
Part 1 General

1.1 RELATED SECTIONS

- .1 Section 22 05 00 - Common Work Results for Plumbing.
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1, 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 A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - .2 ASTM B209M-01, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .3 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .4 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .5 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .6 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
 - .7 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .8 ASTM C552, Standard Specification for Cellular Glass Thermal Insulation.
 - .9 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .10 ASTM C921-03, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Manufacturer's Trade Associations.
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .4 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

- .2 CAN/ULC-S102.2-03, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
- .3 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .4 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.
- .5 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.
- .5 Department of Justice of Canada.
 - .1 Canadian Environmental Assessment Act, 1995, C.37.
 - .2 Canadian Environmental Protection Act, 1999, C.33.
 - .3 Transportation of Dangerous Goods Act, 1992, C.34.
- .6 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .7 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 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
 - .3 CAN/CGSB 51.9, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
 - .4 CAN/CGSB 51.11, Mineral Fibre Blanket Thermal Insulation.
 - .5 CAN/CGSB-51.12, Cement, Thermal Insulating and Finishing.
 - .6 CAN/CGSB-51.40, Flexible, Elastomeric, Unicellular Thermal Insulation, Sheet and Pipe Covering.
 - .7 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

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.
- .3 "NETWORK" - piping, including accessories, fittings, etc., such as valves, elbows, pumps, tees, etc., which are incorporated
- .2 The thickness of insulation is which cover all components of the element to be insulated, as reinforcements, angle irons, brackets, joints, etc.

1.4 SUBMITTAL

- .1 Submit documents and samples in accordance with section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit for approval a 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.

1.5 QUALITY INSURANCE

- .1 The manual quality standards for mechanical isolation of the Canadian Thermal Insulation Association (CTIA) and its additions and amendments allowed, should be used as a standard reference and made a part of the specifications of this project.
- .2 Contractor responsible for the installation of mechanical insulation must keep a copy of the manual quality standards for reference.

1.6 HEALTH AND SAFETY

- .1 Take necessary measures to ensure health and safety on construction site, in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Sort waste in order to re-use and recycle in conformity with section 01 74 21 - Waste Management Plan.
- .2 Place excess or unused insulation and insulation accessory materials in designated containers.
- .3 Dispose unused metallic materials to an approved metal recycling facility.
- .4 Dispose of unused adhesive material at an official and approved hazardous material collections site.

1.8 ACCEPTABLE PRODUCTS AND MATERIALS

- .1 Where a particular brand name is stipulated, see Instructions to Bidders for procedure for requesting approval of substitute materials and products.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: not more than 25.
 - .2 Maximum smoke developed rating: not more than 50.
- .2 Materials must be tested in accordance with ASTM C411.

2.2 SEALANTS

- .1 Caulking with strong odors, which contain toxic chemicals or that are not certified as being mold resistant should not be used in air handling units.
- .2 If using toxic products cannot be avoided, restrict its use in areas where fumes can be vented to the outside or in places where they will be confined behind a sealing air system, or apply several months before the area is occupied to allow the evacuation of the fumes over the longest period possible.

2.3 INSULATION

- .1 Thermal conductivity ("K" factor) not to exceed specified values at a mean temperature of 24°C, when tested in accordance with ASTM C335.
- .2 Insulation type **P-1**: 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: 0.033 W/m•°C at 24°C mean temperature.
 - .4 Temperature range: -29°C to 454°C.
 - .5 Acceptable products:
 - .1 Manson Alley-K;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
- .3 Insulation type **P-2**: mineral fibre blanket faced 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: 0.035 W/m•°C at 24°C mean temperature.
 - .4 Maximum temperature: 120°C.
 - .5 Density: 24 kg/m³.

- .6 Acceptable products:
 - .1 Manson Alley Wrap FSK;
 - .2 Knauf Insulation;
 - .3 Replacement materials or products: approved by addendum according to Instructions to bidders.
- .4 Insulation type **P-3**: flexible unicellular tubular elastomer.
 - .1 Insulation: to CAN/CGSB-51.40.
 - .2 Maximum "K" factor: 0.039 W/m•°C at 24°C mean temperature.
 - .3 Temperature range: -57°C to 105°C.
 - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.4 ADHESIVES, TAPES, AND BANDS

- .1 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, 19 mm wide, 0.5 mm thick
- .2 For **P-1** and **P-2** insulation type:
 - .1 Tapes: aluminium, self-adhesive, ULC rated for following characteristics: flame spread rating less than 25 and smoke developed rating less than 50:
 - .1 Acceptable products:
 - .1 Ruban Fattal Insultape manufactured by S. Fattal Canvas Inc.;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
 - .2 Overlap adhesive: adhesive, quick setting, for vapor retarder jacket joints and overlaps:
 - .1 Acceptable products:
 - .1 Foster 87-75 without asbestos fiber, to cover 6 m²/L;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
 - .3 Insulation coating adhesive, fire retardant:
 - .1 Acceptable products:
 - .1 Foster 30-36 without asbestos fiber, to cover 1.25 m²/L;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.

- .3 For P-3 insulation type:
 - .1 Contact adhesive: adhesive, quick setting, air drying, for insulation transverse and longitudinal joints.
 - .1 Acceptable products:
 - .1 RUBATEX, model 373;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
 - .2 Tapes: PVC, self-adhesive:
 - .1 Acceptable products:
 - .1 Armstrong 520, Foster 85-20 without asbestos fiber, to cover 5 m²/L;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
 - .3 P-3 insulation coating: coating to be installed on all exposed and outdoor piping, water based, semi-gloss finish and flexible, for indoor and outdoor application, white color and can be brushed or to spray.
 - .1 Acceptable products:
 - .1 RUBATEX, model 374;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.

2.5 JACKETS

- .1 Polyvinyl Chloride (PVC) Jackets.
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: by Departmental Representative.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements.
 - .1 Outdoor: UV rated material at least 0.8 mm thick
 - .9 Acceptable products:
 - .1 Zeston;

- .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
- .2 Canvas Jackets.
 - .1 220 gm/m² for visible elements and 120 gm/m² for dissimulated elements, cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.
 - .3 Acceptable products:
 - .1 Fattal Thermocanvas;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
- .3 Aluminium Jackets.
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
 - .7 Acceptable products:
 - .1 Permaclad;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.
- .4 Stainless steel jackets.
 - .1 Type: 304.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
 - .7 Acceptable products:
 - .1 Permaclad;
 - .2 Replacement materials or products: approved by addendum according to Instructions to bidders.

2.6 CEMENT

- .1 Thermal insulating and finishing cement.
 - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.M.

Part 3 Execution

3.1 INSTALLATION

- .1 Only install insulation after required testing is completed and results approved by Departmental representative.
- .2 Make sure surfaces are clean, dry, and free from foreign material during insulation installation and finishing coating application.
- .3 Apply insulation, accessories and coating, and apply finishing coating in accordance with manufacturer's instructions and specification of the present section. Apply at least two layers of finishing coating.
- .4 Install saddles and protection shells as 23 05 29 - Hangers and Supports for HVAC Piping and Equipment:
 - .1 Cut the insulation under piping over a length at least equal to the length of the saddle or shell, and over a width equal to one third of piping perimeter.
 - .2 Replace insulation by high density insulation.
 - .3 For cold or chilled water piping, cover with a vapour retarder jacket or ensure continuity.
 - .4 Install the protection shell.
- .5 Vapor retarder jacket must not have openings or interruptions at the locations of sleeves, fittings and brackets.

3.2 INSULATION

- .1 Insulation Installation: to ANSI/NFPA 90A and ANSI/NFPA 90B.
- .2 Use shells type insulation for piping.
- .3 Multiple Layer Insulation: offset joint of each insulation layer.
- .4 Vertical piping NPS 3 and higher: brackets must be welded or bolted to piping, directly over the lowest fitting and then at each 4.5 m on center.
- .5 Seal and finish the ends of insulation, exposed or not, with cement.

- .6 Insulation Joints: cut straight the ends of each insulation thickness, according to the manufacturer's instructions, leave a gap of 25 mm between successive sections and fill with flexible insulation mineral fibers of type P2 without compacting it.
- .7 Seal and finish the ends of the insulation, exposed or not, with insulating cement.
- .8 Piping Expansion Joint: provide joints to allow free expansion and contraction of piping without damaging insulation or coating.
- .9 Orifice plate mounting flanges, unions and connections at inlet and outlet of apparatus, expansion joints, valves and other components requiring periodic maintenance: install insulation and coating so that it is possible to dismantle and reassemble these components without damaging the adjacent insulation and its coating.
- .10 Fittings, cold application (5°C to 15°C): insulate fittings with sections of pipe insulation cut tight fit tab or with a tightly placed flexible insulation and covered with a reinforcing membrane embedded in a coating vapor barrier. Alternately, insulate fittings with tightly placed flexible insulation and covered with reinforcing membrane embedded in vapor barrier coating and PVC coated.
- .11 Do not insulated the following chromed elements:
 - .1 Piping, valves, and fittings.

3.3 INSULATION FIXING

- .1 Fix each insulation section with tapes at 914 mm on center and at least one tape at each ends and one on the center of each insulation section.

3.4 PIPING INSULATION SCHEDULES

- .1 Unless otherwise specify, the insulation of the piping include the insulation of the valve, filters, and accessories.
- .2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, and fittings.
- .3 Insulate the piping and equipment as indicated in the following table:

SYSTEMS AND EQUIPMENT	FLUID TEMPERATURE °C	INSULATION TYPE
.1 Potable cold water	4	P-1
.2 Potable hot water	60	P-1
.3 Recirculation potable hot water	60	P-1
.4 Exposed storm drainage, on a distance of 5 m from roof, for horizontal pipes, thickness of insulation 25 mm	--	P-1

SYSTEMS AND EQUIPMENT	FLUID TEMPERATURE °C	INSULATION TYPE
.5 Hidden storm drainage, on a distance of 5 m from roof, for horizontal pipes, thickness of insulation 40 mm	--	P-2
.6 Exposed vent piping, length: 5 m from the roof, to main piping and branches	--	P-1
.7 Concealed vent piping, length: 5 m from the roof, to main piping and branches, insulation thickness of 25 mm	--	P-2
.8 Under roof drain, insulation thickness of 50 mm	--	P-2
.9 Air plenum drainage piping, insulation thickness of 25 mm	--	P-1
.10 Over expansion joint insulation, insulation thickness of 25 mm	--	P-2
.11 Domestic cold water strainer caps (removable installation), insulation thickness of 25 mm	--	P-3
.12 Hot water network	50	P-1
.13 Cold water network	4	P-1
.14 Hot glycol network	50	P-1
.15 Cold glycol network	4	P-1

.4 Insulation thickness of P-1 type.

FLUID TEMPERATURE °C	PIPE SIZE (NPS)			
	NPS 1 and less	NPS1¼ to NPS2	NPS 2½ to NPS 4	NPS 5 and more
	Thickness - mm			
151-240	64		76	89
121-150	51	64		76
96-120	38		51	
50-95	25		38	
14-49	25		38	
5-13	25	38		
Less than 5	25	38		
Ventilation	25			

3.5 FINISHES

- .1 Exposed Indoors: PVC jackets.
- .2 Exposed in Mechanical Room: PVC jackets.

- .3 Concealed, Indoors: canvas on valves, fittings. No further finish.
- .4 Finish Attachments: SS screws and bands, at 150 mm on centre. Seals: wing or closed.
- .5 Installation: to appropriate TIAC Code.

3.6 REMOVABLE, PRE-FABRICATED, INSULATION, AND ENCLOSURES

- .1 Application: pumps, visit doors, expansion joints, valves, meter, couplings, flanges, unions, and other accessories.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation.
 - .1 Thermal Insulation of the requested type for the device or the piping network concerned, shaped to fit the shape of the elements to be insulated.
 - .2 Thickness: double the required thickness for the device or the piping network concerned.
 - .3 Vapour barrier added for water cooling systems or other cold surfaces.
- .4 Envelopes: 1.3 mm thick aluminum or 0.6 mm thick stainless steel, with external coating and quick uncoupling belts.

3.7 SEALANTS

- .1 Follow manufacturer's recommendations regarding temperatures, relative humidity and moisture content of the substrate to own implementation and drying sealants, and special instructions for the use of.

END OF SECTION