

**Part 1 General**

**1.1 SUBMITTALS**

- .1 Submittals: in accordance with Division 01 – General Requirements.
- .2 Shop drawings; submit drawings stamped and signed by a professional engineer registered or licensed in the Province of New Brunswick.
- .3 Shop drawings to show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .4 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.
- .5 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.
- .6 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, Departmental Representative 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 components.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
  - .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 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.
- .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 Consultant will provide 1 set of reproducible mechanical drawings. 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 daily 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 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## **1.2 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety.

## **1.3 EQUIPMENT INSTALLATION**

- .1 In accordance with Manufacturer's instructions unless otherwise indicated.

- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

#### **1.4 CLEARANCES**

- .1 Provide space for disassembly, removal of equipment and components as recommended by Manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment or components.

#### **1.5 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.
- .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.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.7 FIRESTOPPING**

- .1 All fire stopping work is to be performed by individual sub-trades as per Section 07 84 00 – Firestopping.
- .2 All Sub-Contractors shall coordinate all fire rated assembly penetrations with General Contractor.
- .3 Sub-Contractor shall provide required clearances between outside surface of pipe and inside surface of sleeve, core drilled hole or listed fire rated system.

#### **1.8 TESTS**

- .1 Give 48 hours written notice of date for all tests.
- .2 Insulate or conceal work only after testing and approval by Departmental Representative and Commissioning Agent.
- .3 Conduct tests in presence of Departmental Representative and Commissioning Agent and local authority having jurisdiction where applicable.
- .4 Bear costs including retesting and making good.
- .5 Equipment: test as specified in relevant sections and Commissioning Sections.
- .6 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

## **1.9 INTERPRETATION OF PLANS AND SPECIFICATIONS**

- .1 These specifications are to be considered as an integral part of the plans which accompany them and neither the plans nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other shall be considered properly and sufficiently specified and must, therefore, be provided by this Contractor.
- .2 Misinterpretation of the plans or specifications shall not relieve this Contractor of responsibility; final interpretation of details and clauses remains with the Departmental Representative.
- .3 Where uncertainty exists in the passing of pipes and location of equipment, the General Contractor and or project manager shall be consulted before work is started. Where such materials and equipment have been installed so as to cause interference with the inside treatment of the building, they shall be removed and relocated without additional cost to the Departmental Representative.
- .4 The plans do not necessarily show all valves, duct offsets, access panels, connections, balancing fittings, bases, isolators, flexible connections, drains, etc., and this Contractor shall not avail himself of these obvious omissions, but shall install the work complete in essential details so that it will function properly, can be easily balanced and so that repairs and removal of equipment can easily be made.
- .5 Building dimensions shall not be scaled from the Mechanical plans but shall be obtained from on-site dimensions of the building. Any discrepancy between the drawings and the building shall be questioned before proceeding with any installation.

## **1.10 CO-OPERATION OF CONTRACTORS**

- .1 This Contractor shall become familiar with the work of other contractors and in laying out and installing the work shall co-operate with the other Contractors, so as to facilitate the progress of the work as a whole and avoid interference or delays. Where interference exists, this Contractor shall notify the General Contractor and/or project manager and the Departmental Representative before installing the work. Any changes in the work or alterations of the Mechanical Contractor's schedule of procedure required for such co-operation will not be considered as a claim for extra compensation.
- .2 Due to the complexities of many sub-trades, and the restrictive space available in this project, it is required that all trades co-operate closely so as to install all systems in their allotted locations as indicated on the drawings, or coordination on site.
- .3 The drawings are not intended to show all elbows, fittings and offsets required to perform the installation of the work where indicated on drawings. Contractor shall coordinate with all other trades and General Contractor on site. It is the responsibility of the Contractor to review site conditions prior to execution of work. Where services are shown to cross other building services, Contractor shall coordinate with other trades and determine best routing on-site prior to execution of work.
- .4 The Contractor shall review all Structural, Mechanical, Electrical and Architectural drawings to determine possible conflicts.

- .5 Contractor shall coordinate location of all hangers and seismic bracing systems as to avoid interference with other trades.
- .6 No extras will be allowed for lack of coordination or if additional fittings are required to perform the work as shown on the drawings.

#### **1.11 ERRORS AND OMISSIONS**

- .1 The drawings are not intended to show every item of accessory equipment, but the Contractor shall tender on and install all essential details to provide for efficiency of operation and ease of maintenance.
- .2 Should this Contractor discover errors or discrepancies in the plans or specification, he shall refer the matter to the Departmental Representative for change or clarification and shall not proceed with that portion of the work until advised by the Departmental Representative to do so.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Choose products and materials with recycled content or resource efficient characteristics whenever possible. Use least toxic sealants, adhesives, sealers and finishes necessary to comply with the requirements of the project.

### **Part 3 Execution**

#### **3.1 PAINTING REPAIRS AND RESTORATION**

- .1 The Environmental Choice guideline CCD-047a, CCD-047b, CCD-047c, CCD-048 and the Master Painters Institute list of Green Approved Products provides acceptable standards for products that provide reduced environmental impacts.
- .2 Low VOC paints are preferable.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 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 Site Tests: conduct tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - 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 - 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 Departmental Representative 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 Departmental Representative will 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**

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**Part 1            General**

**1.1                SUMMARY**

.1            Section Includes:

- .1            Thermal insulation for piping and piping accessories in commercial type applications.

**1.2                REFERENCES**

.1            American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

- .1            ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2            American Society for Testing and Materials International (ASTM):

- .1            ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .2            ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .3            ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .4            ASTM C547-2003, Mineral Fiber Pipe Insulation.

.3            Canadian General Standards Board (CGSB):

- .1            CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2            CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts

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

- .1            Material Safety Data Sheets (MSDS).

.5            Manufacturer's Trade Associations:

- .1            Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.6            Underwriters' Laboratories of Canada (ULC):

- .1            CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
- .2            CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3            CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
- .4            CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

### 1.3 DEFINITIONS

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

### 1.4 SUBMITTALS

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 – General Requirements. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 – General Requirements.
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Division 01 – General Requirements.
    - .1 Submit for approval Manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.
- .3 Samples:
  - .1 Submit samples in accordance with Division 01 – General Requirements.
  - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

### 1.5 QUALITY ASSURANCE

- .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Division 01 – General Requirements.

### 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 – General Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.



- .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

## **Part 2 Products**

### **2.1 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.
- .2 Materials to be tested in accordance with ASTM C411.

### **2.2 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
- .3 Materials:
  - .1 CAN/ULC-S702/ASTM C547, rigid mineral fiber sleeving for piping.
  - .2 Acceptable materials: Fiberglas Canada; Knauf; Manson.
- .4 Thermal Conductivity "k" shall not exceed 0.034 W/m.°C at 24°C mean temperature when tested in accordance with ASTM C335.
- .5 TIAC Code C-2: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
- .6 Material:
  - .1 CAN/ULC-S702/ASTM C547, rigid mineral fiber sleeving for piping and CGSB 51-GP-52Ma, vapour barrier jacket and facing material.
  - .2 Acceptable material: Knauf; Fiberglas Canada; Manson.
- .7 Thermal Conductivity "k" shall not exceed 0.034 W/m°C at 24°C mean temperature when tested in accordance with ASTM C335.

## **2.3 INSULATION SECUREMENT**

- .1 For insulation systems:
  - .1 Tape: self- adhesive, aluminum, ULC labelled for less than 25 flame spread and less than 50 smoke developed.
    - .1 Acceptable Material: Fattal Insulatape by S. Fattal Canvas Inc.
  - .2 Lap seal adhesive: quick-setting for joints and lap sealing of vapour barriers.
    - .1 Acceptable Material: Childers CP.80; Foster 87-75 asbestos free at 6m<sup>2</sup>/L.
  - .3 Lagging adhesive: fire retardant coating: asbestos free.
    - .1 Acceptable Material: Childers CP.50A-HV2; Foster 30-36 asbestos free at 1.25 m<sup>2</sup>/L.

## **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

## **2.5 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

## **2.6 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

## **2.7 JACKETS**

- .1 Polyvinyl Chloride (PVC): (New exposed piping):
  - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Minimum service temperatures: -20°C.
  - .3 Maximum service temperature: 65°C.
  - .4 Moisture vapour transmission: 0.02 perm.
  - .5 Thickness: .033 mm minimum.
  - .6 Fastenings:
    - .1 Standard to Manufacturer
  - .7 Fitting covers, one piece, pre-moulded to match.
- .2 Canvas: (New concealed piping):
  - .1 220 and 120 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.

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**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 datasheet.

**3.2                PRE-INSTALLATION REQUIREMENT**

- .1        Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2        Surfaces clean, dry, free from foreign material.

**3.3                INSTALLATION**

- .1        Install in accordance with ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2        Apply materials in accordance with manufacturers instructions and this specification.
- .3        Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4        Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1        Install hangers, supports outside vapour retarder jacket.
- .5        Supports, Hangers:
  - .1        Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .6        Multi-layered: staggered butt joint construction.
- .7        Vertical pipe over NPS 3: insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter, locate on 4.5 m centres.
- .8        Expansion joints in insulation: terminate single layer and each layer of multiple layers in straight cut at intervals recommended by manufacturer. Leave void of 25 mm between terminations. Pack void lightly with flexible mineral insulation.
- .9        Seal and finish exposed ends and other terminations with insulating cement.
- .10       Expansion joints in piping: provide for adequate movement of expansion joint without damage to insulation or finishes.
- .11       Flanges and unions at equipment, expansion joints, valves, other components requiring regular maintenance: omit insulation and bevel away from studs and nuts to permit use of tools without damage to insulation install insulation and finish to permit easy disassembly and replacement without damage to adjacent insulation and finishes.
- .12       Secure pipe insulation by tape at each end and centre of each section, but not greater than 900 mm on centres.

### 3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: To match adjacent pipe jacketing.

### 3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1:
  - .1 Securements: Tape at 300 mm OC.
  - .2 Seals: Lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: C-2 with Vapour Retarder Jacket:
  - .1 Securements: Tape at 300 mm oc.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation to be as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
  - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Pipe sizes (NPS) and insulation thickness (mm)				
			To 1	1 ¼	2 ½ to 2	5 to 6 to 4	8 & over
Domestic Hot Water & Recirc.		A-1			25	25	38 38 38
Domestic Cold Water	4-13	C-2		25	25	25	25 25

### 3.6 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

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**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Materials and installation for copper domestic water service used in the following:
  - .1        Copper incoming domestic water service, up to NPS 2 1/2.
  - .2        Hard drawn copper domestic hot and cold water services inside building.

**1.2            RELATED SECTIONS**

- .1    Division 01 – General Requirements.
- .2    Division 23 – Heating, Ventilating and Air Conditioning (HVAC).

**1.3            REFERENCES**

- .1    American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME):
  - .1        ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .2        ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .2    American Society for Testing and Materials International, (ASTM):
  - .1        ASTM B88M-03, Standard Specification for Seamless Copper Water Tube (Metric).
- .3    Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1        Material Safety Data Sheets (MSDS).
- .4    Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
- .5    National Research Council (NRC)/Institute for Research in Construction:
  - .1        NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

**1.4            SUBMITTALS**

- .1    Submittals in accordance with Division 01 – General Requirements.
- .2    Submit product data for following: valves.
- .3    Provide maintenance data for incorporation into manual specified in Division 01 – General Requirements.

**1.5            HEALTH AND SAFETY**

- .1    Do construction occupational health and safety in accordance with Division 01 – General Requirements.

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**Part 2 Products**

**2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building:
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

**2.2 FITTINGS**

- .1 Cast copper, solder type: to ANSI/ASME B16.18.
- .2 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

**2.3 JOINTS**

- .1 Solder: 95/5 or tin copper alloy.
- .2 Teflon tape: for threaded joints.
- .3 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

**2.4 BALL VALVES**

- .1 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.
  - .3 Standard of Acceptance: Crane, Jenkins.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with NPC.
- .2 Install pipe work 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.

**3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.

### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times' maximum system operating pressure or 860 kPa.

### **3.4 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.

### **3.5 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.
- .4 Rectify start-up deficiencies.

### **3.6 PERFORMANCE VERIFICATION**

- .1 Timing:
  - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 Sterilize HWS and HWC systems for Legionella control.
  - .3 Verify performance of temperature controls.
  - .4 Verify compliance with safety and health requirements.
  - .5 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.
  - .6 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

- .3 Reports:
  - .1 In accordance with Division 01 – General Requirements.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

**END OF SECTION**



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**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes:
  - .1        The installation of drainage waste and vent piping.
- .2    Related Sections:
  - .1        Division 01 – General Requirements.

**1.2                REFERENCES**

- .1    American Society for Testing and Materials International, (ASTM):
  - .1        ASTM B32-03, Specification for Solder Metal.
  - .2        ASTM B306-02, Specification for Copper Drainage Tube (DWV).
- .2    Canadian Standards Association (CSA International):
  - .1        CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2        CAN/CSA-B125-01, Plumbing Fittings.

**1.3                QUALITY ASSURANCE**

- .1    Health and Safety:
  - .1        Do construction occupational health and safety in accordance with Division 01 – General Requirements.

**1.4                DELIVERY STORAGE AND DISPOSAL**

- .1    Waste Management and Disposal:
  - .1        Separate and recycle waste materials.

**Part 2            Products**

**2.1                COPPER TUBE AND FITTINGS**

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

**Part 3            Execution**

**3.1                INSTALLATION**

- .1    Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED SECTIONS**

- .1       Division 01 – General Requirements.

**1.2            REFERENCES**

- .1       Canadian Standards Association (CSA International):
  - .1       CAN/CSA C22.2No.110-94 (R2009), Construction and Test of Electric Storage Tank Water Heaters.
  - .2       CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
  - .3       CAN/CSA-C309-M90 (R2009), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

**1.3            SHOP DRAWINGS**

- .1       Submit shop drawings in accordance with Division 01 – General Requirements.
- .2       Indicate:
  - .1       Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

**1.4            CLOSEOUT SUBMITTALS**

- .1       Provide maintenance and engineering data for incorporation into manual specified in Division 01 – General Requirements.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials in accordance with Division 01 – General Requirements and with Waste Reduction Workplan.
- .2       Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3       Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
- .4       Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

**1.6            WARRANTY**

- .1       For the Work of this Section, the 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.
- .2       Contractor hereby warrants domestic water heaters in accordance with CCDC2 GC 24, but for number of years specified for each product.

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**Part 2 Products**

**2.1 ELECTRIC (P-4)**

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with 1 immersion type element, 1500W/120V each, and surface mounted or immersion type adjustable thermostats.
- .2 Tank: 10 L, glass lined steel, 360 mm wide x 360 mm high, CFC-free foam insulation, enamelled steel jacket, 1 year warranty certificate.
- .3 Anchor bolts and wall mounting bracket to be provided with unit.
- .4 Acceptable material: John Wood GSW SSØ25 SE15, or approved equal.

**2.2 TRIM AND INSTRUMENTATION**

- .1 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .2 Magnesium anodes adequate for 20 years of operation and located for easy replacement.
- .3 Vacuum breaker to be installed on cold water inlet.
- .4 Unit to be c/w poly sump piped to drain.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

**3.2 FIELD QUALITY CONTROL**

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

**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 The supply and installation of Plumbing Fixtures and Trim.
- .2 Related Sections:
  - .1 Division 01 – General Requirements.
  - .2 Division 22 - Plumbing.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
  - .2 CAN/CSA-B125-01, Plumbing Fittings.
  - .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

**1.3 SUBMITTALS**

- .1 Division 01 – General Requirements.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 01 – General Requirements:
  - .1 Submit shop drawings and product data in accordance with Division 01 – General Requirements.
    - .1 Indicate, for all fixtures and trim:
      - .1 Dimensions, construction details, roughing-in dimensions.
- .3 Closeout Submittals:
  - .1 Submit maintenance data in accordance with Division 01 – General Requirements.
  - .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.

**1.4 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Division 01 – General Requirements.

**1.5 DELIVERY STORAGE AND DISPOSAL**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.

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**Part 2 Products**

**2.1 MATERIAL**

- .1 Sustainable Requirements:
  - .1 Materials and resources in accordance with Division 01 – General Requirements.

**2.2 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.
- .7 Refer to fixture schedule on drawings for further information.
- .8 Fixture piping:
  - .1 Hot and cold water supplies to each fixture:
    - .1 Chrome plated rigid supply pipes each with hand wheel stop, reducers, escutcheon.
  - .2 Waste:
    - .1 Brass P trap with clean out on each fixture not having integral trap.
    - .2 Chrome plated in all exposed places.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

**3.2 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 Checks:
  - .1 Aerators: operation, cleanliness.

### **3.3 VERIFICATION**

- .1 Verification requirements in accordance with Division 01 – General Requirements.

**END OF SECTION**