INSTALLATION MANUAL

BETA FOAM

RIGID POLYISOCYANURATE

For

LNG, CRYOGENIC

CHILLED WATER

APPLICATION
<table>
<thead>
<tr>
<th>Page</th>
<th>Rev.1</th>
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</table>
CONTENT

1. SCOPE

2. CODES

3. GENERAL

4. INSULATION MATERIALS

5. MATERIALS OF CONSTRUCTION

6. INSULATION THICKNESS

7. APPLICATION OF INSULATION

8. APPENDIX
1- SCOPE

1.1 This guideline covers the installation of Beta foam Rigid Polyisocynurate Insulation on LNG, CRYOGENIC and CHILLED WATER piping systems, tanks, vessels and equipment.

1.2 Product data sheets and other BETA ENG. GROUP literature are referenced throughout this guideline. Visit www.betaenggroup.com for the latest version of these documents.

1.3 The information contained in this guideline and referenced BETA ENG. GROUP documents are current as of November 2014. This guideline is subject to revision without notice. Contact BETA ENG. GROUP Insulation Systems Customer Information Group at 021-22376978 or your local BETA ENG.

1.4 Due to the variations in service conditions and use, this guideline may not be pertinent for every application. A design or specifying engineer can create specifications tailored to particular applications or owner’s needs. Such a design or specification engineering service may be more familiar with local conditions, budgets, environment, and desired service life of the system allowing them to generate a precise specification.

1.5 It is the intent of this document to provide guidelines for the installation of Beta foam insulation and Vapor Retarder Film and Tape supply by BETA ENG. GROUP Insulation Systems. While supplemental insulation products may be referenced in this guideline, BETA ENG. GROUP recommends consulting the manufacturers of these products for proper installation and handling.

1.6 This guideline is offered as a guide for the purpose described herein. No warranty of procedures, either expressed or implied is intended. All other express or implied warranties of merchantability or fitness for a particular purpose are disclaimed.
2- CODES

Cold insulating material, shall meet the following codes:

- ASTM A 463: Steel sheet, cold-rolled, Aluminum-Coated, Type 1 and 2
- ASTM C 591: Unfanced Pre-formed Rigid Cellular Polyurethane Thermal Insulation
- ASTM D 2341: Rigid Urethane Foam
- ASTM A 167: Stainless Chromium Steel Plate Sheet and Strip
- ASTM C 795: Wicking type thermal Insulation for use over Austenitic Stainless steel
- ASTM E 84: Surface burning characteristics of building materials
- ASTM E 96: Water vapour transmission of Materials
- BS 1470: Wrought Aluminum and Aluminum-Alloys for general engineering purposes: Plate, Sheet and Strip.
- ASTM C552: Cellular Glass Thermal Insulation
- ASTM C177: Standard test method for steady state heat flux measurements and thermal transmission properties by means of the guarded hot plate apparatus
- ASTM D 2856: Standard test method for open-cell content of rigid cellular plastics.

DB 2224 999 7600 0407 1 Packing, Marking and Shipping Instruction
DB 2224 999 P332 203 1 List of Applicable Codes and Industry Standard
DB 2224 999 P332 301 0 Equipment and Materials Certification
PP 2224 999 7400 0001 0 Instruction to Vendor Documentation
PP 2224 999 7400 002 0 Bidding Instruction and Attachments
RP 2224 999 6500 003 3 Steam Tracing Specification
RP 2224 999 6500 002 1 Heat Insulation of Equipment and Piping in Cold Service
3- GENERAL

3.1 All piping shall be free of foreign substances and free of surface moisture or frost prior to the application of insulation.

3.2 All insulation material shall be delivered to the project site in original, unbroken factory packaging labeled with product designation and thickness. The shipping package should not be air-tight. Shipment of materials from the manufacturer to the installation location shall be in weather-tight transportation. Insulation materials delivered to the job-site shall be stored so as to protect the materials from moisture and weather during storage and installation. Insulation material shall be protected from sunlight to avoid exposure to UV light from the sun.

3.3 All testing of piping systems shall be completed prior to the installation of the insulation system.

3.4 Refer to insulation thickness charts in Appendix C for recommended insulation thickness based on specific design criteria. For additional insulation thickness calculations please call at 021-22376978.

4- INSULATION MATERIALS

Materials used for cold insulation is:

- Polyisocynurate

In conformity to the ASTM listed in section 3 above and as follows. Commercial forms may be used for pre-formed polyisocynurate (PIR)
PREFORMED POLYISOCYANURATE FOAM (PIR)

Polyisocynurate shall be expanded in the manufacturer’s workshop with a control of all parameters: temperature, humidity, pressure and ratio of polyisocynurate components and conformity to the ASTM C 591.

*BETA foam 50 (PIR rigid cold insulation)*

PIR (Polyisocynurate) foam segments are high-quality insulating materials with excellent properties and are supplied in pipe sections and slabs. Other types available on request. Standard densities are 50 (PIR), other densities are also available. PIR are used extensively on equipment and piping operating at lower temperatures in power stations, marine vessels, petrochemical plants, oil refineries etc.

<table>
<thead>
<tr>
<th>Specification</th>
<th>No.</th>
<th>Properties</th>
<th>Standard</th>
<th>Unit</th>
<th>Value (for PIR)</th>
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<tr>
<td>1 Density</td>
<td></td>
<td></td>
<td>ASTM D 1622</td>
<td>kg/m³</td>
<td>50 ± 1%</td>
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<tr>
<td>2 Compressive strength 10% deflection</td>
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<td></td>
<td>ASTM D 1621</td>
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<td>4 Closed cell</td>
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<td></td>
<td>ASTM D 2856</td>
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<td>5 Thermal conductivity</td>
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<td>After 5 months of stabilization</td>
<td>ASTM C 518</td>
<td>Kcal/hm²°C</td>
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<td>6 Friability (@10 min.)</td>
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<td></td>
<td>ASTM C 421</td>
<td>%</td>
<td>-9 ± 1</td>
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<td>7 Water absorption</td>
<td></td>
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<td>ASTM D 2842</td>
<td>% by vol.</td>
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<td>8 Water vapour transmission</td>
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<td>At 23°C and 85% RH</td>
<td>ASTM C 96</td>
<td>g/m² @ 24 H</td>
<td>30 ± 10</td>
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<td>9 Dim. stability @ 70 deg C &amp; 97% R.H. Change in thickness</td>
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<td>ASTM D 2126</td>
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<td>12 Hot Surface</td>
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<td>ASTM C 411</td>
<td>pass</td>
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All properties have been measured at 23°C

For all sizes up to and equal to 10” NPS, the PIR shall be applied in two half section.

For sizes over 10” NPS and equipments, PIR shall be site pre-fabricated with block type insulation.

Fire properties: Self-extinguishing according to ASTM D-1692(10/10 SE)
5- MATERIALS OF CONSTRUCTION

INSULATION ACCESSORIES TO BE USED WITH THE CONVENTIONAL METHOD (WITH PREFORMED ELEMENTS)

5-1 GLUES

These products shall be used to hold in place insulating materials. Product reference: 888-01 from Foster or Equivalent. (TIC 5030)

5-2 SEALERS

These products shall be used to prevent the entrance of moisture or vapour between the insulation elements. Also sealers ensure the differential movements (due to the temperature fluctuations) between the insulation elements.

These sealers must remain plastic at low temperature and must be chemically inert.

Product reference: 886-06 from Foster or Equivalent. (TIC 7010)

5-3 VAPOUR ARRIER

Vapour barrier shall consist of weatherproofing mastic, reinforced by a polyester fabric to ensure the mechanical protection.

It must be moisture proof and waterproof to avoid damaging the insulation. Vapour barrier must be fire resistant proof after drying.

Vapour barrier must resist to long term expansion to sunlight and rain. Vapour barrier may consist of Hypalon mastic.

Product reference: HYPALCOTE 570 from Foster or Equivalent. (TIC 4055/56)

Polyester fabric is Used as reinforcement when mastic is applied as vapour barrier.

5-4 METAL SEALANT

These products shall be used to prevent the entrance of moisture or vapour between the metal jacketing edges.
These sealers must remain plastic at low temperature and must be chemically inert. 
Product reference: 95-44 Foster or Equivalent. (TIC 7030)

5-5 STRAPS, FASTENERS, TAPES

They shall be suitable for the selected insulating materials, the vapour barrier and the metal jacketing. Outer layer of insulation shall only be secured by adhesive tapes.

• STRAPS

Stainless steel (AISI 304 or 304L) or aluminum straps shall be used to secure in position the insulating material on equipment, piping and instruments, and to secure in position the aluminized jacketing when required.

For piping:

  Width 12 mm, Thickness 0.5mm for pipes : \( \varnothing \leq 6" \)
  Width 16 mm, Thickness 0.5mm for Larger Pipes : \( \varnothing > 6" \)

For equipment:

  Width 16 mm, Thickness 0.5mm for equipment : \( \varnothing \leq 1200 \text{ mm} \)
  Width 19 mm, Thickness 0.5mm for equipment : \( \varnothing > 1200 \text{ mm} \)

• FASTENERS

They shall be adapted to the straps on which they are used.

• TAPES

Reinforced adhesives tapes: minimum width 50 mm

5-6 MECHANICAL PROTECTION: JACKETING

In all cases, a metal jacket shall be applied as mechanical reinforcement (example: in circulation zones or near flares to protect the vapour barrier against hot radiation).

This jacketing shall be applied after the complete drying of the vapour barrier and shall be secured by means of straps.

Metal Jacketing shall be aluminum to ASTM B 209 / TYP-3003 or BS 1470 S1C-1/2 H4 or approved equal, with factory applied polykraft vapor barrier.
Thickness of sheets
Thickness of sheets shall be as follows:

- 0.63mm (0.52 mm Al + 0.11 mm Poly Kraft) thick and flat for piping 6" diameter and smaller.
- 0.73mm (0.62 mm Al + 0.11 mm Poly Kraft) thick and flat for piping over 6" diameter.
- 0.63mm thick × 5mm corrugated for vessels, tanks and equipments up to 30".
- 0.73mm thick × 32mm corrugated for vessels, tanks and equipments greater than 30".
- 1.00mm (0.90 mm Al + 0.10 mm Poly Kraft) thick and flat for vessel and equipment exposed heads.

Mechanical protection shall be secured in place by means of straps and fasteners.

6- INSULATION THICKNESS
The service temperature determines the insulation thickness.
Multiple layers shall be provided where the total insulation thickness exceed 50 mm.
For cold conservation and anti-condensation, refer to annexed tables.
For anti-icing (code I) a layer of 25 mm shall be applied on concerned items.

INSULATION TABLES
- ANNEX 1: For cold conservation and anti-condensation with (PIR) only Polyisocynurate

For combined cold and acoustic insulation the normal cold insulation shall be applied, (cold conservation type) then the acoustic insulation shall be applied on the vapour barrier of the preceding cold insulation.

Note: A complete vapour barrier shall be applied on the outer surface of this acoustic insulation.
7- APPLICATION OF INSULATION

7-1 INSULATION TECHNIQUES

7-1-1 FOR EQUIPMENT / PIPING / INSTRUMENT

Conventional method (by means of preformed element)

- On-site units and interconnecting: by means of preformed Polyisocynurate shells and slabs. These elements shall be sealed and weatherproofed by a vapour barrier.

7-1-2 FOR FLANGED ACCESSORIES (FLANGES, VALVES, LOCAL INSTRUMENT)

Insulation may be carried out by the conventional method with prefabricated elements

7-2 PRECAUTIONS PRIOR TO APPLICATION

The following operations shall be performed on equipment, piping and instruments prior to application of insulation.

- Support installation
- Satisfactory hydrostatic or pneumatic test
- Preparation of surfaces to be insulated (cleaning, passivation and painting)

7-2-1 SUPPORT INSTALLATION

Insulation supports on equipment shall be installed by the vessel fabricators and on piping by the Contractor’s Piping Sub-contractor prior to hydraulic test and/or the post weld heat treatment. Field welding on equipment and on tested and stress relieved piping shall be prohibited unless expressly authorized by the Company.
7-2-2 SURFACE CONDITION

All insulated surfaces must be painted as defined in the Project Painting Specification. All surfaces to be insulated shall be cleaned in order to remove all contaminants. During the second phase of insulation, material shall not be applied to surface which are wet or covered with frost; aluminum foil blanket shall be applied on all concerned surfaces.

7-3 APPLICATION OF INSULATION

• FOR EQUIPMENT
  Shells, bottoms, stiffener ring : by the “conventional method”
  Flanged Accessories : by the “conventional method”

• FOR PIPING / INSTRUMENTS

  Straight parts, elbow, reducers and tees : by the “conventional method”
  Flanged Accessories : by the “conventional method”

7-4 EXTEND OF THE INSULATION

For cold insulation, piping, instruments shall be completely insulated, but flanged components such as manholes, hand holes, flanges nozzles, valves shall only be insulated during the second phase of insulation installation, i.e. during the starting phase of the unit ( in cold service ).

7-5 “CONVENTIONAL METHOD” : GENERALITIES

• Only sound and dry materials having the right dimensions and the required quality shall be installed.
• Cut outs in insulation shall be clean cut.
• Any bevelled or rounded edges of insulating component shall be carefully squared off before application.
Basic rules for installation of insulation components on equipment, piping, and instruments, to prevent heat losses through the joints, is the staggered arrangement.

When more than one layer is provided to ensure differential movements between equipment/piping and insulation. These contraction joint shall be filled with mineral wool.

On horizontal pipes jointing of the external layer must be horizontally positioned.

All insulating components shall be glued, and sealed as defined by the product manufacturer/supplier.

All components shall be tight butted.

Then each layer of insulation shall be secured by stainless steel straps or adhesive tapes as defined hereafter:

Multi-layers insulation: Components shall be secured with stainless steel straps except the outer layer that shall be secured with adhesive tape.

Spacing of straps or tapes shall be 250 mm maximum from centre to centre.

On any sharp angles, a small aluminum alloy angle piece shall be installed to prevent the metal strap cutting into the insulation material.

On equipment head, floating ring shall be used to hold straps.

All insulation components shall be carefully cut and adjusted to follow the exact shape of surface, nozzles, manholes, rings, supports, gussets.

All spaces between block or lagging insulation and equipment shall be completely filled and packed with a granular/powder insulation compound.

Compressive joints shall be provided to ensure relative movements (due to the temperature fluctuations) between equipment, pipes and the concerned insulation. These joints shall be caulked with loose mineral fiber.

The outer surface of insulation shall have a regular and smooth contour.

The vapour barrier shall be carefully applied as defined hereafter.

The vapour barrier shall consist of a coat of weather proofing mastic reinforced with an open weave glass nylon cloth.

Insulation of flange components shall consist of prefabricated light gauge metal boxes fitted to the shapes and sizes of equipment or pipe to which they are applied. Polyisocyanurate foam shall be
poured into these boxes according to requirements of the foam manufacturer.

7-5-1 INSULATION ON EQUIPMENT (SHELL AND BOTTOM / HEADS)

- Insulation shall be applied in conformity to the recommendations of section 7.3.
- Insulation elements such as blocks, slabs, shall be applied with length parallel to the greatest dimension of surface being covered.
- The base course shall be applied with alternate length blocks so that all successive end joints are staggered.
- Adequate reservations shall be made in design and application for contraction and expansion of the equipment being insulated.
- Skirts supporting equipment shall be insulated inside and outside as part of the equipment area. The insulation shall extend downward, from the junction of the skirt and the bottom of equipment, down to a distance of five times the thickness of the insulation but in no case less than 250 mm.
- The thickness of the insulation shall be equal to that specified for the equipment.
- Equipment supports legs, cradles, hangers and other connections attached directly to the equipment shall be insulated for a distance of five times the thickness of the insulation.
- The end of the insulation must be carefully sealed to the attachment in order to prevent the entrance of moisture or vapour.
- During the first phase of insulation works flanged components shall not be insulated; around those the insulation end shall be carefully sealed.
- These flanged components shall be insulated after the start-up of the unit, during the second phase of insulation installation.
- Before being insulated, these flanged components must be protected by means of an aluminum foil blanket to permit as easy dismantling after completion.
- Full insulation thickness shall be applied over all support rings, stiffeners and other protuberances on the surfaces of the equipment.
- If possible, equipment identification plates shall be fixed on an un-insulated part of the concerned vessel. If not possible, these plates shall be insulated with a full insulation thickness and an
exact copy shall be fixed on the exterior of the insulation.

7-5-2 INSULATION OF PIPING

Insulation shall be applied in conformity with the recommendations of the section 7.3

- Straight pipe

Edges of pipe insulation segments shall be cut off square leaving a distance between the insulation segment edge and the flange bolt extremity equal to the bolt length plus 25 mm to ensure enough clearance for bolt dismantling.

The end of insulation shall be carefully sealed and insulation of flanges and valves carried out during the second phase of insulation works.

Insulation of fitting, flanges and valves shall be prefabricated with the same insulating material and the same thickness than those of the adjacent pipe.

On valves, stuffing boxes shall be insulated.

- Bends

Material shall be cut into suitable segments and joints shall be carefully staggered.

Each section shall be imposition by a metal strap or adhesives tapes. Outer surface of bends shall be rounder to have a smooth contour.

- Tees and branch connections

Elements shall be carefully cut and adjusted.

When two more layers of insulation are provided, joints shall be staggered as follows:

- First layer on secondary branch
- First layer on main pipe
- Second layer on secondary branch
- Second layer on main pipe, and so on

Finally metallic jacketing shall be applied if locally required.
7-5-3 INSULATION ON INSTRUMENTS

Insulation shall be applied as described in paragraph 7.2.1 to 7.2.2.

Insulation must allow normal instrument control and adjusting operations.

8 APPENDICES

APPENDIX A: DETAILS

The following details are referenced in the text of this guideline by their Figure numbers. The diagrams included in this section are representative of details used within the industry. However, they are not intended to display the only accepted method of installation but to serve as an example of commonly used and acceptable practices.
DOUBLE LAYERED INSULATION SYSTEM

**Detail Notes:**
- Inner Layer longitudinal joints at 12 and 6 O’clock. Outer layer joints at 3 and 9 O’clock.
- Stagger half round segments on each layer and between the two layers as shown above.
- Use thin coat of sealant over whole joint depth. Butter excess down the face of the joint. Use sealant on outer layer only.

![Diagram of a double layered insulation system](image)

**Figure 1**
TRIPLE LAYERED INSULATION SYSTEM

Figure 2
ELBOW FITTING

Figure 3

Detail Notes:
- Shiplap end cut to thickness X to accommodate double layer pipe insulation.
- Use in lieu of double layered fittings.
- Wrap elbow with Vapor Retarder Tape.
TAPPING PATTERN

Use 2 wraps of nylon filament tape or equivalent, 3/4 inch (19 mm) wide.

Figure 4

Detail Notes:
- Use two wraps of tape to insure adequate bond.
- Use nylon or glass filament type tape 3/4” wide.
DOUBLE LAYER EXPANSION/CONTRACTION JOINT DETAIL

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Notes:
• Allow sealant beads to cure prior to installation of outer layer.
• Position outer layer packed glass fiber between sealant dams on inner layer as shown above.
• After glass fiber in contraction joint is installed, insulation sections on either side of contraction joint shall be forced together as tightly as possible.

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Figure 5
VAPOR STOP DETAILS

Notes:
- Mastic should be selected based on the service temperature of the system.
- Mastic shall be sealed to the pipe face and lapped back over the top of the vapor retarder if fitting is left exposed.

Figure 6
TANK HEAD INSULATION DETAILS

Figure 7

Notes:

- In multiple layer systems, each layer shall be installed so that the horizontal and vertical joints in that layer are staggered from the corresponding joints in the preceding layer by half the height or width of a full section.

- At joint between wall and head section, the outer layer shall be staggered below the inner layer by the thickness of a single layer.

- Where mastics or sealants are required to bond the insulation sections to the tank head consult the manufacturer’s recommendations on service and application temperatures.
REDUCER FITTING DETAILS

Figure 8

REDUCER FITTING DETAILS

Figure 9
REDUCER FITTING DETAILS

Figure 10
APPENDIX B: INSULATION THICKNESS TABLE FOR COLD CONSERVATION AND ANTICONDENSATION WITH PIR

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>OPERATING TEMPERATURE (°C) : INSULATION THICKNESS (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal (NPS)</td>
<td>Outside (mm)</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>21.3</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>26.7</td>
</tr>
<tr>
<td>1&quot;</td>
<td>33.4</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>48.3</td>
</tr>
<tr>
<td>2&quot;</td>
<td>60.3</td>
</tr>
<tr>
<td>3&quot;</td>
<td>88.9</td>
</tr>
<tr>
<td>4&quot;</td>
<td>114.3</td>
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<tr>
<td>6&quot;</td>
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<tr>
<td>8&quot;</td>
<td>219.1</td>
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<tr>
<td>10&quot;</td>
<td>273.1</td>
</tr>
<tr>
<td>12&quot;</td>
<td>323.9</td>
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<tr>
<td>14&quot;</td>
<td>385.6</td>
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<tr>
<td>16&quot;</td>
<td>406.4</td>
</tr>
<tr>
<td>18&quot;</td>
<td>457.2</td>
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<tr>
<td>20&quot;</td>
<td>508.0</td>
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<tr>
<td>24&quot;</td>
<td>609.6</td>
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<tr>
<td>30&quot;</td>
<td>762.0</td>
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<tr>
<td>34&quot;</td>
<td>863.6</td>
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<tr>
<td>36&quot;</td>
<td>914.4</td>
</tr>
<tr>
<td>40&quot;</td>
<td>1016.0</td>
</tr>
<tr>
<td>42&quot;</td>
<td>1066.8</td>
</tr>
<tr>
<td>Flat Surface</td>
<td>30</td>
</tr>
</tbody>
</table>

Insulation material : Polyisocyanurate (PIR) 50 kg/m²
<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>Operating Temperature (°C) : Insulation Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal (NPS)</td>
<td>-61/-80</td>
</tr>
<tr>
<td>½&quot;</td>
<td>50</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>50</td>
</tr>
<tr>
<td>1&quot;</td>
<td>50</td>
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<tr>
<td>1½&quot;</td>
<td>60</td>
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<td>2&quot;</td>
<td>60</td>
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<td>3&quot;</td>
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<td>40&quot;</td>
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<td>42&quot;</td>
<td>90</td>
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<tr>
<td>Flat Surface</td>
<td>90</td>
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</tbody>
</table>
APPENDIX B: THICKNESS TABLES

The following tables show the insulation thickness necessary to prevent condensation on the outer surface of the insulation system jacketing. In a few cases, the tables also include the insulation thickness necessary to limit the heat gain to a specific value (usually 8 btu/hr-ft of outer jacketing surface). These thickness recommendations are solely based on various design conditions that are shown with each table. A number of assumptions are also made, including proper system design and installation. There may be additional factors the tables do not address that could influence the end results. These thickness tables are not meant to replace a proper system design and specification by a qualified design engineer familiar with specific ambient design parameters for a given locality.

Thickness calculations are performed using the 3E Plus software program that uses heat flow algorithms based on ASTM C680-95. The required insulation thicknesses do not include a safety factor. Actual operating conditions can vary. Consult a design engineer for an appropriate safety factor.
Table 1: Insulation Thickness Details

<table>
<thead>
<tr>
<th>Total Thickness (in)</th>
<th>Inner Layer (in)</th>
<th>Middle Layer (in)</th>
<th>Outer Layer (in)</th>
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<tbody>
<tr>
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<td>1</td>
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</tr>
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<td>2</td>
<td>2</td>
</tr>
<tr>
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</tr>
<tr>
<td>11</td>
<td>3.5</td>
<td>3.5</td>
<td>4</td>
</tr>
</tbody>
</table>
COLOR (TSTM-01)
Beige (Part A, Paste) / Brown (Part B, Liquid)
Beige (Mixed)

APPLYATION (TSTM-06)
Trowel

DENSITY (ASTM D 1475)
Part A - 1.53 ± 0.05 Kg/l
Part B - 1.22 ± 0.05 Kg/l
Mixed (A&B) - 1.47 ± 0.05 Kg/l

VOLUME NON-VOLATILE (ASTM D 1644)
99 ± 1% (Mixed)

WEIGHT NON-VOLATILE (ASTM D 1644)
99 ± 1% (Mixed)

COVERAGE (TSTM-07)
2.97 Kg/m² (2.02 ft²/m²) / Dried film thickness: 2.0 mm

MIXING RATIO (TSTM-16)
Weight - Part A : Part B = 10 : 1
Volume - Part A : Part B = 8 : 1

POT LIFE (TSTM-09)
1 ~ 2 hours (25°C ± 2°C, 50 ± 2% RH)

DRYING / CURING TIME (ASTM D 1640)
Set to Touch: 8 hours / Dry Through: 24 hours
Curing Time: 48 hours / Maximum Strength: 7 Days

SERVICE TEMPERATURE LIMITS (TSTM-04)
(Temperature at coated surface)
-196 °C ~ 100 °C (-321°F ~ 212°F)

WET FLAMMABILITY (ASTM D 3278)
≥ 93 °C (200°F)

LAP SHEAR STRENGTH (ISO 4587)
≥ 2.0 MPa

TIC 5030 N.T PU Adhesive is two components, high strength thermosetting urethane adhesive containing no flammable solvents. It is designed to bond various types of low-temperature insulation to themselves and to metal and masonry substrates. After curing, it forms a strong, yet flexible bond capable of withstanding thermal shock and mechanical impact.

TIC 5030 N.T PU Adhesive can be used as both an attachment adhesive and joint sealant in low temperature installations using cellular glass, polystyrene or rigid board stock polyurethane foam insulations. It contains no asphalt and can be top coated with solvent base products without bleed through.

TIC 5030 N.T PU Adhesive contains no asbestos, lead, mercury, or mercury compounds.

LIMITATIONS
Store between 4°C (40°F) and 38°C (100°F).

Allow 48 hours curing time at 25°C (77°F) minimum before placing in service.

Pot life will be longer at lower temperatures, shorter at higher temperatures.

Part B is sensitive to moisture and humidity. Keep container tightly sealed when not in use.

Do not heat Part A, Part B, or the mixed material to above 38°C (100°F).
MATERIAL PREPARATION
DO NOT THIN. Stirring should not be necessary, but if Part B has remained undisturbed for any extended period, stir well. Do not use sticks or paddles, which could splinter or otherwise contaminate the product.

Containers must be kept closed and in dry storage when not in use. Blend only the amount of material, which can apply in 1 hour. Mixing should be continued for 3 minutes maximum with a suitable air or electric mixer operating at low speed, until the TIC 5030 N.T PU Adhesive is smooth and completely homogeneous. Do not over mix. Do not heat Part A, Part B, or the mixed material to above 38°C (100°F). Exposure to vapors of heated product may be harmful. Heated vapors are potential respiratory and skin sensitizers, and possible eye irritants. Provide adequate ventilation in enclosed areas.

APPLICATION
Apply only to clean dry surfaces. TIC 5030 N.T PU Adhesive may apply to either or both surfaces at the recommended coverage rate. Surfaces must be bond within one hour after application of the adhesive. On rough surfaces, a thicker application of TIC 5030 N.T PU Adhesive is required as necessary to assure complete contact between the insulation and the substrate.

CLEAN-UP
Before adhesive cures, clean tools and equipment with chlorinated solvent (non-flammable) or mineral spirits (flammable). Dried TIC 5030 N.T PU Adhesive is extremely difficult to remove.

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IMPORTANT: We make no other warranties and expressly disclaim any warranties of merchantability or fitness for a particular purpose. If a product fails to meet this limited warranty, purchaser’s sole and exclusive remedy is replacement of the product or, at our option, refund of the purchase price. Our acceptance of any orders for the product is expressly conditional upon purchaser’s assent to the terms on the applicable invoice.

ADEQUATE TESTS: The information contained herein we believe is correct to the best of our knowledge and tests. The recommendations and suggestions herein are made without guarantee or representation as to results. We recommend that adequate tests be perform by you to determine if this product meets all of your requirements. The warranted shelf life of our products is six months from date of shipment to the original purchaser.
**TIC 7010 Joint Sealant**

**COLOR (TSTM-01)**
Gray

**APPLICATION (TSTM-06)**
Trowel or Power Extrusion Equipment

**DENSITY (ASTM D 1475)**
1.58 ± 0.05 Kg/l

**VOLUME NON-VOLATILE (ASTM D 1644)**
98 ± 1%

**WEIGHT NON-VOLATILE (ASTM D 1644)**
99 ± 1%

**COVERAGE (TSTM-07)**
2.10 Kg/m² (1.33 fl/m²)
Dried film thickness: 1.3 mm

**DRYING TIME (ASTM D 1640)**
Set to Touch: 8 hours

**SERVICE TEMPERATURE LIMITS (TSTM-04)**
(Temperature at coated surface)
-73 ºC ~ 150 ºC (-99ºF ~ 302°F)

**WATER VAPOUR PERMEANCE (ASTM E 96)**
≤ 0.008 perms (DFT 1.3 mm)

**WET FLAMMABILITY (ASTM D 3278)**
≥ 93ºC (200 ºF)

**COMBUSTIBILITY - Dry (TSTM-14)**
Combustible Flame spread and fuel contribution negligible when used as sealant in 1/8 in. wide joints of incombustible insulation.

**TIC 7010 Joint Sealant** is gray vapour barrier sealant, designed for use with rigid thermal insulation including polystyrene foam. It remains flexible and tough in joints and will not shrink or crack during repeated cycles of high and low temperatures.

**TIC 7010 Joint Sealant** seals the joints of cellular glass and other insulations against the entrance of moisture. When used as a bedding compound on iron or steel surfaces and as a joint sealant, **TIC 7010 joint sealant** provides additional protection to the blocks of insulation. Damage to the insulation due to migration of moisture is minimizing.

**TIC 7010 Joint Sealant** is water, weather resistant, and often used as a sealant and flashing compound where structural parts must penetrate an insulation surface.

**TIC 7010 Joint Sealant** contains no asbestos, lead, mercury or mercury compounds.

**LIMITATIONS**

Store between 4°C (40°F) and 38°C (100°F).

Apply between 10°C (50°F) and 43°C (110°F).

Allow to cure one week before placing in heated service.

Not recommend for use under solvent base elastomeric mastics and coatings, if minor surface discoloration and/or dirt pick-up would be objectionable.

Make certain this product is completely dry and the area free from product odor if food is involved.
MATERIAL PREPARATION
DO NOT THIN. Apply only to clean, dry surfaces. Keep container closed when not in use.

APPLICATION
Apply by trowel, putty knife, power extrusion or bulk caulking gun. When sealing insulation joint apply to TIC 7010 Joint Sealant at 1/16 to 1/8 inch wet film thickness (1.6 to 3.2 mm) and press mating surfaces together firmly to squeeze out air bubbles and to obtain complete contact. When flashing, do not trowel out to featheredge but maintain a minimum of 1/8 inch wet film thickness (3.2 mm) throughout the entire area of use. Use membrane as specified. For best results, allow to cure 24-48 hours before top coating with solvent-based elastomeric mastics or coatings.

1. POWER EXTRUSION
TIC 7010 Joint Sealant may be applied using a wide variety of power (pressure) extrusion equipment suitable for use with oil base sealants. Typical viscosity range is $500 \times 10^3\sim1,000 \times 10^3$ cps.

CLEAN-UP
Clean tools and equipment with mineral spirits (flammable) or chlorinated solvent (non-flammable).

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ADEQUATE TESTS: The information contained herein we believe is correct to the best of our knowledge and tests. The recommendations and suggestions herein are made without guarantee or representation as to results. We recommend that adequate tests be perform by you to determine if this product meets all of your requirements. The warranted shelf life of our products is six months from date of shipment to the original purchaser.
**COLOR (TSTM-01)**
TIC 4055 White / TIC 4056 Gray

**APPLICATION (TSTM-06)**
Trowel or Rubber glove.

**DENSITY (ASTM D 1475)**
1.20 ± 0.05 Kg/l

**VOLUME NON-VOLATILE (ASTM D 1644)**
42 ± 1%

**WEIGHT NON-VOLATILE (ASTM D 1644)**
60 ± 1%

**COVERAGE (TSTM-07)**
3.43~5.14 Kg/m² (2.86~4.28 ft²/ft²)
Dried film thickness: 1.2~1.8 mm

**DRYING TIME (ASTM D 1640)**
Set to Touch: 5 hours
Dry Through: 48 hours

**SERVICE TEMPERATURE LIMITS (TSTM-04)**
(Temperature at coated surface)
-46 °C ~ 121 °C (-51°F ~ 250°F)

**WATER VAPOUR PERMEANCE (ASTM E 96)**
≤ 0.02 perms (DFT 1.3 mm)

**WET FLAMMABILITY (ASTM D 93)**
≥ 44°C (111 °F)

**SURFACE BURNING CHARACTERISTICS (ASTM E 84)**
Classification: CLASS A
Flame spread: 10 (0~25)
Smoke Developed: 15 (0~450)
Surface: Applied over fiber reinforced cement board at a coverage rate of 25 sq.ft/gal (0.61 m²/l)

**TIC 4055/56 Vapour Barrier Mastic**

TIC 4055/56 Vapour Barrier Mastic is a tough, flexible, and fire resistive elastomeric finish for protection of outdoor thermal insulation. It contains DuPont Hypalon® rubber. It is excellent vapour barrier for low temperature insulation on tanks, pipe-work, ductwork, vessels, and fittings.

TIC 4055/56 Vapour Barrier Mastic provides outstanding weather barrier protection, showing good color retention, excellent chemical resistance, and durability.

TIC 4055/56 Vapour Barrier Mastic trowels easily and smoothly without drag or excessive stringing. It features higher than average volume solids, reducing the number of gallons that need to apply.

TIC 4055/56 Vapour Barrier Mastic contains no asbestos, lead, mercury or mercury compounds.

**LIMITATIONS**
Store between 4°C (40°F) and 38°C (100°F).
Always test plastic materials for compatibility when using a solvent base product.
Select TIC 4050/51 Vapour Barrier Coating for Brush or Airless Spray application.

- Hypalon® - Trademark of DuPont Performance Elastomers
MATERIAL PREPARATION
DO NOT THIN. Apply only to clean dry surfaces. Keep container closed when not in use to prevent solvent evaporation.

APPLICATION
To prevent water vapor and moisture infiltration, proper and complete flashing is required. Follow flashing specifications.

1. NORMAL SERVICE - Apply a tack coat of TIC 4055/56 Vapour Barrier Mastic at a thickness of 1/32 inch (0.8mm). This is equivalent to 2 gal./100 sq. ft. (0.8 l/m²). Smooth membrane to avoid wrinkles and overlap all seams at least 2 inches (5 cm). Apply a finish coat of TIC 4055/56 Vapour Barrier Mastic at a minimum thickness of 3/64 inch (1.2mm). This is equivalent to 3 gal./100 sq. ft. (1.2 l/m²). This finish coat shall apply no later than 2 hours after the tack coat and shall completely cover membrane. This application shall provide a minimum dry film thickness of 33 mils (0.8mm).

2. SEVERE AND CRYOGENIC SERVICE - Increase the tack coat coverage to 3 gal./100 sq. ft. (1.2 l/m²) and the finish coat to 4 gal./100 sq. ft. (1.6 l/m²). (Allow the tack coat to set up before applying the finish coat on vertical surfaces.) This application shall provide a minimum dry film thickness of 46 mils (1.2mm).

3. TROWEL - Use clean tools. Work in long even strokes to ensure uniform thickness. Wet tool with detergent foam (not soap) occasionally to prevent a build up of dried mastic.

4. RUBBER GLOVE - Best appearance may achieved by smoothing wet TIC 4055/56 Vapour Barrier Mastic with detergent foam (not soap) on a clean glove or brush, being careful not to pick up any TIC 4055/56 Vapour Barrier Mastic onto the glove or brush.

CLEAN-UP
Use xylene (flammable) or chlorinated solvent (non-flammable) for cleaning equipment. (Dried TIC 4055/56 Vapour Barrier Mastic is extremely difficult to remove.)

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ADEQUATE TESTS: The information contained herein we believe is correct to the best of our knowledge and tests. The recommendations and suggestions herein are made without guarantee or representation as to results. We recommend that adequate tests be perform by you to determine if this product meets all of your requirements. The warranted shelf life of our products is six months from date of shipment to the original purchaser.
## PROPERTIES

<table>
<thead>
<tr>
<th>COLOR (TSTM-01)</th>
<th>Aluminum (Gray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLICATION (TSTM-06)</td>
<td>Trowel, Caulking Gun, or Power Extrusion Equipment</td>
</tr>
<tr>
<td>DENSITY (ASTM D 1475)</td>
<td>1.09 ± 0.05 Kg/ℓ</td>
</tr>
<tr>
<td>VOLUME NON-VOLATILE (ASTM D 1644)</td>
<td>78 ± 1%</td>
</tr>
<tr>
<td>WEIGHT NON-VOLATILE (ASTM D 1644)</td>
<td>80 ± 1%</td>
</tr>
<tr>
<td>COVERAGE (TSTM-07)</td>
<td>Trowel 2.24 Kg/m² (2.05 U/m²) / Dried film thickness: 1.6 mm Caulking Gun (310 ml tube) 3.2 mm bead: 38 m / 6.4 mm bead: 9 m</td>
</tr>
<tr>
<td>DRYING TIME (ASTM D 1640)</td>
<td>Set to Touch: 30 ~ 60 minutes Dry through: 72 hours</td>
</tr>
<tr>
<td>SERVICE TEMPERATURE LIMITS (TSTM-04)</td>
<td>-101°C ~ 141°C (~150°F ~ 286°F)</td>
</tr>
<tr>
<td>WATER VAPOUR PERMEANCE (ASTM E 96)</td>
<td>≤ 0.005 perms (DFT 1.3 mm)</td>
</tr>
<tr>
<td>WET FLAMMABILITY (ASTM D 93)</td>
<td>≥ 44°C (111 °F)</td>
</tr>
<tr>
<td>SURFACE BURNING CHARACTERISTICS (ASTM E 84)</td>
<td>Classification: CLASS A Flame spread: 15 (0-25) Smoke Developed: 5 (0-450) Surface: Applied over fiber reinforced cement board at a coverage rate of 25 sq.ft/gal (0.61 m²/l)</td>
</tr>
</tbody>
</table>

## TIC 7030 Flexible Joint Sealing

**TIC 7030 Flexible Joint Sealing** is fire resistive, flexible butyl elastomer based vapour barrier sealant. It is designed for sealing joints in insulation (except polystyrene foam), metal, and masonry wherever maintenance of a watertight and airtight seal is required. It can be used as joint sealant in low velocity duct air-conditioning systems. It is ideal for sealing the laps of aluminum jacketing to prevent the entrance of moisture.

**TIC 7030 Flexible Joint Sealing** is a fast drying vapour barrier sealant that can be top coated with most solvent-thinned, flexible, light colored coatings without danger of bleed through. It is weather resistant and may be used outdoors without top coating.

**TIC 7030 Flexible Joint Sealing** is the preferred product for flashing projections and terminations where a complete moisture and vapour seal is required.

**TIC 7030 Flexible Joint Sealing** contains no asbestos, lead, mercury, or mercury compounds.

**LIMITATIONS**

- Store between 4°C (40°F) and 38°C (100°F).
- Always test plastic materials for compatibility when using a solvent base product.
- When used in exposed locations without top coating, this product may darken or discolor due to surface dirt pick-up. This will not affect its performance.
- Make certain this product is completely dry and the area free from solvent odor if food is involved.
- Select TIC 7010 Joint Sealant for joint sealing polystyrene foam insulations.
APPLICATION GUIDE

MATERIAL PREPARATION
DO NOT THIN. Apply only to clean, dry, oil free surfaces. Keep container closed when not in use.

APPLICATION
Apply by trowel, putty knife, caulk gun or power extrusion. When sealing insulation joints apply TIC 7030 Flexible Joint Sealing to the edges of abutting sections at 1/16 in. to 1/8 in. (1.6 mm to 3.2 mm) wet film thickness and press mating surfaces together firmly to squeeze out air bubbles and to obtain complete contact. Strike off excess sealant on surface with a trowel. When flashing, do not trowel out to feather edge, but maintain a minimum of 1/8 in. (3.2 mm) wet film thickness throughout entire area of use. Use membrane as specified.

1. POWER EXTRUSION
TIC 7030 Flexible Joint Sealing may be applied using a wide variety of power (pressure) extrusion equipment suitable for use with solvent base sealants. Typical viscosity range is $500 \times 10^3 \sim 1,000 \times 10^3$ cps.

CLEAN-UP
Use solvent such as chlorinated solvent (non-flammable) or mineral spirits (flammable) for cleaning tools and equipment.

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ADEQUATE TESTS: The information contained herein we believe is correct to the best of our knowledge and tests. The recommendations and suggestions herein are made without guarantee or representation as to results. We recommend that adequate tests be perform by you to determine if this product meets all of your requirements. The warranted shelf life of our products is six months from date of shipment to the original purchaser.