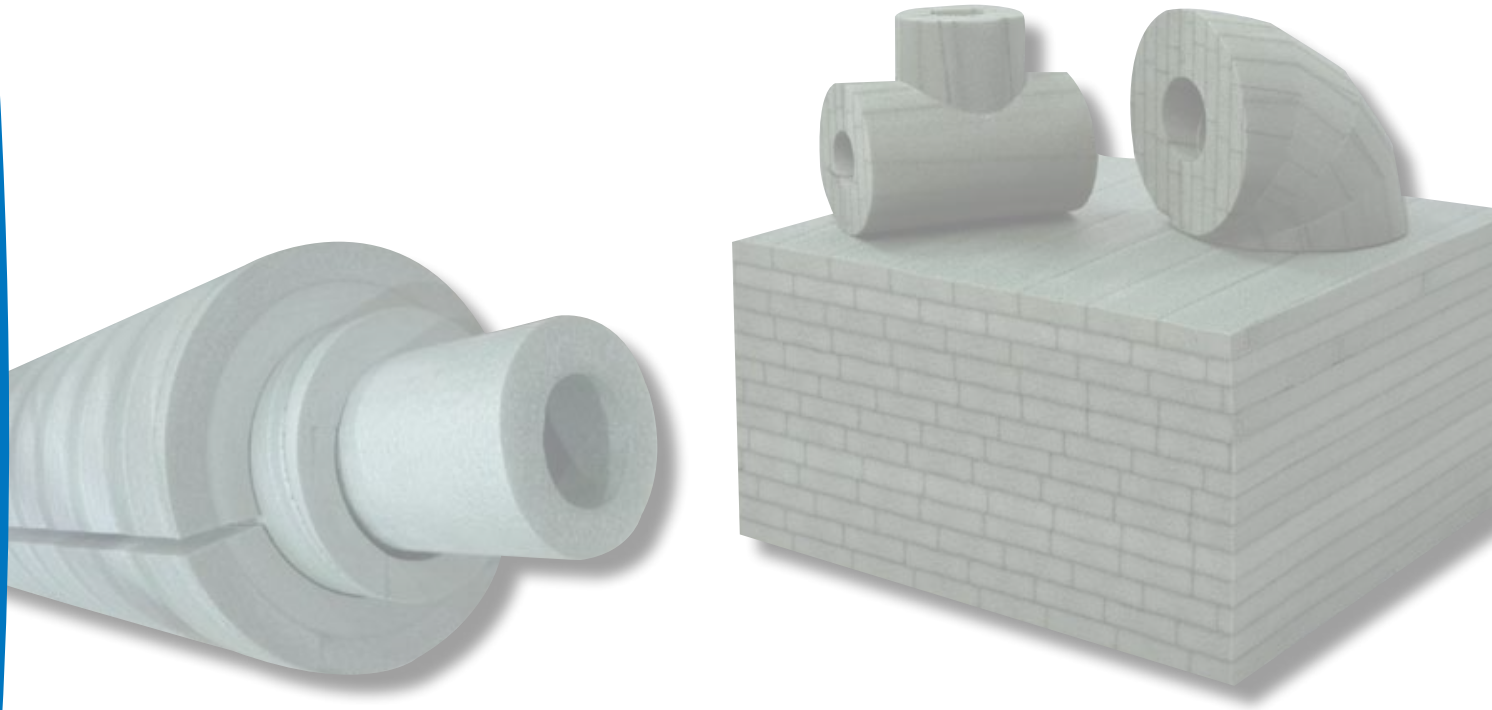
CRYOflex™

DESIGNED FOR INDUSTRIAL REFRIGERATION

Installation Guide



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Scope

Installation Guidelines are general in nature and intended to be used as a tool in the installation process.

Always follow specifications required by the customer.

Pipe Preparation

Before any type of insulation is applied, all equipment and pipe surfaces MUST be dry and clean from contaminants and rust.

Corrosion of any metal under any thermal insulation can occur for a variety of reasons. The outer surface of the pipe should be properly prepared prior to installation of insulation. With any insulation, the pipe can be primed to minimize the potential for corrosion. Careful consideration at the time of the insulation system design stage is essential. Specific recommendations are detailed later in this guideline.

Materials

1) Insulation Cryoflex insulation has a low thermal conductivity with low water vapor permeability and is non-wicking.

2) Insulation Joint Sealant The joint sealant should be resistant to liquid water, water vapor, and be able to bond to the insulation surface. The joint sealant is applied as a full coat to all joints requiring sealant. A properly designed and constructed insulation/sealant/insulation joint will retard liquid water and water vapor migration through the insulation system. Acceptable joint sealants: Daxcel Foamstick 161-D, Dow Corning 732 Multi-Purpose Sealant, Childers Chil-Joint CP-70.

3) Vapor Retarders Cryoflex is a closed-cell insulation material, and as such has a very low water absorption rate. It has a low permeability rating and along with the use of low permeance (water vapor permeability less than 0.1 perm-inches) vapor retarder system completes a secure package to keep out water and water vapor, and prevent water vapor infiltration, thus keeping the insulation dry. This will prevent degradation of thermal properties due to the presence of water and will prevent any moisture from reaching the cold-side surface of the pipe or vessel.

The service life of the insulation and pipe is enhanced by low water vapor permeance of the vapor retarder. The vapor retarder must be free of discontinuities and penetrations. The insulation and the vapor retarder will expand and contract with ambient temperature cycling. The vapor retarder system must be installed with a mechanism to permit this expansion and contraction without compromising the integrity of the vapor retarder. See manufacturers' recommendations for design and installation instructions specific to their products.

Vapor Retarders may be of the following types:

Laminated vapor barrier membrane with a rubber bitumen, butyl or acrylic adhesive on a polyethylene film. Perm ratings of 0.015 perms and lower are published. Solvent based adhesives can attack some types of vapor retarder adhesives and membranes (see manufacturer for specific details). All joints should have a minimum 3" overlap to insure adequate sealing (see manufacturer for specific details). Acceptable products include: PolyGuard Products Insulrap 30, Insulrap 50, ZeroPerm or Zero Perm A, Alumaguard, Alumaguard LT All Weather and Alumaguard Lite membranes. All vapor barriers and retarders shall be installed in accordance with the manufacturer's recommendations.

Coatings, mastics and heavy "paints" are available as vapor retarders. Various preparations for covering insulation are available for applying by trowel, brush or spraying. The perm ratings of the material are a function of the thickness applied. Some products are recommended for indoor use only while others are available for indoor or outdoor use. These products may impart odors, and manufacturers' instructions should be meticulously followed. Care should also be taken to insure that the mastics used are chemically compatible with Cryoflex polyethylene insulation.

Mastics should be applied in two coats to obtain a total dry film thickness as recommended by the vapor retarder coating manufacturer. Apply the mastic as a continuous monolithic moisture vapor retarder as recommended by the manufacturers technical data sheets. The vapor retarder mastic system should extend by a minimum of 2" under any sheet type vapor retarder

membrane where applicable. This is typically done at valves, fittings and expansion joints. These systems must be tied into the rest of the insulation system or bare pipe at the termination of the insulation with a minimum 2 inch overlap to maintain the continuity of the entire system. Acceptable products include: Childers Chil-Perm WB CP-35 Vapor Retardant Coating.

Metallic foil (0.000 perms) or PVDC (0.02 perms) type vapor retarder applied to the surface of the insulation by the fabricator or field applied. These types of jacket have a low (<0.02 perm-inches) water vapor permeability rating under ideal conditions. This low permeability is dependent upon complete sealing of all joints and seams. If factory applied, jacket should be carefully inspected for damage prior to installation. There will be longitudinal joints and butt joints in the jacketing system when these systems are used. These jackets may be sealed with a contact adhesive applied to both of the overlapping surfaces or with acrylic tapes supplied by the manufacturer. Manufacturers' instructions must be strictly followed during the installation. Butt joints are sealed in a similar fashion using metallic foil or PVDC material and contact adhesive or acrylic tapes. Self-seal lap joints and butt joints may be acceptable but seams and butt joints must be perfectly sealed. Acceptable products include: Polyguard Products, Zero Perm and Zero Perm Super White.

Other types of finishes may be appropriate depending upon environmental or other factors.

4) Jacketing The primary purpose of jacketing on insulated pipes and vessels is to protect the vapor retarder system and the insulation. Various plastic and metallic products are available for this purpose.

Any devices used to secure the jacketing must be of the band type which holds and clamps the jacketing in place circumferentially. Pop rivets, sheet metal screws, staples or any other fastener that punctures should not be used because they will compromise the vapor retarder.

Protective jacketing is designed to be installed over the vapor retarder and insulation to prevent weather and mechanical damage. The protective jacketing must be installed independently and in addition to any factory or field applied vapor retarder. Ambient temperature cycling will cause the jacketing to expand and contract. The jacketing must be installed with a mechanism to permit this expansion and contraction to occur without compromising the vapor retarder. Refer to jacketing manufacturers design and installation instructions specific to their products.

Metal jacketing may be smooth, stucco, embossed, or corrugated aluminum or stainless steel with a continuous moisture retarder. PVC jacketing or other finishes may also be appropriate, depending upon environment or other factors. PVC should be smooth, UV inhibited, in precurled rolls. The minimum thickness of PVC should be 0.030". Metallic type jackets are recommended for exposed roof mounted piping systems and equipment.

Protective jacketing is required whenever piping is exposed to wash downs, physical abuse or traffic. Inside of buildings where ultraviolet degradation from sunlight is not a factor, the most common type of jacketing is PVC. All longitudinal and circumferential laps should be seal welded using a solvent welding adhesive. The laps should be located at 10:00 o'clock or 2:00 o'clock positions. All laps on horizontal piping systems shall be positioned to shed water. A sliding lap (PVC) expansion/contraction joint should be located near each end point and at immediate joints no more than twenty feet apart. Where very heavy abuse and/or hot, scalding washdowns are encountered a special CPVC material is required. These materials can withstand temperatures as high as 225°F, where standard PVC will warp and disfigure at 140°F.

Roof piping should be jacketed with a minimum 0.016 inch aluminum (embossed or smooth finish depending on aesthetic choice) or stainless steel. On pitched lines, this jacketing should be installed with a minimum 2 inch overlap arranged to shed any water in the direction of the pitch. Only stainless steel bands should be used to install this jacketing (1/2" X 0.02" 304 stainless), spaced every 12 inches. Jacketing on valves and fittings should match that of the adjacent piping.

5) Weather Barrier Joint Sealant All metal jacketed insulation systems should utilize a weather barrier joint sealant. The joint sealant should be a liquid water resistant elastomeric material able to bond to the specified metal surface. The joint sealant is applied to all joints to prevent driven water from migrating through the joints and accumulating within the insulation system.

Recommended Practices for Insulation Applications

This guideline covers the recommended requirements and design features for typical refrigeration insulation applications. This guideline may be followed unless State or Local Building Codes or contract documents dictate otherwise. For insulation and insulation accessories, specific manufacturer instructions will supersede the recommendations in this guideline.

A qualified engineer may be consulted to specify both the insulation material and the insulation thickness based on specific design conditions. Please note that insulation thickness is chosen to either prevent or minimize condensation on the outside pipe surface or limit heat gain to 8 Btu/hr-ft^2, whichever thickness is greater.

All fabricated pipe, valve and fitting coverings shall have dimensions and tolerances in accordance with ASTM C585 and ASTM C450. The installation of all materials used for thermal insulation should be carried out in accordance with the Midwest Insulation Contractors Association's (MICA) National Commercial and Industrial Insulation Standards.

All insulation must be stored in a cool, dry location and be protected from the weather before and during application. Vapor retarders and weather barriers must be installed over dry insulation.

Corrosion of any metal under any thermal insulation can occur for a variety of reasons. The outer surface of the pipe should be properly prepared prior to the installation of the insulation. With any insulation, the pipe can be primed or coated with a corrosion inhibitor to minimize the potential for corrosion. Careful consideration at the time of the insulation system design stage is essential.

Insulation Installation Guidelines

These are several components of insulation systems which include:

- Insulation material
- Insulation joint sealant
- Vapor retarders
- Weather barriers
- Weather barrier sealants
- Jacketing
- Pipe protection
- Adhesives, sealants or caulks

The following is a brief summary of each component. Each component will be described in more detail.

All welding and other hot work should be completed prior to the installation of the pipe insulation. All hydrostatic and other performance testing should be completed prior to the installation of the insulation. Surfaces to be insulated should be free from all oil, grease, loose scale, rust and foreign matter and shall be dry and free from frost. Site touch-up of all shop coating including preparation and painting at field welds should be completed prior to the installation of the insulation.

Insulation for fittings, flanges and valves should be the same thickness as the insulation of the pipe and shall be fully vapor sealed. If the valve design allows, insulate valves to the packing glands. Stiffener rings where provided on vacuum equipment and/or piping should be insulated with the same thickness and type of insulation as specified for the piece of equipment or line. The rings should be fully independently insulated. Where multiple layers of insulation are used, all joints should be staggered. Insulation should be applied with all joints fitted to eliminate voids. Large voids should not be filled with vapor sealant or fibrous insulation, but eliminated by refitting or replacing the insulation. All joints, with the exception of contraction joint locations and the inner layer of a double layer system, should be sealed with either the proper adhesive or joint sealer during installation. Each line should be insulated as a single unit. Adjacent lines shall not be enclosed within a common insulation cover.

Vapor stops should be installed using either sealant or the appropriate adhesive at all directly attached pipe support locations, guides, anchors and at all locations requiring potential maintenance, such as valves, flanges and instrumentation connections to piping or equipment. If for any reason valves or flanges are required to be left uninsulated until after plant start-up, temporary vapor stops should be installed using either sealant or the appropriate adhesive.

Where applicable, the innermost layer of insulation should be secured with 3/4" wide pressure sensitive filament tape banding spaced at 9" maximum centers applied with a 50% overlap. Single and outer layers above 18" OD, and where inner layers are applied in radiused and beveled segments, should be secured by 3/8" wide stainless steel bands at 9" maximum centers. The bands shall be firmly tensioned and sealed.

Irregular surfaces and fittings should be vapor sealed by applying a thin coat of vapor retarder mastic or finish with a minimum wet film thickness as recommended by the manufacturer. Before the first coat is completely dry, a second coat should be applied. The total thickness of the mastic or finish should be in accordance with the coating manufacturer's recommendation.

When possible, the pipe support mechanism should be located outside of the insulation. Supporting the pipe outside of the protective jacketing eliminates the need to insulate over the pipe clamp, hanger rods, or other attached support components. This method minimizes the potential for vapor intrusion and thermal bridges within the system as a continuous envelope surrounds the pipe.

Hangers need to be spaced to incorporate allowable loading on both the piping as well as the insulation material.

Some installations may require the use of an expansion or contraction joint. These expansion/contraction joints are normally required in the innermost layer of insulation. Expansion/contraction joints may be constructed by using a 2" break in the insulation. All joints should then be tightly packed with fibrous insulation material. The insulation should be secured on either side of the expansion/contraction joint with stainless steel bands that have been hand tightened. Cover the expansion/contraction joint with the appropriate vapor retarder and properly seal.

Fittings Installation

- Insulation for fittings, flanges and valves should be the same thickness as the Insulation of the pipe and shall be fully vapor sealed.
- Install insulation on fittings prior to installation of piping insulation.

- Place one half on elbow, T, and/or valve joint, on pip
- Apply a ¼" bead of recommended caulk or sealant to the other half in a zigzag pattern and join by applying hand pressure, making sure all seams are sealed.
- Hold the insulation in place securely with ¾" fiberglass reinforced strapping tape.
  - Note: Apply sufficient force on tape to keep all seams sealed.

- Using a paint brush, apply a layer of flame retarder mastic to fitting. Continue 2” beyond the butt joint. After the first layer is dry apply a second layer, making sure all voids are sealed.
- Mastic system should extend a minimum of 2” under any sheet type vapor retarder.

First Layer Pipe Installation

- Where multiple layers of insulation are used, all joints should be staggered. Outer layer of insulation should have longitudinal joints at the 3 and 9 o’clock positions. Insulation should be applied with all joints fitted to eliminate voids.
- Large voids should not be filled with vapor sealant, but eliminated by refitting or replacing the insulation.
- All joints, with the exception of contraction joint locations and the inner layer of a double layer system, should be sealed with either the proper adhesive or a joint sealer during installation. Each line should be insulated as a single unit.
- Adjacent lines shall not be enclosed within a common insulation cover.

- Start at a joint. Open insulation and apply a ¼” bead of sealant to the butt joint and the longitudinal seam, and butt the insulation up to the fitting firmly. Use a zigzag pattern on insuation thickness of 2” and above.
- Install the insulation on the pipe, being careful to avoid contamination of the joint / sealant if a corrosion inhibitive coating is present on the pipe.
- For the first layer in a multi-layer installation, the sealant may be omitted.
- Insuring that the longitudinal seam and butt joints are completely sealed, hold insulation in place with ¾” strapping tape. Apply tape around insulation and overlap by 50%. Apply tape starting 2” from each end and every 11” (4 pieces per full pipe insulation length).
- Using a paint brush, completely cover fitting and 2” of pipe cover at butt joint with vapor retarder mastic.

Second Layer Pipe Installation

- Start from a fitting butt joint. In order to stagger the butt joints, measure and cut the second layer of insulation so that the butt joint is offset 18" from the first layer butt joint. Open the pipe insulation and install it over the first layer.
- Lay a ¼" bead of sealant on the longitudinal seam and butt seam. Close pipe firmly, making sure there are no openings,
- Insuring that the longitudinal seam and butt joints are completely sealed, hold insulation in place with ¾" strapping tape. Apply tape around insulation and overlap by 50%. Apply tape starting 2" from each end and every 11" (4 pieces per full pipe insulation length).
- Using a paint brush, completely cover fitting and 2" of pipe cover at butt joint with vapor retarder mastic.
- Continue installing the second layer of insulation in a similar manner until the entire pipe length between fittings is insulated.

Expansion / Contraction Joints

Some installations may require the use of expansion / contraction joints. These expansion / contraction joints are normally required in the innermost layer of insulation. Expansion / contraction joints may be constructed by using a 2" break in the insulation.

- All joints should then be tightly packed with fibrous insulation material.
- The insulation should be secured on either side of the expansion/contraction joint using stainless steel bands that have been hand tightened.
- Cover the expansion/contraction joint with an appropriate vapor retarder and properly seal.

Expansion / contraction joint to allow the expansion and contraction of the jacketing materials shall be installed per the following:

- Contraction joints for vertical piping and equipment shall be provided immediately after each insulation support ring, and installed in each layer of insulation.
- To create a contraction joint, leave a two inch break. Spread a four inch layer of vapor retarder mastic, making sure both ends of insulation and pipe are covered. Use customer's recommended materials to fill 2" opening of contraction joints.
- Location of expansion / contraction joints should be identified on the insulation jacketing.

Pipe Hangers and Saddles

Cryoflex Insulation shall be used at load bearing pipe supports unless otherwise indicated. Provide insulation saddles as specified below:

- Saddles shall be fabricated from galvanized sheet metal rolled with a true radius to suit insulation O.D.
- The saddle length should be a minimum 12" long.
- Saddles shall be sized to wrap the insulation in an arc as pipe cover profile.
- For iron pipe up to 8" install a saddle 12" or longer every 10'.
- Refer to Appendix 1 for recommended saddle lengths for various pipe sizes / hanger spacing for use with Cryoflex insulation (all insulation thicknesses).
- As an alternative to modifying saddle length / hanger spacing, provide load bearing insulation at hangers.
- Insulation protection saddles shall be provided and installed by the contractor at all pipe hangers and supports for insulated lines.
- Contact Nomaco Insulation for specific pipe support recommendations.

Galvanized saddle.

PVC (insulation protection saddle and banding).

Aluminum (insulation protection saddle, not banded yet).

Appendix 1
Recommended Saddle Sizes

								Minimum Saddle Size for pipe support (with 20% safety factor)		
Pipe Size	**OD**	**Wall Thickness**	**ID (inches)**	**ID Circum-ference (FT)**	**wt/LFT**	**Area of 1ft Pipe(ft^3)**	**Ammonia Weight**	**7 FT center**	**10 FT center**	**15 FT center**
1/8"	0.405	0.068	0.269	0.022	0.240	0.00039	0.0167925	6	6	6
1/4"	0.540	0.088	0.364	0.030	0.430	0.00072	0.03074777	6	6	6
3/8"	0.675	0.091	0.493	0.041	0.570	0.00132	0.05640332	6	6	6
1/2"	0.840	0.109	0.622	0.052	0.850	0.00211	0.08978248	6	6	6
3/4"	1.050	0.113	0.824	0.069	1.130	0.00370	0.15756699	6	6	6
1'	1.315	0.133	1.049	0.087	1.680	0.00600	0.25536525	6	6	6
1 1/4"	1.660	0.140	1.380	0.115	2.270	0.01038	0.44194578	6	6	6
1 1/2"	1.900	0.145	1.610	0.134	2.720	0.01413	0.60153731	6	6	6
2"	2.375	0.154	2.067	0.172	3.660	0.02329	0.99149783	6	6	8
2 1/2"	2.875	0.203	2.469	0.206	5.800	0.03323	1.414663	6	6	8
3"	3.500	0.216	3.068	0.256	7.580	0.05131	2.18434647	6	6	10
3 1/2"	4.000	0.226	3.548	0.296	9.120	0.06862	2.92131264	6	8	10
4"	4.500	0.237	4.026	0.336	10.800	0.08836	3.76147653	6	8	10
5"	5.563	0.258	5.047	0.421	14.630	0.13886	5.9112241	6	8	12
6"	6.625	0.280	6.065	0.505	18.990	0.20053	8.53635416	6	10	14
8"	8.625	0.322	7.981	0.665	28.580	0.34723	14.7817358	8	10	16
10"	10.750	0.365	10.020	0.835	40.520	0.54732	23.2994816	10	14	18
12"	12.750	0.406	11.938	0.995	53.570	0.77691	33.0730284	10	16	22
14"	14.000	0.438	13.124	1.094	63.500	0.93894	39.9708384	12	18	24
16"	16.000	0.500	15.000	1.250	82.850	1.22656	52.2147656	12	18	26
18"	18.000	0.562	16.876	1.406	104.760	1.55255	66.0921452	14	20	30
20"	20.000	0.594	18.812	1.568	123.230	1.92920	82.1260159	16	22	32
22"	22.000	0.625	20.750	1.729	170.000	2.34716	99.9187557	18	26	40

Appendix 2
Insulation Thickness Schedule
For Refrigeration Systems - Outdoor

CRYOFLEX POLYETHYLENE INSULATION															
	SERVICE TEMPERATURE (°F)													INSIDE & OUTSIDE	
PIPE SIZES	-60	-55	-50	-40	-30	-20	-10	0	10	20	30	40	50	HOT GAS SUPPLY LINE	DEFROST DRAIN LINES
VESSEL	6"							4"							
24 " Pipe	8.0	7.5	7.5	7.0	7.0	6.5	6	6	5.5	5	4.5	4	3.5	N/A	N/A
20" Pipe	7.5	7.5	7.5	7.0	6.5	6	6	5.5	5	4.5	4	3.5	3.0	N/A	N/A
18" Pipe	7.5	7.0	7.0	6.5	6.5	6	5.5	5.5	5	4.5	4	3.5	3	N/A	N/A
16" Pipe	7.0	7.0	7	6.5	6	5.5	5.5	5	4.5	4	3.5	3	2.5	N/A	N/A
14" Pipe	6.5	6.5	6.5	6.5	6	5.5	5.5	5	4.5	4	3.5	3	2.5	N/A	N/A
12" Pipe	6.5	6.5	6.5	6	6	5.5	5	4.5	4	4	3.5	3	2.5	N/A	N/A
10" Pipe	6.0	6.0	6	6	5.5	5	5	4.5	4	3.5	3	2.5	2	1-1/2"	N/A
8" Pipe	6.0	6	6	5.5	5	5	4.5	4	4	3.5	3	2.5	2	1-1/2"	1-1/2"
6" Pipe	5.5	5.5	5.5	5	5	4.5	4	4	3.5	3.5	3	2.5	2	1-1/2"	1-1/2"
5" Pipe	5.5	5.5	5	5	4.5	4.5	4	4	3.5	3	3	2.5	2	1-1/2"	1-1/2"
4" Pipe	5	5	5	4.5	4.5	4	4	3.5	3.5	3	2.5	2.5	2	1-1/2"	1-1/2"
3" Pipe	5	5	4.5	4.5	4	4	3.5	3.5	3	3	2.5	2	2	1-1/2"	1-1/2"
2-1/2" Pipe	4.5	4.5	4	4	3.5	3.5	3.5	3	3	2.5	2	2	1.5	1-1/2"	1-1/2"
2" Pipe	4.5	4.5	4	4	3.5	3.5	3.5	3	3	2.5	2	2	1.5	1-1/2"	1-1/2"
1-1/2" Pipe	4.5	4	4	4	3.5	3.5	3	3	2.5	2.5	2	2	1.5	1-1/2"	1-1/2"
1 ¼" Pipe	4.5	4	4	4	3.5	3.5	3	3	2.5	2.5	2	1.5	1.5	1-1/2"	1-1/2"
1" Pipe	4	4	3.5	3.5	3	3	3	2.5	2.5	2	2	1.5	1.5	1-1/2"	1"
¾" Pipe	4	3.5	3	3	3	2.5	2.5	2.5	2.5	2	2	1.5	1.5	1-1/2"	1"
½" Pipe	3.3	3	3	3	2.5	2.5	2.5	2.5	2	2	1.5	1.5	1.5	1"	1"
3/8" Pipe	3	3	3	3	2.5	2.5	2.5	2.5	2	2	1.5	1.5	1.5	1"	1"

Note 1: 2-1/2" insulation and above requires two layers for multi-layer pipe covering.

Note 2: Service temperature falling between those listed shall default to listed temperatures immediately below the actual service value.

Service temperature shall not exceed 200°F.

These tables are guidelines only. Consult a qualified design engineer for insulation thickness requirements for specific end use conditions.

Appendix 3
Insulation Thickness Schedule
For Refrigeration Systems - Indoor

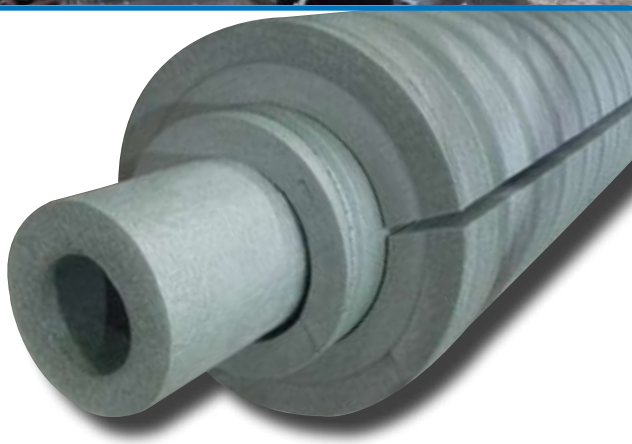
CRYOFLEX POLYETHYLENE INSULATION															
	SERVICE TEMPERATURE (°F)													INSIDE & OUTSIDE	
PIPE SIZES	-60	-55	-50	-40	-30	-20	-10	0	10	20	30	40	50	HOT GAS SUPPLY LINE	DEFROST DRAIN LINES
24"Pipe	6.5	6	6	5.5	5	4.5	4.5	4	3.5	3	2.5	2	N/A	N/A	N/A
22"Pipe	6.5	6	5.5	5.5	5	4.5	4.5	4	3.5	3	2.5	2	N/A	N/A	N/A
20"Pipe	6.5	6	5.5	5.5	5	4.5	4	4	3.5	3	2.5	2	N/A	N/A	N/A
18"Pipe	6	6	5.5	5	5	4.5	4	4	3.5	3	2.5	2	N/A	N/A	N/A
16"Pipe	6	6	5.5	5	5	4.5	4	3.5	3.5	3	2.5	2	N/A	N/A	N/A
14"Pipe	6	5.5	5.5	5	4.5	4.5	4	3.5	3	3	2.5	2	N/A	N/A	N/A
12"Pipe	5.5	5.5	5	5	4.5	4	4	3.5	3	2.5	2.5	2	N/A	N/A	N/A
10"Pipe	5.5	5	5	4.5	4.5	4	3.5	3.5	3	2.5	2	2	1-1/2"	N/A	1-1/2"
8"Pipe	5	5	4.5	4.5	4	3.5	3.5	3	3	2.5	2	1.5	1-1/2"	1-1/2"	1-1/2"
6"Pipe	5	4.5	4.5	4	3.5	3.5	3.5	3	2.5	2.5	2	1.5	1-1/2"	1-1/2"	1-1/2"
5"Pipe	4.5	4.5	4	4	3.5	3.5	3	3	2.5	2.5	2	1.5	1-1/2"	1-1/2"	1-1/2"
4.5"Pipe	4.5	4	4	3.5	3.5	3	3	2.5	2.5	2	2	1.5	1-1/2"	1-1/2"	1-1/2"
4"Pipe	4.5	4	4	3.5	3.5	3	3	2.5	2.5	2	2	1.5	1-1/2"	1-1/2"	1-1/2"
3.5"Pipe	4	4	3.5	3.5	3.5	3	3	2.5	2.5	2	1.5	1.5	1-1/2"	1-1/2"	1-1/2"
3"Pipe	4	4	3.5	3.5	3.5	3	3	2.5	2.5	2	1.5	1.5	1-1/2"	1-1/2"	1-1/2"
2-1/2"Pipe	3.5	3.5	3.5	3	3	2.5	2.5	2	2	2	1.5	1.5	1-1/2"	1-1/2"	1-1/2"
2"Pipe	3.5	3.5	3.5	3	3	2.5	2.5	2.5	2	2	1.5	1.5	1-1/2"	1-1/2"	1"
1-1/2"Pipe	3.5	3.5	3	3	3	2.5	2.5	2	2	2	1.5	1.5	1-1/2"	1-1/2"	1"
1-1/4"Pipe	3.5	3.5	3	3	3	2.5	2.5	2	2	1.5	1.5	1.5	1-1/2"	1-1/2"	1"
1"Pipe	3	3	3	2.5	2.5	2.5	2	2	2	1.5	1.5	1.5	1-1/2"	1"	1"
¾"Pipe	3	2.5	2.5	2.5	2.5	2.5	2	2	2	1.5	1.5	1.5	1-1/2"	1"	
½"Pipe	2.5	2.5	2.5	2.5	2										

Note 1: 2-1/2" insulation and above requires two layers for multi-layer pipe covering.

Note 2: Service temperature falling between those listed shall default to listed temperatures immediately below the actual service value.

Service temperature shall not exceed 200°F.

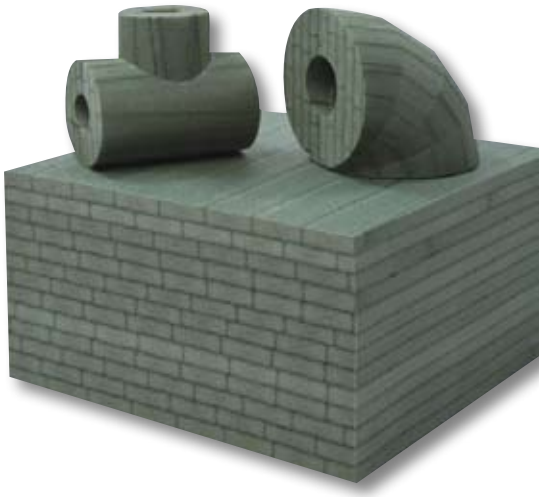
These tables are guidelines only. Consult a qualified design engineer for insulation thickness requirements for specific end use conditions.



CRYOflex is the only flexible insulation solution for cold environment applications

CRYOflex provides:

- improved handling during installation and field fabrications
- single seam clam shell application in standard pipe diameters
- easy to install
- superior performance

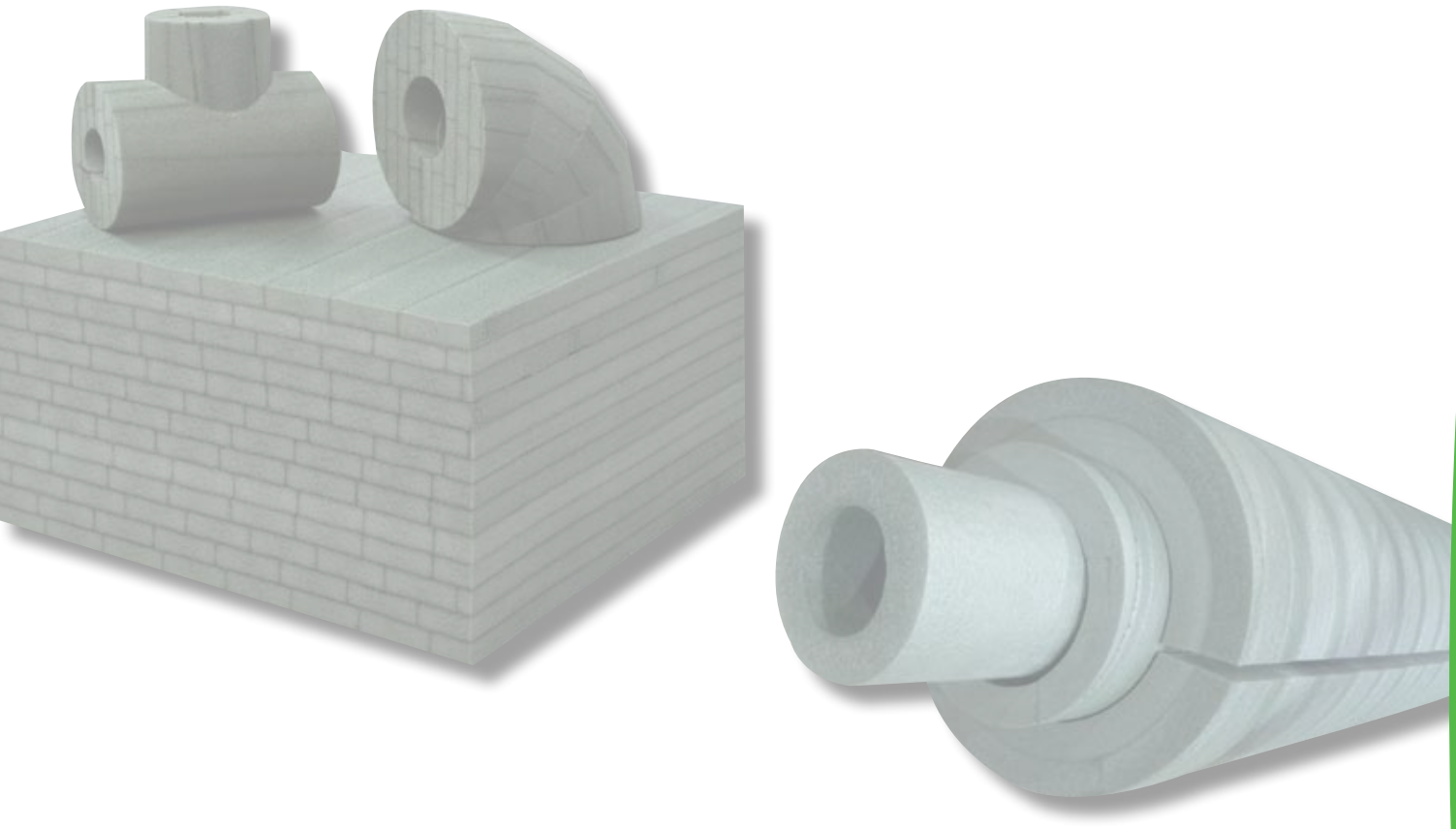


About Nomaco Insulation

Established in 1979, Nomaco Insulation is one of the seven operating units of the Noël Group, a privately held organization of unicellular polymer foam manufacturing companies with more than 1,000 employees worldwide. Nomaco Insulation and its sister companies hold over 45 patents for synthetic foam products and processes worldwide.

Headquartered in Tarboro NC and with production facilities in Tarboro and Oklahoma City, Nomaco Insulation is a global leader in polyethylene foam insulation products. Our products are used in residential, commercial and industrial applications. Our insulation brand names include Cryoflex, Nomaco, Imcoa, therma-cel, and Arcticflex. Nomaco Insulation developed a unique manufacturing process (patent pending) that allows the factory fabrication of polyethylene insulation in pipe sizes up to 24” and wall thicknesses up to 8” when factory nested. It is this unique process that allows Cryoflex to be manufactured in the range of sizes demanded by the industrial refrigeration industry.

Nomaco Insulation is an active member of the International Institute of Ammonia Refrigeration (IIAR), Refrigeration Engineers and Technicians Association (RETA), the National Insulation Association (NIA), the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and ASTM International (formerly the American Society for Testing and Materials).



NOMACO Insulation
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