

---

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Pressure gauges and pressure gauge taps.

**1.2                REFERENCES**

- .1            ASME B40.100 - Pressure Gauges and Gauge Attachments.

**1.3                SUBMITTALS FOR REVIEW**

- .1            Section 21 05 00: Procedures for submittals.
- .2            Product Data: Provide list which indicates use, operating range, total range and location for manufactured components.

**1.4                SUBMITTALS AT PROJECT CLOSEOUT**

- .1            Section 21 05 00: Submittals for project closeout.
- .2            Project Record Documents: Record actual locations of components and instrumentation.

**1.5                ENVIRONMENTAL REQUIREMENTS**

- .1            Section 21 05 00: Environmental conditions affecting products on Site.
- .2            Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

**1.6                EXTRA MATERIALS**

- .1            Section 21 05 00: Submittals for project closeout.
- .2            Provide two bottles of red gauge oil for static pressure gauges.

**Part 2            Products**

**2.1                PRESSURE GAUGES**

- .1            Manufacturers:
  - .1            Winters.
  - .2            Terice.
  - .3            Ashcroft.
  - .4            Substitutions: in accordance with B7.
- .2            Gauge: ASME B40.1, painted black steel, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

- .1 Case: Steel with bronze or brass bourdon tube.
- .2 Gauges shall be dry – no glycerine or silicone fill.
- .3 Size: 152 mm (6 inch ) diameter dial - thermometers located above 3000 mm (10'-0") above finished floor.
- .4 Range: gauges shall be selected based on the application to show twice the normal operating pressure with indicating needle at 12 o'clock position for normal operating pressure.
- .5 Mid-Scale Accuracy: One percent (1%) of full span.
- .6 Scale: Both psi and kPa with psi prominent figure.

## **2.2 PRESSURE GAUGE TAPPINGS**

- .1 Gauge Cock: Tee or lever handle, brass for maximum 1034 kPa (150 psig).
- .2 Needle Valve: Brass 6 mm (1/4 inch) NPT for minimum 1034 kPa (150 psig).
- .3 Pulsation Damper: Pressure snubber, brass with 6 mm (1/4 inch) connections.
- .4 Syphon for gauges on steam systems: Stainless-steel shut-off ball valve complete with 1/4" NPT stainless-steel coil syphon rated minimum 1723 kPa (250 psig) working pressure.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Install positive displacement meters with isolating valves on inlet and outlet. Provide full line size valved bypass with globe valve for liquid service meters.
- .3 Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- .4 Install pressure gauges with pulsation dampers. Provide needle valve to isolate each gauge. Provide syphon on gauges in steam systems. Extend nipples and syphons to allow clearance from insulation.
- .5 Gauges subject to vibration shall have copper tube extension and shall be located away from source of vibration; preferably on an adjacent wall or other stable mounting surface.
- .6 Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 60 mm (2-1/2 inch) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- .7 Install thermometers with back or bottom inlet stems, depending on which is better for ease of reading.
- .8 Brass separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stems and wells to be immersed in liquid flow, minimum length of stems to be 152mm.

- .9 Where a separable well is mounted in pipe 38mm diam. or less, enlarge pipe to 50mm diam. for well length plus 76mm.
- .10 Install thermometers in air duct systems on flanges.
- .11 Dial thermometers to be installed on air handling units on outside-air ducts, mixed air ducts, and supply-air ducts.
- .12 Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- .13 Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.
- .14 Install static pressure gauges at all built-up filter banks, unitary filter sections, and supply fan discharge.
- .15 Coil and conceal excess capillary on remote element instruments.
- .16 Provide instruments with scale ranges selected according to service with largest appropriate scale.
- .17 Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- .18 Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- .19 Locate test plugs adjacent to control device sockets.

**END OF SECTION**

---

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1      Nameplates.
- .2      Tags.
- .3      Stencils.
- .4      Pipe Markers.

**1.2                REFERENCES**

- .1      ASME A13.1 - Scheme for the Identification of Piping Systems.
- .2      CAN/CGSB 24.3 – Identification of Piping Systems

**1.3                SUBMITTALS**

- .1      Section 21 05 00: Procedures for submittals.
- .2      Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .3      Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- .4      Product Data: Provide manufacturers catalogue literature for each product required.
- .5      Manufacturer's Installation Instructions: Indicate special procedures, and installation.

**1.4                PROJECT RECORD DOCUMENTS**

- .1      Section 21 05 00: Submittals for project closeout.
- .2      Record actual locations of tagged valves.

**Part 2            Products**

**2.1                NAMEPLATES**

- .1      Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

**2.2                TAGS**

- .1      Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm (1-1/2 inch) diameter.

- .2 Chart: Typewritten letter size list in anodized aluminum frame.

### **2.3 STENCILS**

- .1 Stencils: With clean cut symbols and letters of following size:
  - .1 20-30 mm (3/4 to 1-1/4 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 15 mm (1/2 inch) high letters.
  - .2 40-50 mm (1-1/2 to 2 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 20 mm (3/4 inch) high letters.
  - .3 65-150 mm (2-1/2 to 6 inch) Outside Diameter of Insulation or Pipe: 300 mm (12 inch) long colour field, 30 mm (1-1/4 inch) high letters.
  - .4 200-250 mm (8 to 10 inch) Outside Diameter of Insulation or Pipe: 600 mm (24 inch) long colour field, 65 mm (2-1/2 inch) high letters.
  - .5 Over 250 mm (10 inch) Outside Diameter of Insulation or Pipe: 800 mm (32 inch) long colour field, 90 mm (3-1/2 inch) high letters.
  - .6 Ductwork and Equipment: 65 mm (2-1/2 inch) high letters.

### **2.4 PIPE MARKERS**

- .1 Colour: Conform to ASME A13.1.
- .2 Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- .3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- .4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm (6 inches) wide by 0.10 mm (4 mil) thick, manufactured for direct burial service.

### **2.5 CEILING TACKS**

- .1 Description: Steel with 20 mm (3/4 inch) diameter colour coded head.
- .2 Colour code as follows:
  - .1 Yellow - HVAC equipment
  - .2 Red - Fire dampers/smoke dampers
  - .3 Green - Plumbing valves
  - .4 Blue - Heating/cooling valves

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Degrease and clean surfaces to receive adhesive for identification materials.

---

**3.2           INSTALLATION**

- .1       Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- .2       Install tags with corrosion resistant chain.
- .3       Install plastic pipe markers to manufacturer's written instructions.
- .4       Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.
- .5       Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .6       Identify control panels and major control components outside panels with plastic nameplates.
- .7       Identify valves in main and branch piping with tags.
- .8       Tag automatic controls, instruments, and relays. Key to control schematic.
- .9       Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 20 mm (3/4 inch) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6 m (20 feet) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**

---

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Piping insulation.
- .2            Jackets and accessories.

**1.2                RELATED SECTIONS**

- .1            Section 22 10 00 - Plumbing Piping: Placement of hangers and hanger inserts.
- .2            Section 23 05 53 - Mechanical Identification.
- .3            Section 23 21 00 - Hydronic Piping: Placement of hangers and hanger inserts.

**1.3                REFERENCES**

- .1            ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .2            ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .3            ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .4            ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- .5            ASTM C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.
- .6            ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .7            ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .8            ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .9            ASTM C547 - Mineral Fibre Pipe Insulation.
- .10           ASTM C552 - Cellular Glass Thermal Insulation.
- .11           ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.
- .12           ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- .13           ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.
- .14           ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.

- .15 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .16 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- .17 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- .18 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- .19 ASTM E84 - Surface Burning Characteristics of Building Materials.
- .20 ASTM E96 - Water Vapour Transmission of Materials.
- .21 CAN/ULC-S102-M88 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .22 NFPA 255 - Surface Burning Characteristics of Building Materials.
- .23 UL 723 - Surface Burning Characteristics of Building Materials.

#### **1.4 QUALITY ASSURANCE**

- .1 Materials: Flame spread/smoke developed rating of 25/50 or less to ASTM E84; NFPA 255; UL 723.

#### **1.5 QUALIFICATIONS**

- .1 Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

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

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Deliver materials to Site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Store insulation in original wrapping and protect from weather and construction traffic.
- .4 Protect insulation against dirt, water, chemical, and mechanical damage.

#### **1.7 ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .2 Maintain temperature during and after installation for minimum period of 24 hours.

---

**Part 2 Products**

**2.1 GLASS FIBRE PRE-FORMED PIPE INSULATION WITH ALL-SERVICE JACKET**

- .1 Manufacturers:
  - .1 Johns Manville Micro-Lok.
  - .2 Knauf Earthwool 1000.
  - .3 Owens Corning FIBREGLAS.
  - .4 Substitutions: Refer to Section 21 05 00.
- .2 Insulation: ASTM C547; rigid moulded, non-combustible.
  - .1 'ksi' ('K') value : ASTM C335, 0.035 at 24 degrees C (0.24 at 75 degrees F).
  - .2 Minimum Service Temperature: -28.9 degrees C (-20 degrees F).
  - .3 Maximum Service Temperature: 454 degrees C (850 degrees F).
  - .4 Maximum Moisture Absorption: 0.2 percent by volume.
- .3 Vapour Barrier Jacket
  - .1 ASTM C921, White kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
  - .2 Moisture Vapour Transmission: ASTM E96; 0.03 ng/(Pa s sq m) (0.02 perm inches).
  - .3 Secure with self sealing longitudinal laps and butt strips.
  - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Tie Wire: 1.3 mm (18 gauge) stainless steel with twisted ends on maximum 300 mm (12 inch) centres.
- .5 Vapour Barrier Lap Adhesive
  - .1 Compatible with insulation.

**2.2 JACKETS**

- .1 Canvas Jacket: UL listed
  - .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
  - .2 Lagging Adhesive
    - .1 Bakelite 120-18 white fire retardant lagging adhesive.
  - .3 Coating
    - .1 Finish with two full brush coats of Bakelite 120-09 white fire retardant paint.

---

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verify that piping has been tested before applying insulation materials.
- .2 Verify that surfaces are clean, foreign material removed, and dry.

**3.2 INSTALLATION**

- .1 Install materials to manufacturer's written instructions.
- .2 On exposed piping, locate insulation and cover seams in least visible locations.
- .3 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
  - .1 Provide vapour barrier jackets, factory applied or field applied.
  - .2 Insulate fittings, joints, and valves with moulded insulation of like material and thickness as adjacent pipe.
  - .3 Finish with glass cloth and vapour barrier adhesive.
  - .4 PVC fitting covers may be used.
  - .5 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
  - .6 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- .4 For insulated pipes conveying fluids above ambient temperature:
  - .1 Provide standard jackets, with or without vapour barrier, factory applied or field applied.
  - .2 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
  - .3 Finish with glass cloth and adhesive.
  - .4 PVC fitting covers may be used, except on steam and condensate piping systems.
  - .5 For hot piping conveying fluids 60 degrees C (140 degrees F) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
  - .6 For hot piping conveying fluids over 60 degrees C (140 degrees F), insulate flanges and unions at equipment.
- .5 Inserts and Shields:
  - .1 Application: Piping 40 mm (1-1/2 inches) diameter or larger.
  - .2 Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - .3 Insert Location: Between support shield and piping and under the finish jacket.
  - .4 Insert Configuration: Minimum 150 mm (6 inches) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - .5 Insert Material: hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- .6 Finish insulation at supports, protrusions, and interruptions.

- .7 Pipe supports:
- .1 All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier shall be continuous, including material covered by the hanger saddle.
  - .2 Piping systems 3" (75 mm) in diameter or less may be supported by placing saddles of the proper length and spacing under the insulation as designated by the insulation manufacturer.
  - .3 For hot or cold piping systems larger than 3" (75 mm) in diameter, operating at temperatures less than +200F (93C) and insulated with fiber glass, high density inserts such as fiberglass or foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200F (93C), high temperature pipe insulation shall be used for high density inserts.
  - .4 Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
  - .5 On vertical runs, insulation support rings shall be used as required.
- .8 For pipe exposed in mechanical equipment rooms or in finished spaces below 3 metres (10 feet) above finished floor, finish with canvas jacket sized for finish painting.
- .9 Fittings and Valves
- .1 Shall be insulated with pre-formed fiberglass fittings, fabricated sections of fiberglass pipe insulation. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings.
  - .2 Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
  - .3 On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion. Valve handle extensions are recommended.

### 3.3 ACCESSORY MATERIALS

- .1 All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

**3.4 TOLERANCE**

- .1 Substituted insulation materials: Thermal resistance within 10 percent at normal conditions, as materials indicated.

**3.5 FIBROUS GLASS INSULATION SCHEDULE**

	<b>PIPING SYSTEMS</b>	<b>PIPE SIZE</b> <Inch><mm>	<b>THICKNESS</b> <Inch><mm>
<b>Plumbing Systems</b>			
	Domestic Cold Water, medical gas piping	> 2" (50mm)	1 1/2" (38mm)
<b>Heating Systems</b>			
	Heating water & glycol supply and return, low pressure steam, steam condensate	=< 2" (50mm)	1" (25mm)
	Heating water & glycol supply and return, low pressure steam, steam condensate	> 2" (50mm)	1-1/2" (38mm)

**END OF SECTION**

---

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1    Pipe and pipe fittings for:
  - .1        Heating water piping system.
- .2    Valves:
  - .1        Gate valves.
  - .2        Globe or angle valves.
  - .3        Ball valves.
  - .4        Plug valves.
  - .5        Butterfly valves.
  - .6        Check valves.

**1.2                RELATED SECTIONS**

- .1    Section 23 05 53 - Mechanical Identification.
- .2    Section 23 07 19 - Piping Insulation.

**1.3                REFERENCES**

- .1    ASME -Welding and Brazing Qualifications.
- .2    ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
- .3    ASME B31.9 - Building Services Piping.
- .4    ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .5    ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .6    AWS D1.1 - Structural Welding Code - Steel.

**1.4                SYSTEM DESCRIPTION**

- .1    Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .2    All valves must be installed with stems upright or horizontal; not inverted.
- .3    Valve body materials shall be compatible with piping system materials. Valves shall meet all pressure, temperature, and fluid handling requirements of the system.

- .4 Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- .5 Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- .6 Provide pipe hangers and supports to ASTM B31.9 unless indicated otherwise.
- .7 Use spring loaded check valves on discharge of pumps.
- .8 Use lug end butterfly valves to isolate equipment.

## **1.5 SUBMITTALS**

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Welders Certificate: Include welders certification of compliance with ASME SEC 9 and applicable provincial labour regulations.
- .4 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

## **1.6 PROJECT RECORD DOCUMENTS**

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of valves.

## **1.7 OPERATION AND MAINTENANCE DATA**

- .1 Submit to Section 21 05 00.
- .2 Include valve schedule complete with valve tags, location, service, normally open/normally closed.
- .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

## **1.8 QUALIFICATIONS**

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 All carbon steel pipe and fittings shall be manufactured in Canada or the United States of America. This does not include stainless steel.
- .3 Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.

- .4 Welders: Certify to ASME SEC 9 and applicable provincial labour regulations.

### **1.9 REGULATORY REQUIREMENTS**

- .1 All pressure piping systems for use in Manitoba shall be designed and constructed in accordance with the applicable ANSI/ASME Piping Codes and the Manitoba Labour and Immigration, Steam and Pressure Plants Act.
- .2 Conform to ASME B31.9 code for installation of piping system.
- .3 Welding Materials and Procedures: Conform to ASME SEC 9 and applicable provincial labour regulations.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

### **1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### **1.11 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install underground piping when bedding is wet or frozen.

### **1.12 EXTRA MATERIALS**

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two repacking kits for each size and valve type.

## **Part 2 Products**

### **2.1 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND**

- .1 Steel Pipe: ASTM A53, Schedule 40, black.
- .1 Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
- .2 Joints: Threaded, or AWS D1.1, welded.

---

**2.2 UNIONS, FLANGES, AND COUPLINGS**

- .1 Flanges for Pipe Over 50 mm(2 inches):
  - .1 Ferrous Piping: 1034 kPa (150 psig) forged steel, slip-on.
  - .2 Copper Piping: Bronze.
  - .3 Gaskets: 1.6 mm(1/16 inch) thick preformed neoprene.
- .2 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

**2.3 BUTTERFLY VALVES**

- .1 Manufacturers:
  - .1 Demco
  - .2 Kitz
  - .3 Mueller
  - .4 Substitutions: in accordance with B7.
- .2 Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- .3 Disc: Stainless Steel.
- .4 Operator: 10 position lever handle. Valves 8" and larger shall have gear operator with position indicator.

**2.4 SPRING LOADED CHECK VALVES**

- .1 Manufacturers:
  - .1 Mueller 71 Series
  - .2 Moygro W12A-I6V (single plate)
  - .3 Substitutions: in accordance with B7.
- .2 Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

**2.5 SWING CHECK VALVES**

- .1 Over 50 mm (2 inches):
  - .1 Manufacturers:
    - .1 Red-White/Toyo
    - .2 Kitz
    - .3 Substitutions: in accordance with B7.
  - .2 Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

---

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.
- .4 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .5 After completion, fill, clean, and treat systems.

**3.2 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Install heating water, glycol, chilled water, and condenser water piping to ASME B31.9.
- .3 Route piping in orderly manner, parallel to building structure, and maintain gradient. Grade hydronic piping up in flow direction or as noted.
- .4 Install piping to conserve building space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.
- .6 Sleeve pipe passing through partitions, walls and floors.
- .7 Slope piping and arrange to drain at low points.
- .8 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .9 Install drain valves (ball valves) c/w hose and cap and chain on each pump (pipe to nearest floor drain), at system low points so that entire system can be drained, and at each zone or branch / riser isolation valve so branch or riser can be drained down completely.
- .10 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- .11 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- .12 Install valves with stems upright or horizontal, not inverted.
- .13 Isolation valves, complete with unions or flanges, shall be provided at junctions or branches of piped HVAC systems and shall be readily accessible.

**3.3 Pressure Testing**

- .1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.
- .2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.
- .3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.
- .4 Hydronic pipe testing shall be in accordance with the applicable ASME piping code, the Contractor's registered Quality Assurance Program (for systems where applicable), and all requirements of the Department of Labour .
- .5 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.
- .6 Test piping system in sections as required by the progress of work.
- .7 Subject piping to a hydrostatic pressure of at least that 1-½ times the operating pressure of the system for a period of at least 12 hours. If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by Contract Administrator or the City's representative) reports to the Contract Administrator.
- .8 Register pressures at the highest system point.
- .9 Provide at least 48 hours (during working days) notice to Contract Administrator or the City's Representative prior to testing to allow the tests to be witnessed.

**END OF SECTION**

---

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Vertical in-line pumps.

**1.2                RELATED SECTIONS**

- .1            Section 23 07 19 - Piping Insulation.
- .2            Section 23 21 00 - Hydronic Piping.

**1.3                REFERENCES**

- .1            UL 778 - Motor-Operated Water Pumps.

**1.4                PERFORMANCE REQUIREMENTS**

- .1            Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

**1.5                SUBMITTALS**

- .1            Section 21 05 00: Procedures for submittals.
- .2            Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- .3            Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

**1.6                PROJECT RECORD DOCUMENTS**

- .1            Section 21 05 00: Procedures for submittals.
- .2            Record actual locations of hydronic pumps.

**1.7                OPERATION AND MAINTENANCE DATA**

- .1            Section 21 05 00: Procedures for submittals.
- .2            Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

**1.8                QUALITY ASSURANCE**

- .1            Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three (3) years documented experience.

---

**1.9 REGULATORY REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**1.10 EXTRA MATERIALS**

- .1 Section 21 05 00: Procedures for submittals.
- .2 Provide one set of mechanical seals for each pump.
- .3 Provide 2 sets of cartridges for each side-stream filter.

**Part 2 Products**

**2.1 MANUFACTURERS**

- .1 Bell & Gossett
- .2 Grundfos
- .3 Armstrong
- .4 Taco
- .5 Substitutions: Refer to Section 21 05 00.

**2.2 VERTICAL IN-LINE PUMPS**

- .1 Type: Vertical, single stage, close coupled, radially split casing, for in-line mounting, for 1200 kPa (175 psig) working pressure at 107 degrees C (225 degrees F).
- .2 Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- .3 Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
- .4 Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
- .5 Seal: Carbon rotating against a stationary ceramic seat, EPT Tungsten/Carbide seal, 120 degrees C (250 degrees F) maximum continuous operating temperature.
- .6 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
- .7 Each pump shall be factory tested and name-plated before shipment.
- .8 Pumps shall conform to ANSI/HI standard for Preferred Operating Region (POR) unless otherwise approved by the Contract Administrator. The pump NPSH shall conform to the ANSI/HI standards for Centrifugal and Vertical Pumps for NPSH Margin.

---

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Verify that electric power is available and of the correct characteristics.

**3.2 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Provide the necessary access space around components to allow for servicing, repair, replacement as well as for the balancing technician to take proper readings. Provide no less than minimum as recommended by manufacturer
- .3 Pumps shall be sized on the capacities, heads, motor sizes and RPM specified, impeller size selected shall not be greater than 85% of the maximum size impeller.
- .4 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 102 mm (4 inches) and over.
- .5 Provide line sized shut-off valve, and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
- .6 Provide a minimum of 5x suction diameter of pipe on pump suction of pipe size shown on drawings
- .7 Lubricate pumps before start-up.

**END OF SECTION**