Counter Top Lavatory – P-4**

- .1 Integrated Corian counter top and sink by architectural (refer to architectural for specifications. Provide drainage piping to suit Corian sink).
- .2 Lavatory Trim:
  - .1 ADA compliant single lever handle mixing faucet, 102 mm (4") centerset, 127 mm (5") long spout, 3/8" O.D. straight, staggered pex supply tubes - 889 mm (35") and 914 mm (36") long, Lever handles c/w red/blue button. Complies with ASME A112.18.1 / CSA B125.1, ASME A112.18.2 / CSA B125.2, and ICC/ANSI A117.1.
  - .2 Acceptable Product: "Delta" Model: 500-DST c/w vandal proof aerator.

## **2.6 Barrier Free Wall Mount Lavatory – P-5**

- .1 Barrier free wall-hung lavatory, vitreous china, white in colour, rear overflow, recessed self-draining deck, 100mm (4") centers, Nominal dimensions: 27" deep, 20" wide, c/w insulated trap and drain to meet ADA requirements, wall hung supports, stainless steel strainer drain. Shall meet ASME A112.19.2 for Vitreous China Fixtures. CSA Approved.
- .2 Acceptable Product: "American Standard" Model: 9141.011 hung lavatory c/w specified options and accessories.
- .3 Lavatory Trim:
  - .1 ADA compliant single lever handle mixing faucet, 102 mm (4") centerset, 127 mm (5") long spout, 3/8" O.D. straight, staggered pex supply tubes - 889 mm (35") and 914 mm (36") long, Lever handles c/w red/blue button. Complies with ASME A112.18.1 / CSA B125.1, ASME A112.18.2 / CSA B125.2, and ICC/ANSI A117.1.
  - .2 Acceptable Product: "Delta" Model: 500-DST c/w vandal proof aerator.

## **2.7 Single Bowl Sink (P-7)**

- .1 Single compartment sink with faucet ledge, 3 hole, 38mm (1 1/2") diameter, 200mm (8") centerset, 18 gauge, type 304, 18-10 stainless steel, self rimming, exposed surfaces are satin finished, spillway between bowls, undercoated to reduce condensation and resonance, complete with factory applied rim seal, universal installation system hardware, cut out template and 89mm (3 1/2") waste assembly, location center back, dimensions: 20 1/2" x 20" x 8"
- .2 Acceptable Product: "Kindred" Model: QSL2020/8
- .3 Sink Faucet

- .1 Single handle kitchen deck faucets for exposed mounting on three hole sink, all metal fabricated body, 221 mm (8 11/16") long spout swings 180°, 5.7 L/min (1.5 gpm) vandal resistant aerator, Lever handle shall return to neutral position when faucet is turned off, Red and blue on handle to indicate hot/cold temperature, Control mechanism shall be the diamond coated ceramic cartridge, Adjustable handle limit stop, 3/8" O.D. straight, staggered copper supply tubes with 3/8" fittings, Model 400 series with 45" (1143 mm) hose and spray attachment has anti-siphon device as integral part of faucet, Mounts on standard 1 3/8 (35 mm) diameter holes on 8" (203 mm) centers. COMPLIES WITH: ASME A112.18.1 / CSA B125.1, NSF 61

- .2 Acceptable Product: "Delta" Model: 100LF-HDF

## **2.8 Shower (P-8)**

- .1 Vandal resistant Institutional shower head, 2 gpm max. flow rate, 30° spray angle, cast brass, 1/2" copper sweat inlet, CSA Certified
- .2 Accessories: Provide low voltage push button, stainless steel cover plate and hardware, and a 4" x 4" standard electrical box. Provide wiring from the existing solenoid valves to the new push button.
- .3 Acceptable Product: "Delta" Model: 060793A c/w Cover plate - part no. 060986A, screws – part no. 060072A, and push button – part no. 060679A

## **2.9 Barrier Free Shower (P-8)**

- .1 Hand shower with standard 24" stainless steel slide bar, 2.5 gpm, ADA Compliant.
- .2 Accessories: Provide low voltage push button, stainless steel cover plate and hardware, and a 4" x 4" standard electrical box. Provide wiring from the existing solenoid valves to the new push button.
- .3 Acceptable Product: "Delta" Model: T17TH155 (less shower valve) c/w Cover plate - part no. 060986A, screws – part no. 060072A, and push button – part no. 060679A

## **2.10 Fixture piping:**

- .1 Hot and cold water supplies to fixtures:
  - .1 Stainless steel braided flexible supply pipes with handwheel stop, reducers, escutcheon.
- .2 Waste:
  - .1 Brass P trap with clean out on fixtures not having integral trap.
  - .2 Chrome plated in exposed places.

**PART 3 EXECUTION**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to manufacturer's recommendations, measured from finished floor.
  - .2 Wall-hung fixtures: measured from finished floor.
  - .3 Barrier free: to most stringent NBCC.

**3.3 ADJUSTING**

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
  - .4 Adjust urinal flush timing mechanisms.
  - .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.
- .3 Checks:
  - .1 Water closets, urinals: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls:
  - .1 Verify temperature settings, operation of control, limit and safety controls.

**3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**