

Comparison of Closed Cell Elastomeric Insulation Products To Fibrous Insulation Products

This Technical Bulletin will focus on a comparison of the physical properties of closed cell elastomeric insulation products with those of fibrous insulation products (ASTM C547) for below ambient applications such as chilled water where moisture from condensation can be an issue. Elastomeric insulation products are an ideal choice for applications such as hot/cold water, chilled water, refrigeration, cryogenic lines, HVAC, and other applications up to 220°F service temperature or 300°F when K-Flex HT™ is used. Elastomeric insulation is particularly well-suited for clean room applications.

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

Insulation Material	Units	Elastomeric	Fibrous w/ASJ	Fibrous w/o ASJ
Conductivity (at 75°F mean)	k	0.242	0.24	NA
Water vapor transmission (wvt)	perm-in	<0.06	0.02	>75
Flammability ASTM E 84 Rating	25/50	25/50 2" and below	25/50	
Service Temperature Range		-297° F to +300°F	0 to +1000°F	

RECOMMENDED WALL THICKNESS TO PREVENT CONDENSATION

Conditions - pipe size up to 1-½" IPS Ambient temp 80°F

Relative Humidity	Fluid Temperature 35° - 49°		Fluid Temperature 50° - 70°	
	Fibrous	Elastomeric	Fibrous	Elastomeric
50%	½"	3/8"	½"	3/8"
70%	1"	½"	½"	½"
90%	2-½"	1-½"	2"	1"

Conditions - pipe size up to 8" IPS Ambient temp 80°F

Relative Humidity	Fluid Temperature 35° - 49°		Fluid Temperature 50° - 70°	
	Fibrous	Elastomeric	Fibrous	Elastomeric
50%	½"	½"	½"	3/8"
70%	1"	¾"	½"	½"
90%	2-½"	2"	2"	1-¼"

COMPARISON CHART

	Closed Cell Elastomeric	Fibrous Products
Excellent thermal k	yes	yes
Excellent wvt without jacketing	yes	no
25/50 flammability rating	yes	yes
Available in white	yes	yes
Available with self seal closure	yes	yes
Closed Cell Structure	yes	no
Fiber Free	yes	no
Non-porous	yes	no
Mold Resistant	yes	*
Flexible	yes	no

* 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 performance distinction between elastomeric and fibrous 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 extreme flexibility and ease of installation of the product. The application temperature range of -297°F to $+220^{\circ}\text{F}$ / 300°F allows it to be used on a wide range of applications well beyond chilled water.

Conversely, fibrous products are composed of fibers that create interconnecting air spaces that provide insulation qualities, but create a rigid product that must be jacketed to prevent moisture pickup. The integrity of the jacket is a key element to the fibrous insulation system and if it is punctured in any way, the insulation system may fail. Fibrous products are ideal for above ambient temperature systems where moisture intrusion or condensation is not a factor.

Excellent thermal conductivity

The above table highlights the fact that the thermal, moisture vapor transmission and flammability properties of elastomeric and fibrous materials are very similar.

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. 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. K-FLEX USA elastomeric products are offered in a wide range of ID and wall thicknesses. Many insulation products are only offered in 1" wall or greater even though in many applications this thickness is not required. In addition, the ability to sleeve products or wrap with a flexible sheet 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. With fibrous products, a jacket (concentrated vapor barrier) is needed to achieve this and if the jacket is punctured or torn from mechanical abuse, the wvt value increases substantially, possibly resulting in system failure. In addition, moisture intrusion can result in the growth of mold and fungi on or in the material. Elimination of moisture is a key factor to the elimination of mold. Closed cell elastomeric foam products with their smooth surface skin also resist dirt entrapment.

Wide product offering, non-fibrous, non-porous

Closed cell elastomeric materials are non-fibrous and non-porous ($\text{ODP} = 0$). This means that no particulates / contaminants are released into the operating environment during installation or service. No special tools are necessary for their installation. They are available in black and white, or can be painted for aesthetics. Elastomeric materials are available with an easy-to-use self-seal closure system for quick, neat installation. Elastomeric pipe insulation is available in $3/8''$, $1/2''$, $3/4''$, $1''$, $1-1/2''$, and $2''$ wall thicknesses for up to $8''$ IPS size. Elastomeric tubular products come in 3 and 6 foot (reduces seams) lengths. Sheet and rolls are available up to $2''$ thickness. Most sizes are available with PSA, ensuring complete adhesive coverage and allowing faster installation. All seams and butt joints can be glued to maintain the integrity of the moisture vapor barrier vs. taped seams for fiberglass that are more prone to failure.

Flexible closed cell elastomeric foams have been used for below ambient insulation applications for years and are the ideal product for these applications. Material specifications are often slow to change, perpetuating themselves despite the availability of newer materials that offer many advantages. We will be glad to assist you in reviewing your specification requirements. For more technical information, particularly on condensation control, please contact K-FLEX USA Technical Services at 800-765-6475.