

## **PART 1 – GENERAL**

### **1.1 RELATED WORK**

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### **1.2 GENERAL REQUIREMENTS**

- .1 For the purpose of this specification, the following terms shall be understood to mean:
- .2 Should any conflicts occur between layouts shown on drawings and applicable codes, the code requirements shall be adhered to. Should the Contractor have any doubts or queries regarding the interpretation or requirements of the design, such queries shall be addressed to the Consultant promptly in writing to obtain resolution.
- .3 These specifications and drawings shall be read in conjunction with the terms and conditions of the General Contract Documents.
- .4 All work and materials shall conform to the requirements as set out in the Base Building, and Tenant Design Criteria.
- .5 This Contractor shall visit the site prior to tender and shall become thoroughly familiar with site conditions. Problems arising from a failure to do so shall not constitute a contract change.

### **1.3 SCOPE OF WORK**

- .1 Relocate existing air diffusers with associated ducts to match new architectural layout.
- .2 Add one kitchen sink with associated domestic cold water, domestic hot water, domestic hot water recirculation, sanitary, and vent pipes in kitchenette 343.
- .3 Replace two existing split condensing AC units with a new computer room split AC (2 ton) and associated ducts, diffusers, T-stat, and control wiring in SSC Lan Room 324.
- .4 Add one split condensing AC unit and associated T-stat and control wiring in SSB Media Room 354.
- .5 Add exhaust fans and associated ducts, louvers, and control system in Kitchenette 343, and Business Centre 345.
- .6 Add ventilation fans and associated ducts, louvers, and control system in Small Boardroom 356, and Lan Storage 341.
- .7 Add VAV boxes with associated electrical duct heaters, ducts, diffusers, and control system in office room 301A, 302A, 323, 325, 340, and Small Boardroom 356.
- .8 Provide balancing and commissioning for all mechanical system in the TI's renovation area.
- .9 Relocate existing sprinkler headers with associated branches to match new architectural layout.
- .10 Add new sprinkler headers with associated branches to match new architectural layout.

- .11 Replace all existing dry sprinkler headers in penthouse mechanical room which were recalled to comply with NFPA13.
- .12 Replace all existing dry sprinkler headers in parkade, basement etc. which are over 50 years old to comply with NFPA13.

#### 1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
- .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 - Shop Drawings, Product Data and Samples 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 Engineer Consultant 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 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 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 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 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.

#### 1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

#### 1.6 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.
  - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

- .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.

#### 1.7 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.

### PART 2 - PRODUCTS

#### 2.1 Not Used.

### PART 3 - EXECUTION

#### 3.1 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 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 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**

## **PART 1 – GENERAL**

- .1 Add and relocate sprinkler headers to suit architectural new ceiling plan in compliance with NFPA-13.
- .2 Replace all existing dry sprinkler headers in the building (including penthouse, parkade and basement etc.)

### **1.2 RELATED SECTIONS**

### **1.3 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Shop drawings; submit drawings (including hydronic calculation if requested) stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
- .3 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2 As-Built drawings:
    - .1 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).
    - .2 Submit to Departmental Representative for approval and make corrections as directed.

### **1.4 QUALITY ASSURANCE**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

### **1.5 MAINTENANCE**

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

### **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.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Materials and products in accordance with NFPA-13.
- .2 Do requirements in accordance with NFPA-13.

### **PART 3- EXECUTION**

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

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 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 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 Thermal insulation for piping and piping accessories in commercial type applications.
- .2 Sustainable requirements for construction and verification.

### 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 B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
  - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal 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 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 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 Submittals: in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples. 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 Section 01 33 00 - Shop Drawings, Product Data and Samples.
- .3 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
    - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
  - .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.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
    - .1 Departmental Representative Engineer Consultant will make available 1 copy of systems supplier's installation instructions.

## 1.5 QUALITY ASSURANCE

- .1 Qualifications:
- .2 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.
- .3 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety 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 Section 01 61 00 - Common Product 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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
  - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

## 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.

### 2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor:.
  - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.
  - .2 Maximum "k" factor: to.
  - .3 Design to permit periodic removal and re-installation.

### **2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

### **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 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>2</sup>.

## 2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: to match adjacent finish paint by Departmental Representative.
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Thickness: 0.50 mm.
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Special requirements:
    - .1 Indoor: 0.50 mm Speedline PVC.
    - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 ABS Plastic:
  - .1 One-piece moulded type and sheet with pre-formed shapes as required.
  - .2 Colours: to match adjacent finish paint by Departmental Representative.
  - .3 Minimum service temperatures: -40 degrees C.
  - .4 Maximum service temperature: 82 degrees C.
  - .5 Moisture vapour transmission: 0.012 perm.
  - .6 Thickness: 0.75 mm.
  - .7 Fastenings:
    - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.
  - .8 Locations:
    - .1 For outdoor use ONLY.
- .3 Canvas:
  - .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.
- .4 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: smooth stucco embossed corrugated.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- .5 Stainless steel:
  - .1 Type: 304 316.
  - .2 Thickness: 0.25 mm.
  - .3 Finish: smooth corrugated stucco embossed.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
  - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

## 2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 10 - Joint Sealants.

## 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 TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's 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.

### 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: aluminum SS PVC ABS high temperature fabric.

### 3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

### 3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: SS wire bands Tape at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: SS wire bands Tape at 300 mm on centre.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
  - .1 Insulation securements:
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .5 TIAC Code: C-2 with vapour retarder jacket.
  - .1 Insulation securements:
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code: A-2.
  - .1 Insulation securements:
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-H.
- .7 Thickness of insulation 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 degree s C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25
Refrigerant hot gas liquid suction	4 - 13	A-6	25	25	25	25	25	25
Refrigerant hot gas liquid suction	below 4	A-6	25	25	38	38	38	38
Cooling Coil cond. drain		C-2	25	25	25	25	25	25

.8 Finishes:

- .1 Exposed indoors: canvas aluminum SS PVC jacket.
- .2 Exposed in mechanical rooms: canvas aluminum SS PVC jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Outdoors: water-proof aluminum SS ABS jacket.
- .6 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.
- .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

### 3.7 FIELD QUALITY CONTROL

- .1 Verification requirements
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Resource reuse.
  - .4 Recycled content.
  - .5 Local/regional materials.
  - .6 Certified wood.
  - .7 Low-emitting materials.

### 3.8 CLEANING

- .1 Proceed in accordance with Section 01 11 55 – General Instructions.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## PART 1- GENERAL

### 1.1 REFERENCES

- .1 National Fire Prevention Association (NFPA)
  - .1 NFPA 13-2007, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 25-2008, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4 S543-M984, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Canada.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.
    - .2 Signs.SPEC NOTE: Specify which test reports are required and identify material to which they are to apply.
- .5 Test reports:
  - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .7 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
- .8 Field Quality Control Submittals:
  - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

### 1.3 CLOSEOUT SUBMITTALS

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with ANSI/NFPA 20.
- .2 Manufacturer's Catalog Data, including specific model, type, and size for: Pipe and fittings.
  - .1 Sprinkler heads.
  - .2 Pipe hangers and supports.
  - .3 Mechanical couplings.
- .3 Drawings:
  - .1 Sprinkler heads and piping system layout.
    - .1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
    - .2 Show data essential for proper installation of each system.
    - .3 Show details, plan view, elevations, and sections of systems supply and piping.
    - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
- .4 Design Data:
  - .1 Calculations of sprinkler system design.
  - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Records:
  - .1 As-built drawings of each system.
    - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
    - .2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.

- .6 Operation and Maintenance Manuals:
  - .1 Provide detailed hydraulic calculations including summary sheet, and Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

#### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company or person specializing in wet sprinkler systems with documented experience approved by manufacturer.
  - .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

#### 1.6 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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
  - .1 Store materials indoors in dry location.
  - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### PART 2 - PRODUCTS

#### 2.1 DESIGN REQUIREMENTS

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.
- .2 Location of Sprinkler Heads:
  - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary extra hazard occupancy.
  - .2 Uniformly space sprinklers on branch.

## 2.2 SUSTAINABLE REQUIREMENTS

- .1 Grooved couplings and fittings made from minimum 90% recycled metal.

## 2.3 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
  - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

## 2.4 PIPE, FITTINGS AND VALVES

- .1 Pipe:
  - .1 Ferrous: to NFPA 13.
  - .2 Copper tube: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
    - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
  - .2 Copper tube: screwed, soldered, brazed, grooved.
  - .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
  - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
  - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
  - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
  - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
  - .8 Side outlet tees using rubber gasketed fittings are not permitted.
  - .9 Sprinkler pipe and fittings: metal.
- .3 Pipe hangers:
  - .1 ULC listed for fire protection services in accordance with NFPA.

## 2.5 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
  - .1 Type A: upright bronze.
  - .2 Type B: pendant chrome link and lever type.
  - .3 Type C: pendant chrome glass bulb type.
  - .4 Type D: recessed polished satin chrome glass bulb fusible link type with ring and cup.
  - .5 Type E: flush polished satin chrome link and lever type.

- .6 Type F: side wall polished satin chrome link and lever type.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
  - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
  - .2 Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.
  - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
  - .4 Provide sprinkler heads as indicated.
  - .5 Deflector: not more than 75 mm below suspended ceilings.
  - .6 Ceiling plates: not more than 25 mm deep.
  - .7 Ceiling cups: not permitted.

## 2.6 WATER GONG

- .1 To NFPA 13 and ULC listed for fire service. Location as indicated.

## 2.7 INSPECTOR'S TEST CONNECTION

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

## 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 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with NFPA 13.

### 3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

### 3.4 DISINFECTION

- .1 Disinfect new piping and existing piping.
- .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.
- .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

### 3.5 FIELD PAINTING

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 mil, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 mil.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
  - .1 Piping in Finished Areas:
    - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
    - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
    - .3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
  - .2 Piping in Unfinished Areas:
    - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
    - .2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

### 3.6 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
  - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
  - .2 Test, inspect, and approve piping before covering or concealing.

- .3 Preliminary Tests:
  - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
  - .2 Flush piping with potable water in accordance with NFPA 13.
  - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
  - .4 Test alarms and other devices.
  - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
  - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
  - .2 Submit written request for formal inspection at least 15 days prior to inspection date.
  - .3 Repeat required tests as directed.
  - .4 Correct defects and make additional tests until systems comply with contract requirements. Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
  - .5 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### 3.7 CLEANING

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

**END OF SECTION**

## **PART 1- GENERAL**

### **1.1 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA13-2007, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 25-2011, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4 S543-M1984, Standard for Internal Lug Quick Connect Coupling for Fire Hose.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data and Samples.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems, applicable series designation or style and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Canada.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.
    - .2 Signs and valve tags.
- .5 Test reports:
  - .1 Submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .2 Test each pump/driver package at factory to provide detailed performance data and to demonstrate compliance with NFPA and specification. Submit certified test curves for approval of Departmental Representative. Test hydrostatically to meet requirements of fire protection system to which it will be connected.
- .6 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
  - .1 Instructions: provide manufacturer's installation instructions.
- .8 Field Quality Control Submittals:
  - .1 Manufacturer's Field Reports: submit manufacturer's field reports specified.

### 1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide detailed hydraulic calculations including: summary sheet, Contractor's Material and Test Certificate for aboveground piping, as well as other deliverables for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, in accordance with NFPA 13.

### 1.4 QUALITY ASSURANCE

- .1 Qualifications:
  - .1 Installer: company or person specializing in dry sprinkler systems with documented experience approved by manufacturer.
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

### 1.6 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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 - PRODUCTS

### 2.1 ENGINEERING DESIGN CRITERIA

- .1 Design system in accordance with NFPA 13, using following parameters:
  - .1 Hazard:
    - .1 To suit occupancy as indicated.
  - .2 Pipe size and layout:
    - .1 Hydraulic design.
    - .2 Sprinkler head layout: to NFPA 13 or as directed by authority having jurisdiction.
  - .3 Water supply:
    - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with NFPA 13.

- .4 Zoning:
  - .1 System zoning as indicated.

## 2.2 PIPE, FITTINGS AND VALVES

- .1 Pipe:
  - .1 Ferrous: to NFPA 13.
  - .2 Copper tube: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
    - .1 Grooved joints designed with two ductile iron housing segments, flush seal gasket for dry service, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
  - .2 Copper tube: screwed, soldered, brazed, grooved.
- .3 Auxiliary valves:
  - .1 ULC listed for fire protection service.
  - .2 Up to NPS 2: bronze, screwed ends, grooved, OS & Y gate.
  - .3 NPS 2 1/2 and over: cast or ductile iron, flanged or roll grooved ends, indicating butterfly valve.
  - .4 Swing or spring-actuated check valves.
  - .5 Ball drip.
  - .6 Tamper devices wired back to fire alarm panel.
- .4 Pipe hangers:
  - .1 ULC listed for fire protection services.

## 2.3 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.

## 2.4 SPRINKLER HEAD TYPE A

- .1 Upright bronze.

## 2.5 SPRINKLER HEAD TYPE B

- .1 Pendant chrome link and lever type.

## 2.6 SPRINKLER HEAD TYPE C

- .1 Pendant chrome glass bulb type.

## 2.7 SPRINKLER HEAD TYPE D

- .1 Recessed polished satin chrome glass bulb-fusible link type with ring and cup.

## 2.8 SPRINKLER HEAD TYPE E

- .1 Flush polished satin chrome link and lever type.

## **2.9 SPRINKLER HEAD TYPE F**

- .1 Side wall polished satin chrome link and lever type.

## **2.10 AUXILIARY SUPERVISORY SWITCHES**

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Flow switch type:
  - .1 With normally open and normally closed contacts and supervisory capability.
- .4 Pressure alarm switch:
  - .1 With normally open and normally closed contacts and supervisory capability.

## **2.11 WATER GONG**

- .1 To NFPA 13 and ULC listed for fire service. Location as indicated.

## **2.12 SPARE PARTS CABINET**

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Construct to sprinkler head manufacturers standard.

## **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 INSTALLATION**

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.
- .2 Testing to be witnessed by authority having jurisdiction.
- .3 Install water gong as indicated.
- .4 Install fire department connections as indicated.
- .5 Install spare parts cabinet as indicated.
- .6 Pressure gauges:
  - .1 Location:
    - .1 On water side and air nitrogen side of dry pipe valve.
    - .2 At air receiver.
    - .3 In each independent pipe from air supply to dry pipe valve.
    - .4 At exhausters and accelerators.

- .2 Install to permit removal.
- .3 Locate so as not subjected to freezing.
- .7 Valve identification:
  - .1 Identify drain valve, by-pass valves and main shut-off valve and all auxiliary valves.

### 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 - 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### 3.4 CLEANING

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

**END OF SECTION**