

Comparison of Closed Cell Elastomeric Insulation Products To Polyisocyanurate Insulation Products

This Technical Bulletin will focus on a comparison of the physical properties of closed cell elastomeric insulation products with those of polyisocyanurate insulation products for various applications such as chilled water to cryogenic applications where water intrusion or moisture from condensation can be an issue. Elastomeric insulation products are an ideal choice for applications such as process lines, chilled water, refrigeration, cryogenic lines and other applications in the range of -297°F up to 220°F service temperature.

The following chart highlights the physical properties of the elastomeric and poly iso insulation products. The properties listed are common to industry published literature or are taken from ASTM standards

Insulation Material	Units	Elastomeric	Polyisocyanurate
Thermal (at 75°F mean)	k	<0.27	.19
Wvt	perm-in	<0.10	2.0 - 4.0
Flammability ASTM E 84 Rating		25/50 1-1/2" and below	25/50
Service Temperature Range		-297° to +220°F	-297 to 300F

Table 1

RECOMMENDED WALL THICKNESS

Conditions - pipe size up to 3" IPS Ambient temp 80°F Wind Speed 0 mph Emissivity of outer surface = 0.90 **

Relative Humidity	Fluid Temperature 35° - 49°		Fluid Temperature 50° - 70°	
	Poly iso	Elastomeric	Poly iso	Elastomeric
50%	¾"	½"	¾"	½"
70%	¾"	¾"	¾"	½"
90%	2"	2"	1 1/2"	1 1/2"

Conditions - pipe size up to 3" IPS Ambient temp 80°F Wind Speed 0 mph Emissivity of outer surface = 0.90 **

Relative Humidity	Fluid Temperature -100°F		Fluid Temperature -250 °F	
	Poly iso	Elastomeric	Poly iso	Elastomeric
50%	1"	1 3/4"	1 ½"	1 ½"
70%	2"	4"	3"	3"
85%	3 1/2"	6 1/2"	6"	7"

* Polyisocyanurate insulation products are only offered in ¾" wall and above.

Calculations did not take into account the loss in k value over time that polyisocyanurate exhibits

**** Low emissivity jackets (reflective) will increase the thickness required to prevent condensation**

COMPARISON CHART

	Closed Cell Elastomeric	Polyisocyanurate
Excellent thermal k	Yes	?
Excellent wvt without jacketing	Yes	No *
25/50 flammability rating	Yes	?
Available in white	Yes	Yes
Available with self seal closure	Yes	No
Closed Cell Structure	Yes	No
Fiber Free	Yes	Yes
Non-porous	Yes	No
Mold Resistant	Yes	**
Flexible	Yes	?
Thicknesses Available	3/8", 1/2", 3/4" 1", 1-1/2 Other sizes can be sleeved	3/4" and above Structural issue below 3/4"
Lengths	6 foot lengths	3 foot lengths
In Field Fabrication	Yes	No

* Poly iso products always require a vapor barrier – usually Dow Saran is recommended.

** Mold and mildew require two key elements, moisture and a nutrient source such as dirt. A material's resistance to moisture and dirt accumulation is a major factor in eliminating mold issues.

Differences in composition and structure, no jacket required

The key distinction between elastomeric and polyisocyanurate insulation products is fundamental in their composition and structure. Closed cell elastomeric insulation products are comprised of individual cells filled with gas. These non-connecting cells resist moisture, compression and provide excellent thermal conductivity values. On indoor applications, no additional jacket or covering is necessary because of this closed cell structure. For outdoor applications with severe UV exposure, a protective coating or jacket is recommended to protect the product from the effects of UV and mechanical abuse. The elastomeric composition of the product creates the extreme flexibility and ease of installation of the product. The application temperature range of -297°F to 220°F allows it to be used on a wide range of applications well beyond chilled water.

Conversely, polyisocyanurate products are composed of polymeric cells that create interconnecting air spaces which provide insulation qualities but creates a semi-rigid product which must be jacketed to prevent moisture pickup. The integrity of the jacket is a key element to the open cell insulation system and if it is punctured in any way, the insulation system may fail. Open cell products are ideal for above ambient temperature systems where moisture intrusion is not a factor.

Excellent thermal conductivity

Table 1 highlights the fact that in regard to thermal properties, moisture vapor transmission and flammability properties, elastomeric is similar or better than the poly iso materials provided the poly iso has a vapor retarder jacket as part of its system.

When comparing thermal k, one has to be reminded that copper has a thermal k of about 250. Most insulation products have a thermal k in the range of 0.23 – 0.30 and would all be considered excellent insulators. In evaluating thermal k values, it should be noted that over time, the thermal k of poly iso materials tends to degrade. Additionally other factors would play a more important role in the selection of an insulation material i.e. maintaining the integrity of the system and the consequences if the jacket is punctured (for every 1% moisture pickup, the insulation loses 7 of its insulation value. Water is 15 times more conductive than typical insulation products). In addition, the ability of a material to resist compression / crushing (resulting in thickness loss) is also a key concern to maintaining the long term thermal properties of the insulation system.

Range of product offering can also play a role in thickness selection. Polyiso is not offered in thickness below 3/4" and is actually seldom seen below 1" wall thickness because the product is easily fractured below this thickness. Nomaco Insulation elastomeric products are offered in a wide range of ID and wall thicknesses. In addition, the ability to sleeve products to attain a specific thickness allows for greater latitude in product selection.

Inherent moisture vapor retarder

When comparing moisture vapor transmission values, it is important to note that materials with a wvt of 0.10 perms-in or less are considered to be moisture vapor retarders as defined by ASHRAE and ASTM. In the case of elastomeric products, this wvt value is achieved without the addition of a jacket. Whereas with poly iso products, a jacket is needed to achieve this and if the jacket is punctured or torn from mechanical abuse, the wvt value increases substantially such that the system may fail. In addition, this type of situation can result in the growth of mold and fungi on the material. Elimination of moisture is a key factor in the elimination of mold. Closed cell elastomeric foam products also resist dirt entrapment.

Wide product offering, non-fibrous, non-porous

Closed cell elastomeric materials are non-fibrous and non-porous. No special tools are necessary for their installation. This means that no particulates / contaminants are sent into the operating environment either during installation or service. They can be painted for aesthetics but are also available in white. Elastomeric materials are available with an easy-to-use self-seal closure system for quick, neat installation. Elastomeric pipe insulation is available in 3/8", 1/2", 3/4", 1" and 1-1/2" wall thicknesses for up to 4" IPS size. Elastomeric material is also available in sheet and rolls up to 2" thickness.

Flexible closed cell elastomeric foams have been used for below ambient insulation applications for years and are the preferred product for this application. Material specifications are often slow to change, perpetuating themselves despite the availability of newer materials which offer many advantages.