

---

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 23 05 01 – Common Work Results for Mechanical.

**1.2            REFERENCES**

- .1        American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1            ANSI/AWWA C111/A21.11-07, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .2            ANSI B 36.19M-04 Stainless Steel Pipe
- .2        American Society of Mechanical Engineers (ASME)
  - .1            ASME B16.3-16, Malleable Iron Threaded Fittings: Classes 150 and 300.
  - .2            ASME B 16.9-18, Factory-Made Wrought Butt Welding Fittings.
- .3        ASTM International
  - .1            ASTM A 47/A 47M-99(2018), Standard Specification for Ferritic Malleable Iron Castings.
  - .2            ASTM B 61-15, Standard Specification for Steam or Valve Bronze Castings.
  - .3            ASTM A 53/A 53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
  - .4            ASTM A 312/A 312M-21, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .5            ASTM A 536-84(2019), Standard Specification for Ductile Iron Castings.
- .4        Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .5        Canadian Standards Association (CSA International)
  - .1            CSA B139-19, Installation Code for Oil Burning Equipment.
  - .2            CSA B242-05(R2021), Groove and Shoulder Type Mechanical Pipe Couplings.
  - .3            CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .6        National Fire Code of Canada (NFCC 2015)
- .7        Manufacturer's Standardization of the Valve and Fittings Industry (MSS)

**Part 2            Products**

**2.1            PIPE**

- .1        Steam:
    - .1            Seamless stainless steel pipe: to A 312/A 312M, Schedule 40S.
  - .2        Chilled/hot water:
-

- .1 Steel pipe: to ASTM A 53/A 53M, Grade B, Schedule 40.
- .3 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B 88M.
- .4 Drainage, condensation:
  - .1 Cast Iron DWV
  - .2 Copper DWV (pipes 32mm diameter and larger)
  - .3 Copper type L (pipes smaller than 32mm diameter)

## 2.2 PIPE JOINTS

- .1 Steel Piping:
  - .1 DN 50 and under: welding fittings and flanges to CSA W48.
  - .2 DN 65 and over: welding fittings and flanges to CSA W48.
  - .3 Screwed fittings shall be acceptable on DN 50 and under where indicated for ease of servicing.
- .2 Copper Piping:
  - .1 Brazed 95:5 silver solder to ANSI/AWS A5.8
- .3 Flanges: weld neck
- .4 Orifice flanges: slip-on raised face, 2100 kPa.
- .5 Flange gaskets: to ANSI/AWWA C111/ A21.11.
- .6 Pipe thread: taper.
- .7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .8 Roll grooved fittings shall not be acceptable.

## 2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ASME B16.9, Class 150.
- .2 Pipe flanges and flanged fittings:
  - .1 Stainless steel: to ASME B16.9.
  - .2 Brass or bronze
  - .3 Cast Iron
- .3 Butt-welding fittings: ASME B16.9.
- .4 Unions: malleable iron, to ASTM A 47/A 47M and ASME B16.3.
- .5 Wrought copper and copper alloy solder joint pressure fittings to ANSI/ASME B 16.4.

## 2.4 THERMAL INSULATION FOR PIPING

- .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 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 C 335.
    - .3 Minimum thickness: 25mm, unless specified otherwise.
    - .4 Thickness: As per ASHRAE 90.1 latest version.
  - .2 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
    - .1 Mineral fibre: to CAN/ULC-S702.
    - .2 Maximum "k" factor: to CAN/ULC-S702.
  - .3 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
    - .1 Mineral fibre: to CAN/ULC-S702.
    - .2 Jacket: to CGSB 51-GP-52Ma.
    - .3 Maximum "k" factor: to CAN/ULC-S702.
  - .4 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket.
    - .1 Mineral fibre: to CAN/ULC-S702.
    - .2 Jacket: to CGSB 51-GP-52Ma.
    - .3 Maximum "k" factor: to CAN/ULC-S702.
  - .5 Insulation securement
    - .1 Tape: self-adhesive, aluminum, 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, 19mm wide, 0.5 mm thick.
  - .6 Cement
    - .1 Thermal insulating and finishing cement:
      - .1 Hydraulic setting on mineral wool, to ASTM C 449/C 449M.
  - .7 Vapour retarder lap adhesive
    - .1 Water based, fire retardant type, compatible with insulation.
  - .8 Indoor vapour retarder finish
    - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .9 Jackets
    - .1 Aluminum:
      - .1 To ASTM B 209.
      - .2 Thickness: 0.50 mm sheet.
-

- .3 Finish: 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, 0.5mm thick at 300 mm spacing.

## **2.5 THERMOMETERS**

- .1 Industrial, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB 14.4 & ASME B40.200.
- .2 Thermometer wells shall be copper for copper piping and brass for steel piping.

## **2.6 PRESSURE GAUGES**

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

## **2.7 VALVES**

- .1 DN 50 and smaller: ends for soldering.
- .2 DN 65 and larger: flanged.
- .3 Butterfly valves: for isolation on systems DN 65 and larger
- .4 Globe valves: used for throttling or flow control.
- .5 Circuit Balancing Valves: calibrated balancing valves for flow balancing.
- .6 Ball Valves: for isolation on DN50 and under.

## **2.8 AUTOMATIC AIR VENTS**

- .1 Standard float type: brass body and DN 6 connection and rated at 310 kPa working pressure.

## **2.9 PIPE STRAINER**

- .1 DN 50 and smaller: bronze body to ASTM B 62 soldered ends, y pattern.
- .2 DN 65 and larger: cast iron body to ASTM A 278/A 278 M, class 30, flanged connections.
- .3 Blowdown connections 25mm.
- .4 Stainless steel screen with 1.19mm perforations.

## **Part 3 Execution**

### **3.1 THERMOMETERS**

- .1 Install so they can be easily read from floor.
- .2 Install between equipment and first isolation valve.

- .3 Install in wells on piping with heat conductive paste inside well.
- .4 Install on inlet and outlet of all coils.
- .5 Use extensions where installed through thermal insulation.

### **3.2 PRESSURE GAUGES**

- .1 Install as follows:
  - .1 Inlet and outlet of coil
  - .2 Upstream and downstream of control valves
  - .3 As indicated
- .2 Install ball valves for isolation of pressure gauges.
- .3 Use extension where installed through thermal insulation.

### **3.3 CONNECTIONS TO EQUIPMENT**

- .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/disassembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

### **3.4 CLEARANCES**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicate (whichever is greater) without interrupting operation of other system, equipment, and components.

### **3.5 DRAINS**

- .1 Install piping with in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
  - .1 Discharge to be visible.
- .4 Drain valves: DN 20 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

### **3.6 AIR VENTS**

- .1 Install air vents at high points in piping systems.
- .2 Install isolating ball valve at each automatic air valve.

---

**3.7 DIELECTRIC COUPLINGS**

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 DN 50 and under: isolating unions or bronze valves.
- .4 Over DN 50: isolating flanges.

**3.8 PIPE WORK INSTALLATION**

- .1 Screwed fittings jointed with Teflon tape.
  - .2 Protect openings against entry of foreign material.
  - .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
  - .4 Assemble piping using fittings manufactured to ANSI standards.
  - .5 Saddle type branch fittings will not be permitted. A proper fitting with new connection shall be welded into the existing supply pipe.
  - .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
  - .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
  - .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
  - .9 Group piping wherever possible.
  - .10 Ream pipes, remove scale and other foreign material before assembly.
  - .11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
  - .12 Provide for thermal expansion as required.
  - .13 Valves:
    - .1 Install in accessible locations.
    - .2 Remove interior parts before soldering.
    - .3 Install with stems above horizontal position unless indicated.
    - .4 Valves accessible for maintenance without removing adjacent piping.
    - .5 Install globe valves in bypass around control valves.
    - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where specified.
    - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
    - .8 Provide stem handle extensions as required to allow for clearance to insulation.
    - .9 Layout valves to ensure full stroke of valve handle. No modifications of valves handles will be permitted to allow for full valve actuation.
-

---

### 3.9 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for fire stopping.
    - .2 Maintain fire rating integrity.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.

### 3.10 PREPARATION FOR FIRE STOPPING

- .1 Install fire stopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

### 3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Before start-up, clean interior of new piping systems.
  - .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
  - .3 Contractor shall allow for additional isolation valves, connection points, bypass connection and circulator to ensure complete flushing and cleaning of new piping systems.
  - .4 Prior to commencement of work provide Department Representative with proposed flushing and cleaning procedures including list of chemicals used and concentrations. Procedure shall be reviewed and approved by Department Representative.
-

---

**3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK**

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate work only after approval and certification of tests by Departmental Representative.

**3.13 EXISTING SYSTEMS**

- .1 Connect into existing piping systems at times approved by Departmental Representative. Be responsible for damage to existing plant by this work.

**3.14 PIPE THERMAL INSULATION**

- .1 Insulate all heating and steam piping to TIAC code A1 c/w aluminum jacketing. Thickness shall be as per ASHRAE 90.1 with a minimum thickness of 25mm.
- .2 Insulate all chilled water piping to TIAC code A3 c/w aluminum jacketing. Thickness shall be as per ASHRAE 90.1 with a minimum thickness of 25mm.
- .3 Provide removable pre-fabricated insulation enclosures for all valves, flanges and unions. Pre-fabricated enclosures to match TIAC code and jacketing of system.

**3.15 AUTOMATIC AIR VENTS**

- .1 Provide at high points of the systems and coil headers.
- .2 Provide ball isolation valve on all air vents.