REFRIGERATION PIPE & VESSEL
AND
UNDERGROUND APPLICATION

SPECIFICATION

1.0 PRODUCTS

1.1 Insulation Materials for Piping, Fittings, and Valves

A Insulation shall be DUPONT manufactured by The Dupont Chemical Company.

B Material Thickness can be determined by referencing the insulation thickness chart (Table 1)

C Insulation shall have a minimum density of 1.6 lbs/ft3 (26 kg/m3)

D Insulation shall have a maximum thermal conductivity of 0.259 btu-in/hr-ft2 - deg F and 180 days aging per ASTM D-1624.

E Insulation shall have a maximum water absorption of 0.5% by volume per ASTM C-272 and a maximum water vapor permeability of 1.5 perm-inch per ASTM E-96, (procedure B).

F Insulation dimensional stability at 158 Deg F / 97% RH for 7 days shall be a maximum of 2% volume change as measured by ASTM D-2126.

1.2 Temperature Limitations

Polystyrene insulation (Dupont Styrofoam SM) will begin to suffer dimensional instability between the temperatures of 165 Deg F and 180 Deg F. Dimensional instability will occur and intensify as the temperature increases from 180 Deg F up to 240 Deg F. At temperatures above 240 Deg F polystyrene will begin to melt.

Polystyrene should not be used to insulate any lines that operate at temperatures above 165 Deg F. Lines that require insulation with operating temperatures above 165 Deg F should be insulated with Polyisocyanurate.

1.3 Fabrication of Insulation

Pipe insulation shall have tongue and groove on the longitude and shiplap at both ends as per Belform.
Insulation shall be fabricated in required shapes from Dupont SM laminated sheets in accordance with ASTM C-450, Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Belform Prefab Dome Heads C-585 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System). Domehead must be as per ASTM specification.

Fittings, such as 90 Deg and 45 Deg elbows, Valves and Tees shall be two piece Belform with Tongue and Groove and Shiplap at both ends. This also applies for larger diameter size.

1.4 Adhesives, Joint Sealers, & Mastics

A Belform insulation interlocking system does not require adhesive.

1.5 Vapor Retarder

A Vapor retarder shall be Dow Saran 560 Vapor Retarder Film of Polyguard Zero-Perm or Mylar. Refer to product literature and installation guidelines for recommended application instructions.

B Elbows and fittings shall be wrapped with two layers of Saran 520 Vapor Retarder Tape or single layer of Zero-Perm Vapor Barrier Tape.

C For tanks, vessels, and equipment, use Saran 560 Vapor Retarder Film or Polyguard Zero-Perm or Mylar

1.6 Protective Jacketing Materials

Indoor Applications:

A Jacketing shall be of Walton PVC jacketing. PVC thicknesses to be .015 or .020 with 1/2" double faced tape on the longitude joint. All joints of PVC jacket shall be solvent weld on the circumference. in production areas.

B Color to be defined by the plant maintaining consistencey with existing Belform insulation.

C All fittings, tees, elbows, valves, caps etc shall be jacketed with preformed Belform PVC covers of the same thickness as straight pipe jacketing.

D PVC protective jacketing shall not be considered a vapor retarder.

E Rivets, screws, staples, or any other fastener capable of penetrating the underlying vapor retarder shall **NOT** be used to secure the PVC jacketing

Finished Outdoor Applications:

A Jacketing shall be aluminum metal cladding using aluminum alloys 3033, 110, or 3105 in accordance with ASTM B-209 with H-14 temper and a Polysurlyn-craft moisture barrier on the under-side. Minimum thickness shall be 0.016", with 1/2" safety edge on the longitude.

B Kraft paper interior jacketing must NOT be used.

C Aluminum jackeing for all fittings, tees, elbows, valves, caps, etc shall be sectional, factory contoured, or field fabricated to fit closely around insulation.

D Banding for jacketing shall be 0.020" thick by 1/2" wide stainless steel positioned on 12" centers.

E Aluminum protective jacketing shall not be considered a vapor retarder.

F Rivets, screws, staples, or any other fastener capable of penetrating the underlying vapor retarder shall **NOT** be used to secure the aluminum jacketing only where absolutely needed.

1.7 Protection Saddles

A Insulation protection saddles shall be galvanized steel in non-production areas and stainless steel in production areas or areas where food safety must be considered.

B Saddles shall be installed between hangers or supports and pipe to distribute the load uniformly across the outer surface of the insulation.

C Pipe supports shall be Belform K Blocks 5lb density

D Saddles 6" and over shall be secured to the outer surface of the insulation with two 1/2" x 0.020" stainless steel in food process area and galvanized in other areas.

E Saddles shall be sized in accordance with the Protection Saddle Sizing Chart (Table 2)

2.0 APPLICATION & FIELD REQUIREMENTS

2.1 Installation Guidlelines

A Install pre-fabricated insulation fittings on elbows and tees. Insulation shall be the same thickness at fittings as pipe sections.

B Insulation shall be secured to the pipe with 3/4" wide fiber reinforced tape

C All insulation shall be tightly butted and free of voids and gaps at all joints.

D Elbows and fittings shall be wrapped with Vapor Retarder Tape or covered with a mastic type vapor retarder product. Vapor Retarder Tape shall be spiral wrapped with a minimum 50% overlap. If using mastic type vapor retarder at fittings and elbows, form mastic so that fitting covers can be applied true and tight.

E Valves - install 2 pieces Belform pre-fabricated valve system

2.2 Insulation Handling

All insulation material shall be delivered to the project site in original, unbroken factory packaging labeled with product designation and thickness. Shipment of materials from the manufacturer to the installation location shall be in weather tight transportation. Insulation materials on site ir preparation for installation shall be stored so as to protect the materials from moisture, prolonged UV sunlight and any adverse weather conditions, prior to installation and during the process of installation.

2.3 Indoor Piping

* If mastic is to be used, it must be allowed to dry prior to the installation of PVC jacketing.
* Insulation systems on indoor piping, 2 piece valves and flanges shall be covered with vapor barrier and finished with PVC jacketing.
* Seal around protrusions, such as pipe nipples for service activities, with a full bead of silicone sealant.
* All line valves in insulate pipe runs are to be insulated.

2.4 Outdoor Piping

* Insulation shall be protected from prolonged exposure to UV light and weather prior to and during the installation process.
* Vapor Retarder shall be covered with Saran 560 vapor barrier, polyguard or Mylar, within two weeks fo installation to eliminate long term exposures to UV light.
* Jacketing overlap shall be .016 aluminum at a minimum of 2" at butt joints and a minimum of 2" at longitudinal joints. Longitudinal joints must be oriented to avoid water infiltration.
* Straight sections of jacketing shall be neatly secured with bands and seals with a maximum spacing of 12" on center. End joints shall be secured with bands and seals centered directly over the joint. Rivets, screws, staples or any other fastener capable of penetrating the underlying vapor retarder shall **NOT** be used.
* All aluminum must have a 1/2" safety edge on the longitude.

2.5 Vessel & Tanks

A All insulation materials shall be the same as those used on the piping associated with the vessel, tank or equipment.

B Insulation shall be double layer if the vessel diameter is greater than 30", tongue and groove not required on two layers

C Insulation shall be double layer if the vessel operating temperature is below 0 Deg F

D Vessel and tank head shall be single Belform Dome head system or triple or quads system.

E Curved segments shall be fabricated to fit the contour of the surface in equal size pieces to go around the vessel with a minimum number of through joints. Cutting in the field shall be minimized. All sections shall be tightly butted and free of voids and gaps. Curved segments shall be with a shiplap all the way around to minimize single joints.

F In double layer applications, the horizontal and vertical joints of the inner and outer layer curved segments shall be staggered, no shiplap or tongue and groove needed.

G The top of the outer layer of wall insulation in a double layer system shall be held below the inner layer top a minimum of the insulation thickness. The tank head insulation should be one or 2 piece dome head single layer system manufactured by Belform Insulation.

H The shell insulation shall be secured with stainless steel bands on 12" centers.

I Install Saran 560 Vapor Retarder Film or Mylar. Tightly wrap the vessel insulation circumferentially with Vapor Retarder Film. Overlap the seams by a minimum of 2 inches. Seal the overlapped seams with Vapor Retarder Tape. On vertical vessels apply the Vapor Retarder Film starting with the bottom course, working up words, each course should overlap on top of the one below it, providing a joint that will naturally shed water.

J The vapor retarder on curved head sections shall be Mylar glued on.

K Legs and appendages attached directly to the shell shall be insulated out from the vessel head or wall four times the insulation thickness and the insulation termination sealed with vapor stop.

L Indoor vessels, tanks, and equipment shall be covered with PVC Jacketing "Protective Jacketing Materials" and .016 aluminum jacket for outdoor application.

2.6 Items not Insulated

The following items shall not be insulated unless specific project related circumstances are required by owner.

- Oil Pots
- Control Valves and Strainers
- Booster discharge lines (BD)
- High stage dischrge lines (HSD)
- All thermosyphon piping (TSS & TSR)
- All gauge piping and tubing (gauge line isolation valves located immediately adjacent to a main and a minimum of 2 feet of pipe or tube past this valve should be insulated)
- All relief valve discharge piping (RV)
- All purge lines (PRG)
- All high pressure liquid lines (HPL)
- All condenser water lines and pumps
- Hot gas piping located in the machinery room

3.0 SELCTION TOOLS

3.1 TABLE 1 - INSULATION THICKNESS CHART

NPS	Process Temperatue (Deg F)																					VESSELS
(IN)	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	2' - 20' DIA
0.5	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1	1	1	1	30 °F TO 40 °F
0.75	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1	2"
1	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1	15 °F TO 29 °F
1.25	2.5	2.5	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	2.5"
1.5	2.5	2.5	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	0 °F to 14 °F
2	2.5	2.5	2	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	3"
2.5	2.5	2.5	2	2	2	2	2	2	2	2	1.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	(-1)°F TO (-25)°F
3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1	1	3.5"
4	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1	1	(-26)°F TO (-50)°F
5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1	4"
6	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	1.5	1.5	1.5	1.5	1.5	
8	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	1.5	1.5	1.5	1.5	
10	3.5	3.5	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2	2	2	2	1.5	1.5	1.5	1.5	2'-10' DIA.
12	3.5	3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2	2	2	2	1.5	1.5	1.5	1.5	(-51)°F TO (-75)°F
14	4	4	3.5	3.5	3.5	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	2	2	2	1.5	1.5	1.5	4.5"
16	4	4	4	3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2	2	2	2	1.5	1.5	11'-20' DIA.
18	4	4	4	4	3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2	2	2	2	1.5	1.5	(-51)°F TO (-75)°F
20	4	4	4	4	3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2	2	2	1.5	1.5	5"

Based on Dupont recommendations to prevent condensation for 95 °F ambient, 80% humidity, aluminum jacket (e=0.1), and 7 mph wind speed

3.2 TABLE 2 - PROTECTION SADDLE SIZING CHART

OD of Insulation	Gauge	Length
0.5" thru 5.5"	18	12"
5.6" thru 10.75"	16	18"
1076" thru 17"	14	24"
Over 17"	12	24"

Belform Styrofoam SM is ideal application for underground system such as hot water system, cold water system, chilled water system, heating and glycol systems, sanitary, drainage etc. Insulation must be tongue and groove and shiplap at both ends. Insulation to be covered with a protective waterproof jacket MFM Subseal 40.

Specification is strictly based on 60 years of past experience.

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