

## **BACKGROUND**

Cold pipe is quite often located on rooftops with the two most common examples of this being refrigeration (e.g. ammonia) and chilled water lines.

The rooftop environment is quite harsh due to exposure to the weather and sunlight and the potential for physical abuse. Chilled water and even refrigeration pipe insulation systems are inspected too infrequently and maintenance is often inadequate. These factors make it critical that Roof top cold pipe insulation systems be designed and installed using the best quality materials and the concepts described in this document. The insulation systems for rooftop cold pipe should, in most cases, use aluminum jacketing as the outermost protective surface.

## **INSULATION SYSTEM**

The insulation system for rooftop cold pipe will consist of one or more layers of a high quality water resistant closed cell insulation, a high quality and continuous vapor retarder, metal jacketing with PFMB, and possibly other accessories.

## **INSULATION**

The insulation used should be one of three materials depending on the specifics of the application and the preferences of the specifier. These materials are:

- Extruded Polystyrene Pipe Insulation Billet (XPS PIB)
- Trymer 2000XP Polyisocyanurate (PIR)
- Trymer Supercel Phenolic

The XPS PIB is the most popular choice for refrigeration applications. It has excellent water resistance and a multi-decade history of successful use in this application. For more information on the XPS PIB, consult the ITW Insulation Systems data sheet and other ITW literature.

The Trymer 2000XP PIR insulation is the best choice for insulation on rooftop chilled water lines. It can also be used on refrigeration lines especially any dual-temp lines that will experience hot temperatures.

The Trymer Supercel Phenolic is typically used only on chilled water lines when a flame spread/smoke developed rating of  $\leq 25/50$  is required by the spec. Since this rating is not required by codes for outdoor applications, this product is seldom used in rooftop applications.

## **VAPOR RETARDER**

The vapor retarder should be based on Saran CX Film and Tape and must be continuous throughout the entire insulation system. For refrigeration pipe operating above 0°F and for chilled water pipe, Saran 540CX Film should be used. For refrigeration pipe below 0°F, Saran 560CX Film should be used. Saran CX Tape should be used on butt joints and spiral wrapped around fittings and elbows. For more details, consult the Saran Vapor Retarder Film and Tape Installation Guide on the ITW Insulation Systems website.

ITW does not recommend the use of any vapor retarder containing paper such as ASJ or FSK. The paper layer in these absorbs water and holds it against the interior surface of the jacketing which can increase the potential for corrosion on this hidden jacket surface.

## **METAL JACKETING**

In most cases, the jacketing used should be aluminum roll jacketing or cut and roll. Two-piece aluminum elbows should be used when available in the sizes required. For larger size elbows, aluminum gores should be used.

The metal jacketing can have a smooth, stucco embossed, or 3/16" corrugated finish but the most commonly used finish on roof top cold lines is stucco embossed as this will hide minor damage from hail and other impacts better than the alternative finishes.

Painted aluminum jacketing with a smooth, stucco, or 3/16" corrugated finish can be used as an upgrade from the standard jacketing. Painted aluminum better resists exterior corrosion and also raises the emissivity of the jacketing which can allow reduction in insulation thickness when the key design criterion is condensation control. For more information on this, consult the ITW data sheet on painted aluminum jacketing.

## **POLYFILM MOISTURE BARRIER**

Polyfilm Moisture Barrier (PFMB) is an engineered three layer coextruded film of polyethylene and Surlyn\* polymers with a total film thickness of 3 mils (76  $\mu\text{m}$ ) that is factory heat laminated to the interior surface of metal jacketing. It is critical that PFMB be used on all types of aluminum jacketing including painted aluminum in all applications and especially on rooftop cold pipe to help

prevent corrosion of the interior surface of the metal jacketing and the insulated pipe, tank, or equipment.

ITW does not recommend the use of polykraft (PK) moisture barrier. The poor water resistance properties of the PK coupled with lab tests and real world experience clearly demonstrate that PK is an inferior moisture barrier and that PFMB performs much better. For more information on this, see the ITW literature on PFMB.

### METAL JACKETING THICKNESS

ITW recommends that the thickness of aluminum jacketing used vary based on the outer diameter of the insulation system per the requirements of ASTM C1729. This is shown in the table below. For refrigeration applications and most chilled water pipe, an aluminum jacket thickness of 0.016” will typically be sufficient. For larger diameter chilled water insulation systems or where greater jacket strength is desired, such as when fibrous flexible insulation is used, 0.020” or even greater thickness aluminum jacketing may be needed.

Outer Insulation Diameter (in)	Minimum Aluminum Jacket Thickness, inches (mm) when Using Rigid Insulation
≤ 8	0.016 (0.41)
Over 8 thru 11	0.016 (0.41)
Over 11 thru 24	0.016 (0.41)
Over 24 thru 36	0.020 (0.51)
>36	0.024 (0.61)

### ACCESSORIES

Depending on the pipe temperature and the preferences of the specifier, various accessories may be used on pipe insulation systems. These include insulation joint sealant, filament tape, mastic/fabric/mastic for vapor stops or vapor retarder, SSL tape to close vapor retarder longitudinal joints, and flashing sealant on the joints of metal jacketing. Consult ITW installation guides for more information on these accessory materials.

### COMPLIANCE TO STANDARDS

All of the insulation, vapor retarder, and metal jacketing materials mentioned in this document comply with the relevant ASTM standards as follows:

- XPS PIB – Complies with ASTM C578, Type XIII
- Trymer 2000XP PIR – Complies with C591, Type IV
- Trymer Supercel Phenolic – Complies with C1126
- Saran Vapor Retarder – Complies with C1136, Type VII or VIII
- Aluminum Jacketing – Complies with C1729
- Stainless Steel Jacketing – Complies with C1767

### INSTALLATION

Consult ITW installation guidelines for insulation, vapor retarders, and metal jacketing for the details. The most important general concepts to follow for installation of rooftop cold pipe insulation systems are:

- ITW installation guidelines are to be followed unless these conflict with the job specifications.
- Metal jacketing longitudinal joints shall be located at the 3 o'clock position and, along with the butt joints, shall have a minimum 2” overlap and shall be oriented to naturally shed water or to face away from the prevailing wind direction.
- Metal jacketing and elbows shall be secured with bands. No screws, rivets, or other devices that can penetrate the underlying vapor retarder shall be used.
- The vapor retarder system must provide a continuous barrier over all of the insulation.
- The insulation shall be installed neatly and professionally with no gaps or voids. Joints must abut uniformly and excess sealant shall not be used.
- Insulation thickness must be designed to accomplish the desired design criteria (e.g. condensation control, limit heat gain, comply with codes, etc.).
- Each insulation system component shall be clean and dry prior to applying the next successive component. For example, the insulation must be clean and dry prior to applying the vapor retarder.
- Consideration shall be given to the use of corrosion inhibiting coatings on metal pipe if the pipe will spend a significant fraction of time in the temperature range where corrosion of that type metal occurs. See the ITW document on “Metal Corrosion Under Thermal Insulation” for more information.