

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139-04, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC 2005)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 QUALITY ASSURANCE

- .1 Sustainability Standards Certification:
 - .1 Low-Emitting Materials: provide listing of sealants and coatings used in boiler rooms, comply with VOC and chemical component limits or restriction requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for recycling packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181.

- .1 Primers and Coating: in accordance with manufacturer's recommendations for surface conditions.
- .2 Primer: maximum VOC limit 250 g/L to Standard GS-11 or SCAQMD Rule 1113.
- .3 Paints: maximum VOC limit 150 g/L to Standard GS-11 or SCAQMD Rule 1113.
- .2 Sealants: maximum VOC limit to SCAQMD Rule 1168 or GSES GS-36.
- .3 Adhesives: maximum VOC limit to SCAQMD Rule 1168 or GSES GS-36.
- .4 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 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.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer, CSA B139, and as indicated without interrupting operation of other system, equipment, or components.

3.4 DRAINS

- .1 Install piping with grade 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: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install air vents to 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.

3.6 DIELECTRIC COUPLINGS

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

3.7 PIPEWORK INSTALLATION

- .1 Install fuel oil pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material. 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 may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .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 indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves. Use gate valves at branch take-offs for isolating purposes except where 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.
- .15 Check Valves:
 - .1 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.8 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 uninsulated 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: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.

- .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.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system 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 in relevant mechanical sections.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

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 or conceal 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.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .3 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP)
 - .1 IPMVP 2007 Version.
- .4 Green Seal Environmental Standards (GS)
 - .1 GS-11-11, Standard for Paints and Coatings.
 - .2 GS-36-11, Standard for Commercial Adhesives.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test and Evaluation Reports:
 - .1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store thermometers and pressure gauges off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for recycling packaging materials as specified in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: 0-115°C (0-240°F).

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4 or ASME B40.200.
 - .1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

- .1 Re-use existing thermometer wells which are in good condition. Install new only where existing wells are in poor condition. New wells shall be as follows:
 - .2 Copper pipe: copper or bronze
 - .3 Steel pipe: brass or stainless steel.

2.4 ROTARY TEMPERATURE GAUGES

- .1 112 mm, rotary dial type: to CAN/CGSB-14.4 or ASME B40.200. having 0.5% accuracy full scale unless otherwise specified.
- .2 Configured for rear surface mounting.
- .3 Remote reading.

2.5 PRESSURE

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel or

GAUGES

phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 0-415 kPa (0-60 psi).

.2 Provide:

.1 Snubber for pulsating operation.

.2 Diaphragm assembly for corrosive service.

.3 Gasketed pressure relief back with solid front.

.4 Bronze stop cock.

.5 Oil filled for high vibration applications.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.

.1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in existing wells on piping in locations indicated on drawings. Provide new heat conducting material in new and existing wells.

.2 Install rotary type on face of boiler as indicated on drawings.

.3 Use extensions where thermometers are installed through insulation.

**3.4 PRESSURE
GAUGES**

.1 Install in locations as follows:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Outlet of boilers.

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- .5 In other locations as indicated.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.
- 3.5 NAMEPLATES** .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01 - Mechanical Identification, identifying medium.
- 3.6 CLEANING** .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 PROTECTION** .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983 (R2006), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A276-08, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283-08a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-08a, Standard Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
 - .2 Submit data for valves specified in this Section.

1.3 CLOSEOUT SUBMITTALS

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

**1.4 MAINTENANCE
MATERIAL
SUBMITTALS**

- .1 Extra Materials/Spare Parts:
 - .1 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.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
 - .2 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints.

**1.5 DELIVERY,
STORAGE AND
HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for recycling packaging materials in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
- .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
 - .2 Copper tube systems: solder ends to ANSI/ASME B16.18.
- .3 Lockshield Keys:
 - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

- .1 Requirements common to gate valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Packing: non-asbestos.
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
 - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
 - .2 Operator: handwheel.
- .3 NPS 2 and under, rising stem, split wedge disc, Class 125:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
 - .3 Operator: handwheel.
- .4 NPS 2 and under, rising stem, solid wedge disc, Class 150:
 - .1 Body: with long disc guides, union bonnet.
 - .2 Operator: handwheel.

.5 Globe Valves:

- .1 Requirements common to globe valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, composition disc, Class 125:
 - .1 Body and bonnet: screwed bonnet.
 - .2 Disc and seat: renewable rotating disc of composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.

- .3 Operator: handwheel but lockshield where temper proofing is required.
- .3 NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: handwheel but lockshield where temper proofing is required.
- .4 NPS 2 and under, plug disc, Class 150, screwed ends:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
 - .3 Operator: handwheel.
- .5 Angle valve, NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
 - .3 Operator: handwheel but lockshield where tamper proofing is required.
- .6 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 NPS 2 and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 NPS 2 and under, swing type, bronze disc:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .4 NPS 2 and under, swing type, composition disc, Class 200:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
 - .5 NPS 2 and under, horizontal lift type, composition disc,

- Class 150:
 - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
 - .2 Disc: renewable PTFE or No. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .7 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .4 Disc and seat: renewable rotating disc.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.
- .8 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel, solid ball and Teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASTM International Inc.
 - .1 ASTM A49-01 (2006), Standard Specification for Heat-Treated Carbon Steel Joint Bars.
 - .2 ASTM A126-04, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .3 ASTM A536-84 (2004) e1, Standard Specification for Ductile Iron Castings.
 - .4 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM B85/B85M-08, Standard Specification for Aluminum-Alloy Die Castings.
 - .7 ASTM B209-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS SP-61-03, Pressure Testing of Steel Valves.
 - .2 MSS SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS SP-82-1992, Valve Pressure Testing Methods.
 - .5 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

**1.3 CLOSEOUT
SUBMITTALS**

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

**1.4 DELIVERY,
STORAGE AND
HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for recycling all packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.5 MAINTENANCE
MATERIAL SUBMITTALS**

- .1 Extra Materials/Spare Parts:
- .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.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
- .3 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints.

Part 2 Products

2.1 MATERIAL

- .1 Valves:
 - .1 Except for specialty valves, to be of single manufacturer.
- .2 Standard specifications:
 - .1 Gate valves: MSS SP-70.
 - .2 Globe valves: MSS SP-85.
 - .3 Check valves: MSS SP-71.
- .3 Requirements common to valves, unless specified otherwise:
 - .1 Body, bonnet: cast iron to ASTM B209 Class B or ductile iron to ASTM A536 Grade 65-45-12, match existing.

- .2 Connections: flanged ends with 2 mm raised face to ANSI B16.1.
- .3 Inspection and pressure testing: to MSS SP-82.
- .4 Bonnet gasket: non-asbestos.
- .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
- .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
- .7 Gland packing: non-asbestos.
- .8 Handwheel: die-cast aluminum alloy to ASTM B85/B85M or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
- .9 Identification tag: with catalogue number, size, other pertinent data.
- .4 All products to have CRN registration numbers.

2.2 GATE VALVES

- .1 NPS 2 1/2 - 8, non-rising stem, inside screw, bronze trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, Class 125.
 - .2 Disc: solid offset taper wedge, bronze to ASTM B62.
 - .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
 - .4 Stem: bronze to ASTM B62.
 - .5 Operator: handwheel.
 - .6 Bypass: complete with union and NPS 2 gate valve as Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.
 - .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
 - .3 Seat rings: renewable bronze screwed into body.
 - .4 Stem: nickel-plated steel or manganese-bronze, match existing.
 - .5 Pressure-lubricated operating mechanism.
 - .6 Operator: handwheel.
 - .7 Bypass: complete with union and NPS full size gate or globe

valve as Section 23 05 05 - Installation of Pipework.

2.3 GLOBE VALVES

- .1 NPS 2 1/2 - 10, OSY:
- .1 Body: with multiple-bolted bonnet.
 - .2 WP: 860 kPa steam, 1.4 MPa CWP.
 - .3 Bonnet-yoke gasket: non-asbestos.
 - .4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
 - .5 Seat ring: renewable, regrindable, screwed into body.
 - .6 Stem: bronze to ASTM B62.
 - .7 Operator: handwheel.
 - .8 Bypass: complete with union and NPS 2-1/2 gate valve as Section 23 05 23.01 - Valves - Bronze.

2.4 VALVE OPERATORS

- .1 Install valve operators as follows:
- .1 Handwheel: on valves except as specified.
 - .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms.

2.5 CHECK VALVES

- .1 Swing check valves, Class 125:
- .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Grooved or flanged ends: plain faced with smooth finish.
 - .1 Up to NPS 10: cast iron to ASTM A126 Class B or ductile iron ASTM A536 Grade 65-45-12, match existing.
 - .2 Ratings:
 - .1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
 - .2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
 - .3 NPS 18 and over: 1.03 MPa CWP.
 - .3 Disc: rotating for extended life.
 - .1 Up to NPS 6: bronze to ASTM B62 or stainless steel type 316.
 - .2 NPS 8 and over: bronze-faced cast iron.
 - .4 Seat rings: renewable bronze to ASTM B62 screwed into body.
 - .5 Hinge pin, bushings: renewable bronze to ASTM B62 or stainless steel, match existing.
 - .6 Identification tag: fastened to cover.
 - .7 Hinge: galvanized malleable iron or stainless steel, match existing.

Part 3 Execution

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Clean installed products in accordance to manufacturer's recommendation.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .4 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

	.5	Manufacturers' Instructions:
	.1	Provide manufacturer's installation instructions.
	.1	Departmental Representative will make available 1 copy of systems supplier's installation instructions.
1.3 CLOSEOUT SUBMITTALS	.1	Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
1.4 DELIVERY, STORAGE AND HANDLING	.1	Deliver, store and handle materials in accordance with manufacturer's written instructions.
	.2	Delivery and Acceptance Requirements:
	.1	Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
	.3	Packaging Waste Management: remove for recycling all packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
Part 2 Products		
2.1 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 ASME B31.1 or MSS SP58.
	.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 pipework or connected equipment.
	.5	Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
2.2 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.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 13 mm FM approved.
 - .2 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 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
 - .2 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: to ASME B31.1.
 - .2 Steel brackets: to ASME B31.1.
 - .3 Sway braces for seismic restraint systems: to ASME B31.1.
- .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 pipework 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.
 - .2 Attachments for copper piping: copper plated black steel.

	.3	Use insulation shields for hot pipework.
	.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 rivetting 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 pipework: galvanized.
	.11	Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.
2.4 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.
2.5 INSULATION PROTECTION SHIELDS	.1	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.
2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES	.1	Provide templates to ensure accurate location of anchor bolts.
2.7 HOUSE-KEEPING PADS	.1	Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 100 mm larger than equipment; chamfer pad edges.
	.2	Exposed surfaces shall have a formed and brushed finish. Concrete: shall be batched, formed and poured per CAN-3-A23.1 Concrete Materials and Methods of Construction.
Part 3 Execution		
3.1 MANUFACTURER'S	.1	Compliance: comply with manufacturer's written recommendations

INSTRUCTIONS

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 pipework 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 pipework 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 Plumbing piping: to Canadian Plumbing Code Provincial Code and authority having jurisdiction.
- .2 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size :
NPS

Maximum Spacing

		Steel Copper	Maximum Spacing	
		up to 1-1/4	2.4 m	1.8 m
		1-1/2	3.0 m	2.4 m
		2	3.0 m	2.4 m
		2-1/2	3.7 m	3.0 m
		3	3.7 m	3.0 m
		3-1/2	3.7 m	3.3 m
		4	3.7 m	3.6 m
		5	4.3 m	
		6	4.3 m	
		8	4.3 m	
		10	4.9 m	
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 pipework 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 CLEANING	.1	Clean in accordance with Section 01 74 11 - Cleaning.		

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.
- .2 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.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.3 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.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures .
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 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 29.06 - 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.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Dispose of unused paint or coating material at official hazardous material collections site approved by Departmental Representative.
 - .3 Do not dispose of unused paint or coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:

- .1 Conform to following table:

Size # mm (mm)	Sizes (mm)	No. of Lines	Height of Letters
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8

7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Boiler Rooms: use size # 9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new 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 Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Fuel oil: to CSA/CGA B139 and authority having jurisdiction.

.2 Standpipe and hose systems: to NFPA 14.

2.5 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 plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
- .1 Where not listed, obtain direction from 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 |
| ** Add design temperature | | |
| ++ Add design temperature and pressure | | |
| City water | Green | CITY WATER |
| Treated water | Green | TREATED WATER |
| Hot water heating supply | Yellow | HEATING SUPPLY |
| Hot water heating return | Yellow | HEATING RETURN |
| Make-up water | Yellow | MAKE-UP WTR |
| Domestic hot water supply | Green | DOM. HW SUPPLY |
| Dom. HWS recirculation | Green | DOM. HW CIRC |
| Domestic cold water supply | Green | DOM. CWS |
| No. 2 fuel oil suction | Yellow | # 2 FUEL OIL |
| No. 2 fuel oil return | Yellow | # 2 FUEL OIL |
| Compressed air (700kPa) | Green | COMP. AIR 700 kPa |
| Compressed air (700kPa) | Yellow | COMP. AIR kPa |
| Fire protection water | Red | FIRE PROT. WTR |
| Sprinklers | Red | SPRINKLERS |
| Instrument air | Green | INSTRUMENT AIR |

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

	.2	Colours: back, or co-ordinated with base colour to ensure strong contrast.
2.7 VALVES, CONTROLLERS	.1	Brass or lamicoid tags with 12 mm stamped identification data filled with black paint.
	.2	Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.
2.8 CONTROLS COMPONENTS IDENTIFICATION	.1	Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
	.2	Inscriptions to include function and (where appropriate) fail-safe position.
2.9 LANGUAGE	.1	Identification in English.
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 painting.
3.3 INSTALLATION	.1	Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
	.2	Provide ULC and or CSA registration plates as required by respective agency.
	.3	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 AND DUCTWORK
SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms: at not more than 17 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 both 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 VALVES,
CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 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 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ASTM International Inc.
 - .1 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .3 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .4 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .5 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .6 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .7 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

		.4	Green Seal Environmental Standards (GSES)
		.1	Standard GS-36-00, Commercial Adhesives.
		.5	South Coast Air Quality Management District (SCAQMD), California State
		.1	SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
		.6	Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
		.7	Underwriters Laboratories of Canada (ULC)
		.1	CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
		.2	CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
1.2 ACTION AND INFORMATIONAL SUBMITTALS		.1	Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
		.2	Product Data:
		.1	Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
		.1	Description of equipment giving manufacturer's name, type, model, year and capacity.
		.2	Details of operation, servicing and maintenance.
		.3	Recommended spare parts list.
		.3	Shop Drawings:
		.1	Provide drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
		.4	Samples:
		.1	Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
		.2	Mount sample on 12 mm plywood board.
		.3	Affix typewritten label beneath sample indicating service.
		.5	Manufacturers' Instructions:
		.1	Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, and cleaning procedures.
1.3 QUALITY		.1	Qualifications:

ASSURANCE

- .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

**1.4 DELIVERY,
STORAGE AND
HANDLING**

- .1 Deliver, store and handle in accordance with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.
- .3 Packaging Waste Management: remove for recycling all packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

**2.1 FIRE AND SMOKE
RATING**

- .1 To CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas:
- .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
- .1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168 and GSES GS-36.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit 50 170 200 g/L to SCAQMD Rule 1168 GSES GS-36.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
- .6 Contact adhesive: quick-setting
 - .1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168 and GSES GS-36.
- .7 Canvas adhesive: washable.
 - .1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168 and GSES GS-36.
- .8 Fasteners: 4 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE- INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

1.2 REFERENCES

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

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

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

- .1 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .2 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .3 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .4 ASTM C547-2003, Mineral Fiber Pipe Insulation.
- .5 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

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

.4 Department of Justice Canada (Jus) Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

- .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

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

- .1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

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

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

1.3 DEFINITIONS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive

proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - 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 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

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

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous

material collections site approved by Departmental Representative.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.

2.3 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.

2.4 CEMENT

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

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

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

**2.7 OUTDOOR VAPOUR
RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m⁵.

2.8 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: white.
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 1 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
- .2 Canvas:
 - .1 220 gm/m⁵ cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.

Part 3 Execution

**3.1 MANUFACTURER'S
INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.2 PRE-INSTALLATION
REQUIREMENT**

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

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification. Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.

	.4	Supports, Hangers:	
	.1	Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.	
3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES	.1	Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.	
	.2	Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.	
	.3	Insulation:	
	.1	Insulation, fastenings and finishes: same as system.	
	.2	Jacket: high temperature fabric.	
3.5 PIPING INSULATION SCHEDULES	.1	Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. TIAC Code: A-1.	
	.1	Securements: Tape at 300 mm on centre.	
	.2	Seals: lap seal adhesive, lagging adhesive.	
	.3	Installation: TIAC Code 1501-H.	
	.2	TIAC Code: A-3.	
	.1	Securements: Tape at 300 mm on centre.	
	.2	Seals: VR lap seal adhesive, VR lagging adhesive.	
	.3	Installation: TIAC Code: 1501-C.	
	.3	Thickness of insulation as listed in following table.	
	.1	Run-outs to individual units and equipment not exceeding 4000 mm long.	
	.2	Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.	
		Application Temp degrees	
		C TIAC	
		code Pipe sizes (NPS) and insulation thickness (mm)	
		Run out to 1 1/4	
		to 2 2 1/2	
		to 4 5 to 6 8 &	
		over	
		Boiler Feed Water A-1 25 25 25 25	
		Hot Water Heating 60 - 94 A-1 25 38 38 38	
		Domestic HWS A-1 25 25 25 38	
	.4	Finishes:	
	.1	Exposed indoors: canvas jacket.	
	.2	Exposed in mechanical rooms: canvas jacket.	

- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

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 CLEANING
AND START-UP OF
MECHANICAL PIPING
SYSTEMS**

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

**1.2 SYSTEMS -
PERFORMANCE
VERIFICATION (PV)**

- .1 Perform systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform tests outlined in the following subsections.

**1.3 FUEL OIL
SYSTEMS**

- .1 Fuel oil pumps:
 - .1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.
 - .2 Verify pump performance.
 - .3 Pump performance within plus 20% and minus 0% of design.
- .2 Operational Tests:
 - .1 Charge system and verify operation.
 - .2 Verify adequacy of flow rates and pressure from storage facilities to burners.
 - .3 Verify accurate metering of fuel to burners.
 - .4 For further details refer to relevant sections of Division 23.
- .3 Notify authorities having jurisdiction to enable witnessing of tests as required.

**1.4 BOILER
WATER FEED
SYSTEMS**

- .1 Test operation of back flow preventer.
- .2 Test operation of pressure reducing valve by observing inlet and outlet pressures.

**1.5 AIR
HANDLING UNIT
SUPPLY AIR RESET
SYSTEM**

- .1 Test for correct operation of 3-way diverting valves at ATB and CSB air handlers.
- .2 Adjust supply air setpoint and verify response of 3-way valves to achieve supply air temperature reset.

1.6 REPORTS

- .1 Provide checklists to Departmental Representative of verified performance criteria for each of the following assemblies to be installed in the CSB and ATB buildings.
 - .1 3-way valves.
 - .2 Boiler water feed systems (make-up assemblies).
 - .3 Fuel oil systems (transfer pump systems).

1.7 TRAINING

- .1 Provide training of O&M Personnel on the operation of the following. Schedule training to the satisfaction of the Departmental Representative.
 - .1 Fuel oil transfer pump systems in CSB and ATB Boiler Rooms.

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 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202-00, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .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 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - 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.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).

3.3 START-UP OF HYDRONIC SYSTEMS

- .3 Use water metre to record volume of water in system to +/- 0.5%.
- .4 Add chemicals under direct supervision of chemical treatment supplier.
- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Clean out strainers repeatedly until system is clean.
 - .5 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .6 Repeat with water at design temperature.
 - .7 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

3.4 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 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-B16.3-2006, Malleable-Iron Threaded Fittings: Classes 150 and 300.
 - .2 ASME-B16.9-2007, Factory-Made Wrought Steel Butt welding Fittings.
- .2 ASTM International
 - .1 ASTM A47/A47M-99 (2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B75M-99 (2005), Standard Specification for Seamless Copper Tube Metric.
- .3 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4 CSA International
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
 - .2 CSA-B140.0-03, Oil Burning Equipment: General Requirements.
 - .3 CSA-C282-05, Emergency Electrical Power Supply for Buildings.
- .5 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2008, 2nd Edition, Paints and Coatings.
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 - .1 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Association of Corrosion Engineers (NACE)

- .1 NACE SP0169-2007, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- .9 National Fire Code of Canada (NFCC 2010)
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
- .11 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S603.1-03, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.
 - .2 ULC ORD-C107.12-1992, Line Leak Detection Devices for Flammable Liquid Piping.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Prior to installation of facility fuel oil piping:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Indicate on manufacturer's catalogue literature the following: valves.
 - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating

compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturers' Instructions: provide manufacturer's installation instructions.

**1.4 CLOSEOUT
SUBMITTALS**

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

**1.5 QUALITY
ASSURANCE**

.1 Sustainability Standards Certification:

.2 Ensure piping is installed by company authorized by authority having jurisdiction.

**1.6 DELIVERY, STORAGE
AND HANDLING**

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for recycling all packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FUEL OIL PIPE

.1 Materials as per CSA-B139, CEPA SOR/2008-197, and NFCC.

.2 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

.3 Copper: type K, soft copper tubing, to ASTM B75M, in long lengths.

2.2 STEEL PIPE COATING

.1 Bituminous paint: in accordance with manufacturer's recommendations.

.2 Primer and Paints: in accordance with manufacturer's

recommendations for surface conditions.

2.3 JOINTING MATERIAL

- .1 Screwed fittings: Teflon tape.
- .2 Brazed fittings: 85/15.

2.4 FITTINGS

- .1 Steel:
 - .1 Malleable iron: screwed, banded, Class 150 to ASME-B16.3.
 - .2 Welding: butt-welding to ASME-B16.9.
 - .3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A47/A47M.
 - .4 Nipples: Schedule 40, to ASTM A53/A53M.
- .2 Copper:
 - .1 Piping: brazed type.
 - .2 Connections to equipment: compression.

2.5 GATE VALVES

- .1 NPS 2 and under, screwed bonnet: rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, solid wedge disc as specified under Section 23 05 23.01 - Valves - Bronze.

2.6 GLOBE VALVES

- .1 NPS 2 and under, screwed: to MSS-SP-80, Class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc suitable for oil service as specified under Section 23 05 23.01 - Valves - Bronze.
 - .1 Lockshield handles: as indicated.

2.7 BALL VALVES

- .1 NPS 2 and under: bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG as specified under Section 23 05 23.01 - Valves - Bronze.

2.8 SWING CHECK VALVES

- .1 NPS 2 and under, screwed: to MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc suitable for oil service, screw in cap, regrindable seat as specified under Section 23 05 23.01 - Valves - Bronze.

2.9 LUBRICATED PLUG COCKS

- .1 NPS 2 and under, screwed: to ASTM B61, Class 150, 1 MPa, bronze body.

2.10 FUEL OIL TRANSFER

- .1 Install in ATB and CSB Boiler Rooms.

PUMPS

- .2 To CEPA SOR/2008-197.
- .3 Two positive displacement self-priming, rotary gear type, direct driven from TEFC motors, mounted on common base with drip tray. Complete with mechanical seal, permanently sealed ball bearings, relief valve, compound gauge on inlet, pressure gauge on discharge, integral strainers, check valves, isolation valves, high pressure switch and low pressure switch.
- .4 Capacity:
 - .1 Pumped fluid: number 2 fuel oil.
 - .2 Flow rate: 341 L/h; 172 kPa discharge pressure.
 - .3 Motor: 1/4 hp , 208V, 1ph., 60Hz, 900 r/min.
- .5 Pump control panel mounted on pump common base complete with NEMA 1 enclosure, single pole circuit breakers with through the door operation, across-the line contactors, power "ON" lights, pump "RUN" lights, hand-OFF-Auto selector switches, pump "FAIL" lights, low pressure switch control, pump lead/lag control, transformers and relays, etc. as required.

2.11 OIL FILTER

- .1 Duplex type replaceable cartridge type as recommended by oil burner manufacturer.
- .2 Furnish spare filter cartridge.

2.12 BYPASS RELIEF VALVE

- .1 CAN/CSA B-139 compliant and ULC approved.
- .2 All brass construction, 3/8 NPS NPT connections.
- .3 3 – 15 psi operating range.
- .4 Set valve to 3.4 psi to accommodate valve's 1.6 psi over-pressure at 1.5usgpm. Valve shall maintain 5 psi when burners are off.

2.13 FLEXIBLE BURNER HOSE

- .1 Provide hoses for burner pump inlet and outlet.
- .2 Galvanized steel outer braid with NPT fittings.
- .3 CAN/CSA B-139 compliant and ULC approved.
- .4 ½ NPS lines, 900mm long.

2.14 FUSIBLE HEAD FIRE

- .1 All brass construction.

VALVE

- .2 Eutectic soldered fusible link.
- .3 Rising stem, handwheel shut-off.

2.15 FUEL SAFETY VALVE

- .1 CAN/CSA B-139 compliant and ULC approved.
- .2 ½ NPS NPT female connections.
- .3 Automatic shut off feature to protect against line breakage.
- .4 Valve shall limit line pressure on inlet side of burner pumps to 20.7Pa (3psi).

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PIPING

- .1 Install piping in accordance with CEPA SOR/2008-197 and Section 23 05 05 - Installation of Pipework, supplemented as specified.
- .2 Install oil piping system in accordance with NFCC CSA-B139 and CSA-B140.0.
- .3 Slope piping down in direction of storage tank unless otherwise indicated.
- .4 Underground piping to be protected in conformance with CAN/ULC-S603.1.
- .5 Above ground piping to be protected from physical damage due to impact.
- .6 Piping inside building:
 - .1 Ensure piping in solid flooring is installed to CSA-B139 and authority having justification.
 - .2 Use approved fitting to CSA-B139 for steel piping.
 - .3 Install filter, gate valve, and fire valve at burners.
- .7 Clearly label piping runs in legible form indicating;
 - .1 Piping product content.
 - .2 Direction of flow.
 - .3 Identify transfer points in piping systems to CPPI

Colour-Symbol System to Mark Equipment and
Vehicles for Product Identification

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless approved otherwise by Departmental Representative.
- .2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves.
- .4 Install swing check valves on discharge of pumps and as indicated.
- .5 Install plug cocks as indicated.

**3.4 OIL TRANSFER
PUMPS**

- .1 Equip pumps with check valve installed below suction pump to permit contents of pipe to drain back to storage tank if suction is broken.
- .2 Install as indicated.
- .3 Install gate ball -valves on inlet and discharge connections.
- .4 Install pressure gauge at pump discharge, compound gauge on pump inlet connection.
- .5 Install relief valve in pump discharge piping with relief valve discharge pipe to return line to tank.

3.5 OIL FILTERS

- .1 Install ULC approved in supply branches to each burner.
- .2 At time of acceptance, replace filter cartridge with new.

**3.6 FIELD QUALITY
CONTROL**

- .1 Site Tests/Inspection:
 - .1 Test system to CSA-B139 and CSA-B140.0 and authorities having jurisdiction.
 - .2 Isolate tanks from piping pressure tests.
 - .3 Maintain test pressure during backfilling.
- .2 Manufacturer's Field Services:
 - .1 Provide only if required for warranty purposes.
 - .2 Have manufacturer of products, supplying materials for Work of this Section, review Work involved in handling, installation/application, protection and cleaning, of its products and submit written reports,

in acceptable format, to verify compliance of Work with Contract.

.3 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.

.4 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Upon completion of the Work, after cleaning is carried out.

.5 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

.3 Performance Verification:

.1 Refer to Section 23 08 01 - Performance Verification Mechanical Piping System.

3.7 CLEANING

.1 Clean in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems and manufacturer's written recommendations, supplemented as follows:

.1 Flush after pressure test with number 1 number 2 fuel oil for a minimum of two hours. Clean strainers and filters.

.2 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.

.3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.

.4 Ensure entire installation is approved by authority having jurisdiction.

.5 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-04 (2007), Boiler and Pressure Vessel Code.
- .2 ASTM International Inc.
 - .1 ASTM A47/A47M-99 (2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A278/A278M-01 (2006), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
 - .3 ASTM A516/A516M-06, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A536-84 (2004), Standard Specification for Ductile Iron Castings.
 - .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B51-03 (R2003), Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B51-03 (R2005), Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with manufacturer's written instructions.

- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for recycling all packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BLADDER TYPE EXPANSION TANK

- .1 Expansion tank EXT-1 for Air Terminal Building only.
- .2 Constructed to requirements of ASME Boiler and Pressure Vessel Code, section VIII, Division 1 – Rules for construction of Pressure Vessels.
- .3 Expansion tank shall have a Canadian Registration Number (CRN).
- .4 Vertical, steel, pressurized type expansion tank.
- .5 Acceptance Volume: 1000 L.
- .6 Size: 1900 mm high x 914 mm diameter.
- .7 Bladder suitable for 115 degrees C operating temperature.
- .8 Working pressure: 860 kPa with ASME stamp and certification.
- .9 Air precharged to 84 kPa (initial fill pressure of system).
- .10 Base mount for vertical installation.
- .11 Supports: provide supports with hold down bolts and installation templates incorporating seismic restraint systems.
- .12 Replaceable Bladder.

2.2 AUTOMATIC AIR VENT

- .1 Standard float vent: brass body and NPS 1/8 connection and rated at 620 kPa working pressure.
- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
- .3 Float: solid material suitable for 115 degrees C working temperature.

2.3 AIR SEPARATOR - BOILER MOUNTED

- .1 For boilers B-1 and B-2 in Air Terminal Building only.
- .2 Complete with dip tube.

	.3	Working pressure: 860 kPa.
2.4 AIR SEPARATOR - EXPANSION TANK FITTING	.1	Complete with adjustable vent tube and built-in manual vent valve.
	.2	Working pressure: 860 kPa.
2.5 AIR SEPARATOR - IN-LINE	.1	Working pressure: 860 kPa.
	.2	Size: as indicated on drawings.
2.6 PIPE LINE STRAINER	.1	NPS 2 to 8: T type with ductile iron body to ASTM A536 flanged ends.
	.2	Blowdown connection: NPS 1.
	.3	Screen: stainless steel brass with 1.19 mm perforations.
	.4	Working pressure: 860 kPa.
2.7 BACK FLOW PREVENTER	.1	All bronze construction.
	.2	Reduced pressure principal operation.
	.3	Ball valve test cocks.
	.4	¾ NPS connections.
	.5	Replaceable check seats with intermediate relief valve.
Part 3 Execution		
3.1 APPLICATION	.1	Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
3.2 GENERAL	.1	Run drain lines and blow off connections to terminate above nearest drain.
	.2	Maintain adequate clearance to permit service and maintenance.
	.3	Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
	.4	Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve or 3-way valve larger than NPS 1 and as indicated.

3.4 AIR VENTS

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.5 EXPANSION TANKS

- .1 Adjust expansion tank pressure to suit design criteria.
- .2 Install lockshield type valve at inlet to tank.

3.6 PRESSURE SAFETY RELIEF VALVES

- .1 Run discharge pipe to terminate above nearest drain.

3.7 PERFORMANCE VERIFICATION

- .1 Operational requirements in accordance with Section 01 78 00 – Closeout Submittals, include:
 - .1 Repair and maintenance materials and instructions.
 - .2 Spare parts as recommended by manufacturer.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Materials, components, equipment and chemicals for installation of complete HVAC water treatment system.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME Boiler and Pressure Vessel Code, Section VII-2004.

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

- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTAS

.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.

- .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.

.3 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.

.4 Closeout Submittals:

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

	.2	Include following:
	.1	Log sheets as recommended by manufacturer Departmental Representative.
1.4 QUALITY ASSURANCE	.1	Health and Safety:
	.1	Do construction occupational health and safety in accordance with Section 01 35 29.06 - 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.
	.2	Waste Management and Disposal:
	.1	Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
Part 2 Products		
2.1 MANUFACTURER	.1	Equipment, chemicals, service provided by one supplier.
2.2 POT FEEDER	.1	Welded steel, pressure rating: 862kPa. Temperature rating: 90 degrees C.
	.2	Capacity: 19 litres
	.3	Connections: ¾ NPS
2.3 CHEMICAL FEED PIPING	.1	Resistant to chemicals employed. Pressure rating: 862kPa.
2.4 SHIPPING/FEEDING CHEMICAL CONTAINERS	.1	High density moulded polyethylene, with liquid level graduations, cover.
2.5 CHEMICALS	.1	Provide 1 year's supply.
	.2	Chemical formulation per chemical manufacturer's recommendation based on local water conditions.
	.3	Obtain chemicals from manufacturer with existing valid

contract with Transport Canada.

2.6 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify water conditions before treatment and chemical concentrations after treatment.
- .2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

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 HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.3 CHEMICAL FEED PIPING

- .1 Install crosses at changes in direction. Install plugs in unused connections.

3.4 CLEANING OF MECHANICAL SYSTEM

- .1 Contact Goeff Crowe at Alpha Chemical Limited 902-481-2532.
- .2 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.
- .3 Provide cleaning chemical, pH reducer and corrosion inhibitor in quantities recommended by the treatment chemical specialist. Ensure chemicals are on site before the cleaning procedures are initiated in the Combined Services Building and the Air Terminal Building.
- .4 Completely drain heating system piping, boilers and equipment. Refill system with clear water using a flow meter to determine system volume. This volume must be measured in order to determine the quantity of treatment chemical required.
- .5 Add cleaning chemical as recommended by chemical

treatment supplier to achieve a concentration of 5-20% by volume.

- .6 Circulate system for 72 hours and clean pump strainers at 24 hour intervals. During the 72 hour circulation period, test and adjust pH to 7 by adding pH reducer as required.
- .7 Drain system and refill with clear water and perform a one hour rinse cycle.
- .8 Drain system upon completion of rinse cycle.
- .9 Fill system again with clear water. Partially open system drain valve and continue to supply clear water to the system, at a reduced rate, for a period of 15 hours.
- .10 Disposal of cleaning solutions shall be approved by authority having jurisdiction.
- .11 Arrange for the treatment chemical specialist to test water for presence of residual cleaning chemicals, upon completion of the 15 hour flush.
- .12 Treatment chemical specialist shall test for conductivity and establish that the system water condition is suitable for addition of the corrosion inhibitor. Corrosion inhibitor shall be added to achieve a concentration within the range of 900 – 1100ppm.
- .13 Re-check pump strainers and clean as required.
- .14 Obtain test schedule from treatment chemical supplier and conduct specified tests as directed.
- .15 Submit water samples from the CSB and ATB boiler plants to the treatment chemical supplier at 3 month intervals.

3.5 WATER TREATMENT SERVICES

- .1 Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
 - .1 Initial water treatment recommendations.
 - .2 System start-up assistance.
 - .3 Operating staff training.
 - .4 Visit plant during period of operation and as required until system stabilizes, and advise on treatment system performance.
 - .5 Provide necessary recording charts and log sheets for one year operation.
 - .6 Provide necessary laboratory and technical

assistance.

- .7 Provide clear, concise, written instructions and advice to operating staff.

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 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 01 35 29.06 - Health and Safety Requirements.
 - .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .4 Section 07 84 00 - Firestopping.
 - .5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .2 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.
- .6 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 – Submittal Procedures for the following:
 - .1 Sealants.
 - .2 Tape.
 - .3 Proprietary Joints.

1.4 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Separate for recycling and place in designated containers Steel, Metal, and Plastic waste in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 Products

**2.1 SEAL
CLASSIFICATION**

- .1 Classification as follows:
- | Maximum Pressure Pa | SMACNA Seal Class |
|---------------------|-------------------|
| 500 | C |
| 250 | C |
| 125 | C |
| 125 | Unsealed |
- .2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant or combination thereof .
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed.
- .4 Unsealed seams and joints.

2.2 SEALANT

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
- .1 Rectangular: standard radius short radius with single thickness turning vanes Centreline radius: 1.0 times width of duct in plane of elbow.
- .3 Branches:
- .1 Provide volume control damper in branch duct near connection to main duct.
- .4 Transitions:
- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.
- .5 Offsets:
- .1 Full radiused elbows as indicated.

2.5 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.
- .2 Fire stopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA .
- .3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10
 - .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

**3.3 SEALING AND
TAPING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of two (2) coat of sealant to manufacturers recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
- .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .2 American Society for Testing and Materials International (ASTM)
- .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 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.
- .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
- .1 Pressure drop.
- .2 Face area.
- .3 Free area.

- .2 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 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .3 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick mounting flange, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, SS washer and aluminum body.
- .7 Screen: 19 mm intake mesh, 2 mm diameter wire aluminum

birdscreen on inside face of louvres in formed U-frame.

- .8 Finish: anodized. Colour: Mill finish to Departmental Representative approval.
- .9 Combined Services building combustion air louver L-1 size = 815 W x 510 H, minimum free area = 0.20 m².
- .10 Air Terminal building combustion air louver L-2 size= 915 W x 610 H, minimum free area = 0.28m².

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 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

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