

PART 1 – GENERAL

1.1 GENERAL REQUIRMENTS

- .1 Conform to the requirements of Section 21 05 01, “Common Work Results for Mechanical”.
- .2 Under no circumstances may any insulation product containing asbestos fibre be used on this project.
- .3 All products used must have a flame spread rating less than 25 and smoke developed classification not more than 50 when tested in accordance with CAN/ULC S102 m88.
- .4 Submittals: Provide shop drawings which included product description, list of materials and thickness for each service and manufacturers’ installation instructions.
- .5 Environmental Requirements: Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics and insulation cements.
- .6 Quality Assurance: Insulation materials must be manufactured by a member of the Master Insulators Association(M.I.A.).
- .7 Storage of Materials: Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove any damaged materials from the site immediately. Remove and replace at no additional cost any installed materials which are damaged.
- .8 Delivery: Deliver insulation, coverings, cements, adhesives coatings, etc., to the site in Manufacturer’s original containers with the manufacturer’s stamp or label affixed showing flame and smoke ratings on the products, name of manufacturer and brand.

1.2 DEFINITIONS

- .1 In this Specification, “exposed to view” means all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings, or shafts, furred spaces, trenches or chases.
- .2 In this Specification, “exposed to weather” means all services located outdoors.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Use materials specified herein or approved equal as defined in Section 21 05 01, “Common Work Results for Mechanical”, Clause “Material and Equipment “.

**SECTION 23 07 00
HEATING/COOLING INSULATION**

2.2 PIPING INSULATION INSERTS

- .1 Make rigid insulation on steam and condensate piping inserts equal in thickness to the adjoining insulation. Use Johns Manville Thermo 12 Gold hydrous calcium silicate rigid pipe insulation. Inserts to extend up to pipe centreline on both sides. Use the following insert lengths:

Nominal Pipe Size		Insert Length	
mm	(inches)	mm	(inches)
40-65	(1-1/2 – 2-1/2)	250	(10)
80-150	(3-6)	300	(12)
200-250	(8-10)	400	(16)
300 and over	(12 and over)	560	(22)

2.3 PIPING INSULATION INSERT SHEILDS FOR STEAM/CONDENSATE

- .1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Shield length to be 100 mm (4”) less that length of associated insert.
- .2 Heating and cooling follow table as below.

SPECIFICATIONS FOR THE BELFORM INSULATED PIPE SUPPORT INSERTS (TABLE)

NOMINAL PIPE SIZE NPS	SUPPORT CENTRES	MINIMUM SAFETY FACTOR	MIMIMUM SUPPORT LENGTH IN INCHES BY DENSITY		METAL SADDLE GUAGE	METAL SADDLE LENGHT
			3.75 lb/ft2	5 lb/ft2		
(inch)	(ft)					
1/2	10	5	6		22	4
3/4	10	5	6		22	4
1	10	5	6		22	4
1-1/4	10	5	6		22	4
1-1/2	10	5	6		20	4
2	10	5	6		20	4
2-1/2	10	5	6		20	4
3	10	5	6		20	4
3-1/2	10	5	6		20	4
4	10	5	6		16	4
5	10	5	6		16	4
6	10	5	9		14	7
8	10	5	9		14	7
10	10	5	9		14	7
12	10	5		9	14	7
14	10	5		9	14	7
16	10	5		9	14	7
18	10	5		12	14	10
20	10	5		12	14	10
24	10	5		12	14	10

2.4 PIPE INSULATION

.1 Piping Heating/Cooling

- .1 Use Belform Insul-Phen insulation with factory applied AP T Plus jacket. Jacket to consist of aluminum foil vapour barrier reinforced with fibreglass scrim and laminated to a fire resistant kraft facing.
- .2 In areas exposed to view, finish with Belform PVC (15mil) thickness "Cut and Curled" jacketing. With self seal adhesive tape. Tacking of jackets will not be accepted.

.2 Valves and Fittings

- .1 Insulate valves and fittings in exposed areas with two pieces Insul-Phen. Finish with Belform PVC insulated fitting and jacketing .015mm thickness.
- .2 On steam and condensate systems where service is required, use Firwin Thermowrap 1200 Series or *equivalent* removable insulation blankets. Blankets to consist of fibreglass insulation adhered to silicone impregnated fibreglass cloth, fastened with capstan rivets.
- .3 Pipe Thickness Schedule (below)

2.5 Minimum Insulation Thickness to Conform to ASHRAE 90.1

Pipe Insulation Schedule – Imperial

Steam, Steam Condensate

Insulation Conductivity		Nominal Diameter (in)				
Conductivity Range Btu in (hr.ft ² F)	Mean Rating Temperature (OF)	1 & less	1 to 1-1/2	1-1/2 to 4	4 to 8	8 & up
0.32 0.34	250	2.5	3.0	3.0	4.0	4.0
0.29 0.32	200	2.0	2.5	3.0	3.0	3.0

Hot Water & Combined Heating/Cooling Heating Systems

Insulation Conductivity		Nominal Diameter (in)				
Conductivity Range Btu in (hr.ft ² F)	Mean Rating Temperature (OF)	1 & less	1 to 1-1/2	1-1/2 to 4	4 to 8	8 & up
0.27 0.30	150	1"	1"	1"	1"	1"
0.25 0.29	125	1.0	1.0	1"	1"	1"
0.22 0.28	100	1.0	1.0	1.0	1"	1"

2.6 HEAT EXCHANGERS, STORAGE TANKS AND STORAGE HEATERS

- .1 For shell and coil heat exchangers, storage tanks and storage heaters, use 50 mm (2") thickness 48 kg/m³ (3 lb/ft³) density Johns Manville or *equivalent* pipe and tank semi rigid fiberglass board bonded to a flexible type AP or FSK jacket .
- .2 For plate heat exchangers insulated with 50 mm (2") thickness 48 kg/m³ (3 lb/ft³) density Johns Manville or *equivalent* pipe and tank semi rigid fiberglass board bonded to a flexible type AP or FSK jacket.
- .3 Finish with PVC jacket or canvas jacket

2.7 REFRIGERATION PIPING

- .1 Use Armaflex or equivalent insulation. Use type 'W' outdoors.

2.8 FINISHING CEMENT

- .1 Use Ryder hydraulic setting finishing cement.

2.9 LAGGING ADHESIVE

- .1 Use white Childers CP52 or Foster 30 30 or *equivalent* water based fire retardant lagging adhesive.

2.10 CANVAS COVERING

- .1 Use UL listed fabric 1.83 kg/m² (6 oz/ft²) fire retardant canvas covering.

2.11 ALUMINUM COVERING

- .1 Use 0.045 mm (0.016") aluminum jacket with integral moisture barrier for all piping exposed to the weather.

2.12 EQUIVALENT MANUFACTURERS

- .1 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":
 - .1 Johns Manville
 - .2 Knauf
 - .3 Roxul
 - .4 Manson
 - .5 Owens Corning (except flexible duct insulation)
 - .6 Insul-Phen

2.13 GENERAL

- .1 Install all insulation in strict accordance with manufacturer's published recommendations.
- .2 Install all insulation continuous through walls and sleeves.
- .3 Do not apply insulation until piping has been tested and improved.
- .4 In order to address aggressive project construction schedule verify that piping and equipment have been tested according to the specifications and as required by agencies having jurisdiction and approved before apply insulation material. Work can proceed with written permission by mechanical consultant/contractor with the understanding that any necessary insulation removal and repairs are corrected at the contractor's expense.
- .5 Do not insulate union or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with the vapour resistant mastic.
- .6 Insulate ALL components of insulated systems unless specifically excluded.
- .7 Extend all surface finishes to protect all surfaces, ends and raw edges of insulation

2.14 PIPING SYSTEMS

- .1 General: This Clause refers to all piping systems except Refrigeration.
- .2 Condenser Water System: All piping located outdoors may require insulation and heat tracing Size Insulation to suit.
- .3 Heat Pump Water System: Insulate all piping located outside of building. Insulate all condensate piping associated with heat pump units.
- .4 Other Systems: Insulate the following piping systems in their entirety:
 - .1 Glycol Heating
 - .2 Reheat Coils
 - .3 hot water heating
 - .4 chilled water
 - .5 steam and condensate
 - .6 condensate drains (horizontal portion only)
 - .7 humidification steam
- .5 *Insulation Application*
 - .1 Hanger Points: Provide and insulation insert and shield at each hanger point on all systems. On cold lines, vapour seal butt joints on each side of insert.
 - .2 Pipe: Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75mm (311) wide strip of the jacketing material. Use a Vapour barrier adhesive on all "cold" lines and dual temperature systems.

**SECTION 23 07 00
HEATING/COOLING INSULATION**

.6 *Fittings and Valves*

- .1 For piping in exposed areas use the two piece Belform fittings finished with the Belform PVC fittings to a thickness matching adjoining insulation. In areas where insulation is not exposed to view, insulation ends may be mitred at elbows and sealed with aluminum tape.
- .2 Cold system: Vapour seal the end of cut out insulation with 3" aluminum tape. This applies to

to: .1 chilled water .2 condensate drains

On components which require regular services fabricate easily removable and reusable covers for strainers, unions, pumps , casings (Thermowrap removable insulation blankets to a thickness matching adjoining insulation. Fasten with Capstan rivets and stainless steel wire.)

- .3 Pipe Insulation Covering: In all locations where the insulation will be exposed to view, finish with Belform PVC .015 or canvas. Follow strictly manufacturer's installation procedures for cold and hot systems.
- .4 Aluminum Covering: On all piping exposed to weather, apply aluminum jacket over insulation with 15mm x 0.38mm (1/2" x 0.015") stainless steel banding at 300mm (12") o/c. Overlap all joints at least 80mm (3") with longitudinal joint lapped to the weather.