

## COMPARISON OF CLOSED CELL POLYETHYLENE INSULATION PRODUCTS TO FIBROUS INSULATION PRODUCTS

This Technical Bulletin will focus on a comparison of the physical properties of closed cell polyethylene insulation products with those of fibrous insulation products for below ambient applications such as domestic cold water where moisture, primarily from condensation can be an issue.

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

Insulation Material	Units	Polyethylene	Fibrous w/ASJ	Fibrous w/o ASJ
Thermal (at 75°F mean)	k	.25	.24	NA
Wvt	perm-in	<.05	0.02	75
Flammability ASTM E 84 Rating	25/50	25/50	25/50	
Service Temperature Range		-297° to +210°F	0 to +850°F	

Table 1

### RECOMMENDED WALL THICKNESS

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

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

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

	Fluid Temperature 35° - 49°		Fluid Temperature 50° - 70°	
Relative Humidity	Fibrous	Polyethylene	Fibrous	Polyethylene
50%	1"	½"	½'	½"
70%	1"	½'	½"	½"
90%	2"	1-5/8"	1-1/2"	1-3/8"

### Comparison Chart

	Closed Cell Polyethylene	Fibrous Products
Excellent thermal k	yes	yes
Excellent wvt without jacketing	yes	*
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

\* Fibrous products require a jacket

\*\* 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 polyethylene and fibrous insulation products is fundamental in their composition and structure. Closed cell polyethylene insulation products are comprised of individual cells filled with air. These non-connecting cells, resist moisture, compression and provide excellent thermal conductivity values. For these applications, no additional jacket or covering is necessary because of this closed cell structure. The polyethylene composition of the product creates the flexibility and ease of installation of the product. The application temperature range of  $-297^{\circ}\text{F}$  to  $210^{\circ}\text{F}$  is also a function of the composition of the product and allows it to be used on hot water applications as well.

Conversely, fibrous products are composed of spun fibers that create interconnecting air spaces which provide insulation qualities but creates a rigid product which 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 from condensation is not a factor.

### **Excellent thermal conductivity**

Table 1 highlights the fact that in regard to thermal properties, moisture vapor transmission and flammability properties, polyethylene and fibrous materials are very similar.

When comparing thermal properties, 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, particularly the concern regarding 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). The ability of a product to resist compression / crushing (resulting in thickness loss) is also a key feature in maintaining the long term thermal properties of the insulation.

Product offering can also play a role in thickness selection. Nomaco polyethylene insulation products are offered in a wide range of ID and thicknesses. In addition, the ability to sleeve products to attain a specific thickness allows for greater latitude and 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 polyethylene products, this wvt value is achieved without the addition of a jacket. In the case of fibrous products, a jacket is required to achieve this value, 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. The elimination of moisture generally eliminates any mold issues. The closed cell structure of the polyethylene material resists dirt entrapment.

### **Wide product offering, non-fibrous, non-porous**

Closed cell polyethylene 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. Polyethylene products are available in white as well as black. Polyethylene materials are available with an easy-to-use self-seal closure system for quick, neat installation.

Polyethylene pipe insulation is available in 3/8", 1/2", 3/4" and 1" wall thickness for up to 4" IPS size. Polyethylene material is also available in sheet and rolls up to 2 1/2" thickness.

Flexible closed cell polyethylene insulation products have been used for domestic hot and cold water applications for years and are the preferred product for this application. Fibrous material specifications are often slow to change, perpetuating themselves despite the availability newer materials which offer many advantages.