

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 11 - Cleaning.
- .2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 DRAWINGS AND SPECIFICATIONS

- .1 The existing buried piping and conduit infrastructure (i.e., GPS locate) information indicated on the Design Drawings was determined by Stantec. The Contractor shall review and verify this information prior to ordering the new buried piping and fittings.

1.4 INTERFERENCE

- .1 Below-grade piping interferences shall be discovered, coordinated, and resolved prior to ordering the new piping materials.

Part 2 Products

2.1 PAINT

- .1 Primer: carbozinc 859.
- .2 Epoxy: carboguard 880.
- .3 Top coat: carbothane 134HG polyurethane.

2.2 CORROSION INHIBITOR

- .1 Corrosion inhibitor used shall be GE Corrshield MD 4100 DC3.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

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

3.3 AIR VENTS

- .1 Install manual air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.4 EXISTING PIPEWORK

- .1 Demolish existing piping from within the vault to the Ellis Building.
- .2 Install caps on the existing piping in the vault to the Coastguard building, and refill with water for the course of construction.
- .3 Connect new piping to existing piping with a butt weld joint.

3.5 PIPEWORK INSTALLATION

- .1 Protect openings against entry of foreign material.
- .2 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install exposed piping parallel or perpendicular to building lines.
- .5 Install concealed pipe work to minimize furring space, maximize headroom, and conserve space.
- .6 Where the new insulated and jacketed district energy piping penetrates the existing vault, the Contractor shall make the end seal absolutely water-tight.
- .7 Connect new piping to existing piping with a butt weld joint.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.

- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Use butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
 - .6 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .7 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

3.6 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and un-insulated pipe or 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 (including concrete vault chamber): Use "Link-Seal" piping penetrations for all penetrations. Fire retardant, waterproof non-hardening mastic, where required for fire separation integrity.
 - .2 Elsewhere: Provide space for fire-stopping. 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.

3.7 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.8 PAINT

- .1 Apply anti-rust/anti-corrosive paint to all new and existing exposed Schedule 40 steel piping, valves, and fittings within the existing below-grade vault.
- .2 Sand and prepare the piping surface prior to paint application in accordance with manufacturer's recommendations.
- .3 Apply one (1) coat of carbozinc 859 (primer), one (1) coat of carboguard 880 epoxy, and one (1) coat of carbothane 134HG polyurethane (top coat).

3.9 PREPARATION FOR FIRESTOPPING

- .1 Un-insulated unheated pipes not subject to movement: No special preparation.
- .2 Un-insulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging Fire-Stopping material or installation.
- .3 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified herein.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF NEW PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipe work: Test as specified in relevant sections specified herein.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of specified herein.
- .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 or conceal work only after approval and certification of tests by the Departmental Representative.

- .8 Pressure testing of the below grade, direct-bury, insulated heating and cooling piping shall be done in sections, such that piping exposure is minimized, and site excavation/trenches can be quickly in-filled/back-filled. To do this, the Contractor shall install blank/blind pipe flanges, pressure test the piping, and then backfill the trenching after testing has been witnessed, signed off and accepted. The Contractor shall make allowances for this sectional piping pressure test procedure to be commenced every 12.2 meters.
- .9 All new below grade, direct-bury, insulated heating and cooling piping shall be pressure tested prior to being connected into existing piping. Following connection with existing piping, the entire system shall be pressure tested from the central heating plant to the Canadian Coast Guard building.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by the Departmental Representative.
- .2 Request written approval ten (10) days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing facility by this work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
 - .1 ANSI/ASME B31.1-2020, Power Piping.
 - .2 ANSI/ASME B31.3-2020, Process Piping Addenda A.
 - .3 ANSI/ASME B31.3-2020, Process Piping Addenda B.
 - .4 ANSI/ASME Boiler and Pressure Vessel Code-2021:
 - .1 Section I: Power Boilers.
 - .2 Section V: Non-destructive Examination.
 - .3 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA).
 - .1 ANSI/AWWA C206-17, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS).
 - .1 AWS C1.1-2012, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-2012, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1-2015, Welding Inspection Handbook.
- .4 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.
- .5 Canadian Standards Association (CSA International).
 - .1 CSA W47.2-11(R2020), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-2018, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-2019, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-2019, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2018, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-2018, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

- .1 Welders
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to the Departmental Representative for review.

- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors
 - .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

- .1 Registration of welding procedures in accordance with CSA B51.
- .2 Copy of welding procedures available for inspection.
- .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.1, B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1 and applicable requirements of the Provincial Authority Having Jurisdiction.

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with the Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with the Departmental Representative.

- .3 Do not conceal welds until they have been inspected, tested and approved by the inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General
 - .1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by the Departmental Representative.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 20% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and spot full gamma ray radiographic (hereinafter referred to as "radiography") tests]. Must be done after hours.
- .2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by the Departmental Representative of total of up to 20% of welds, selected at random by the Departmental Representative by particle tests.
- .5 Full magnetic particle tests or radiographic tests for district heating piping systems and district chilled water piping systems.
 - .1 Spot radiography to CAN/CGSB-48.2.
 - .1 Conduct spot radiographic tests of up to 20% of welds, selected at random by the Departmental Representative from welds, which would be most difficult to repair in event of failure after system is operational.
 - .2 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder, and submit to the Departmental Representative. Replace film if rejected because of poor quality.
 - .3 Interpretation of radiographic films:
 - .1 By qualified radiographer.
 - .4 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fails tests.

3.5 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, Heating and Chilled Water systems:
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
 - .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
 - .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
 - .5 Repair cracks and defects in excess of 0.8 mm in depth.
 - .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic or particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS:

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 30 - Health and Safety Requirements.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.1-2020, Cast Iron Pipe Flanges and Flanged Fittings.
 - .3 ANSI/ASME B16.5-2020, Pipe Flanges and Flanged Fittings.
 - .4 ANSI/ASME B16.11-2016, Forged Fittings, Socket-Welding and Threaded.
 - .5 ANSI/ASME B16.25-2017, Buttwelding Ends.
 - .6 ANSI/ASME B16.34-2020, Valves - Flanged, Threaded and Welding Ends.
- .2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
 - .1 ANSI/API 609-2017, Lug- and Water-Type Butterfly Valves.
- .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A126-04(2019), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B209M-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS SP-67-2017, Butterfly Valves.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Submit data for valves specified this section.
- .2 Closeout Submittals:

- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 MAINTENANCE

- .1 Extra Materials:
- .2 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.
 - .2 Discs: one for every 10 valves, each size, minimum 1.
 - .3 Stem packing: one for every 10 valves, each size, minimum 1.
 - .4 Valve handles: 2 of each size, minimum 1.
 - .5 Gaskets for flanges: one for every 10 flanged joints, minimum 1.

Part 2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT – 2.0 MPA (285 PSIG)

- .1 Sizes: Lug type: NPS 6 (150 mm diam.).
- .2 Suitable for dead end service.
- .3 CRN registration number required for products.
- .4 Pressure rating: 2.0 MPa (285 psig) at 135 degrees C.
- .5 Lug body: 150 ANSI bolt pattern.
- .6 Full lug body (threaded).
- .7 Application: for on-off service.
- .8 Operators:
 - .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black lacquer.
 - .2 Install parallel or perpendicular to pipeline.
- .9 Designed to comply with MSS SP-67 and API 609.
- .10 Compatible with ANSI B16.1 Class 125 (iron) and ANSI B16.5 Class 150 (steel) flanges.
- .11 Construction:
 - .1 Body: ductile iron.
 - .2 Disc: 316 SS.

- .3 Seat: EPDM.
- .4 Refer to manufacturer's literature for additional materials.
- .5 Shaft: NPS 2 - 12: 416 stainless steel.
- .6 Taper pin: 316 SS.
- .7 Blowout proof stem.
- .8 O-Ring: Buna-N.
- .9 Bushings: Teflon.
- .10 Disc shall not be pinned to shaft.
- .11 Bubble tight shutoff with downstream flanges removed, Class 6 shutoff.

2.2 MOUNTING FLANGES

- .1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

Part 3 Execution

3.1 PREPARATION

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Install butterfly valves with disc in almost closed position.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Mount actuator on to valve prior to installation.
- .5 Handle valve with care so as to prevent damage to disc and seat faces.
- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

- .1 Cycle valve operation from fully closed to fully open then back to fully closed.
- .2 At same time, check travel stop settings for proper disc alignment.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
 - .1 ANSI/ASME B31.1-2020, Power Piping.
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A125-1996(R2018), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 413.4 MPa (60,000 PSIG) Tensile Strength.
 - .3 ASTM A563-15, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS).
 - .1 MSS SP58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC).

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58.ASME B31.1 or
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipe work or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings for review.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .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 The Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 2 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.

- .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
- .6 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipe work is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel- galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipe work.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for riveting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipe work: galvanized.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

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 in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Clamps on riser piping:

- .1 Support independent of connected horizontal pipe work using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.
- .3 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
 - .1 Vertical movement of pipe work is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .2 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel
up to 1-1/4	2.1 m
1-1/2	2.7m
2	3.0 m
2-1/2	3.6 m
3	3.6 m
3-1/2	3.9 m
4	4.2 m
5	4.8 m
6	5.1 m

- .3 Pipe work greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.

- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipe work from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 – Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.2 SUBMITTALS

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new insulated pipe work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from the Departmental Representative.

2.2 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:

- .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive vinyl with protective over-coating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from the Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

Background Colour	Legend, Arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN

2.3 LANGUAGE

- .1 Identification in English.
- .2 Use one nameplate and label.

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 TIMING

- .1 Provide identification only after insulation and PVC jacketing has been installed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 5 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On either sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.

- .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .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 RELATED SECTIONS

- .1 Section 23 05 05 – Installation of Pipework.
- .2 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 Piping to be capped off and terminated where indicated on the Drawings.
- .3 Hydrostatic pressure test all piping installed. Close isolation shut-off valves, drain new piping installed and then cap at far end for future connection.

1.5 REPORTS

- .1 Provide piping test certificates for all new piping installed for review by the Departmental Representative.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 23 08 01 – Performance Verification Mechanical Piping Systems.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 Products

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

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 CLEANING HYDRONIC SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least four (4) weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .4 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
- .5 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .6 Hydronic Systems:
 - .1 Fill system with water, ensure air is vented from system.
 - .2 Use water metre to record volume of water in system to +/- 0.5%.
 - .3 Add chemicals under direct supervision of chemical treatment supplier.
 - .4 Flush velocity in system mains and branches to ensure removal of debris.
 - .5 Cap piping for future connection. Make water-tight.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .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 RELATED SECTIONS.

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 30 - Health and Safety Requirements.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 21 05 01 - Common Work Results for Mechanical.
- .5 Section 23 05 17 - Pipe Welding.
- .6 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .7 Section 23 05 01 - Installation of Pipework.
- .8 Section 23 05 23 – Butterfly Valves.
- .9 Section 23 08 01 - Performance Verification of Mechanical Piping.
- .10 Section 33 65 13 – District Energy Buried Distribution Piping.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-2020, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3-2016, Malleable Iron Threaded Fittings.
 - .3 ASME B16.5-2020, Pipe Flanges and Flanged Fittings.
 - .4 ASME B16.9-2018, Factory-Made Wrought Buttwelding Fittings.
 - .5 ASME B18.2.1-2012, Square and Hex Bolts and Screws (Inch Series).
 - .6 ASME B18.2.2-2015, Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M-99 (R2018), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A536-84(2019)e1, Standard Specification for Ductile Iron Castings.
 - .4 ASTM B61-15, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM E202-18, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 American Water Works Association (AWWA).
 - .1 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48-2018, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-11, Butterfly Valves.
 - .2 MSS-SP-70-06, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-18, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80-19, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85-11, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:

1.4 QUALITY ASSURANCE

- .1 Health and Safety.
 - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 MAINTENANCE

- .1 Extra Materials.
 - .1 Provide following spare parts:
 - .1 Valve seats: one for every ten (10) valves, each size. Minimum one.
 - .2 Discs: one for every ten (10) valves, each size. Minimum one.
 - .3 Stem packing: one for every ten (10) valves, each size. Minimum one.
 - .4 Valve handles: min. one of each size.
 - .5 Gaskets for flanges: one for every ten (10) flanges.

Part 2 Products

2.1 PIPE

- .1 NPS 6 Steel pipe: to ASTM A53/A53M, Grade B, as follows: Welded Schedule 40, Grade B, ERW black steel pipe.

- .2 Refer to Section 33 65 13 – District Energy Buried Piping for underground (i.e., buried) piping requirements.

2.2 PIPE JOINTS

- .1 NPS2-1/2 and over: welding fittings and flanges to CAN/CSA W48.
- .2 Roll grooved: standard rigid coupling to CSA B242.
- .3 Flanges: plain or raised face, weld neck to AWWA C111.
- .4 Orifice flanges: slip-on raised face, 2100 kPa.
- .5 Flange gaskets: to AWWA C111.
- .6 Pipe thread: taper.
- .7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .8 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

- .1 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ASME B16.1, Class 300.
 - .2 Steel: to ASME B16.5.
- .2 Butt-welding fittings: steel, to ASME B16.9.
- .3 Fittings for roll grooved piping: ductile iron to ASTM A536.

2.4 VALVES

- .1 Connections:
 - .1 NPS2.1/2 and larger: Flanged or grooved ends.
- .2 Butterfly valves: to Section 23 05 23.

2.5 PIPE PENETRATION SEALS

- .1 Modular, thru-the-wall and thru-the-floor, core-drilled, pipe penetration seals:
 - .1 Rubber links to make water-tight/continuously fill the annular space between the pipe and the core-drilled wall opening.
 - .2 Size: NPS 6 (nominal 150 mm diam., Schedule 40 ductile iron piping).
 - .3 Rated at 14.1 m head (20 psig).
 - .4 Standard Warranty: one year.
 - .5 Carbon steel nuts and bolts per ASTM B633 with 2 part zinc plated dichromate hardware c/w corrosion resistant organic coating.
 - .6 Black EPDM seal element.
 - .7 Temperature range: -40 to 121°C.
 - .8 Tensile strength: 413.4 MPa (60,000 psig).
 - .9 Composite pressure plates molded of glass reinforced nylon.
 - .10 Tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test.

- .11 Manufactured with materials conforming to ASTM D-256, ASTM D-297, ASTM S-395, ASTM D-412, ASTM D-638, ASTM D-790, ASTM D-792 and ASTM D-2240.
- .12 Penetration/hole size: 254 mm (10" diam.).
- .13 10 links per seal.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Install pipe work in accordance with Section 23 05 01 - Installation of Pipework.

3.2 CIRCUIT BALANCING VALVES

- .1 Install flow balancing valves as indicated.
- .2 Leave hand wheel after installation.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 CLEANING, FLUSHING AND START-UP

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 TESTING

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical, min. of 860 kPa (125 PSIG) and Section 23 05 05 - Installation of Pipework.

3.5 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

END OF SECTION