

# Metal Corrosion under Thermal Insulation

## TRYMER® POLYISOCYANURATE INSULATION

The corrosion of insulated metal is a problem throughout the insulation industry and is not unique to any one type of insulation or region of the country. While it is true that corrosion of metal pipes and vessels can occur when covered by any and all types of thermal insulation materials, it is also true that there are several techniques that can be employed to minimize or even eliminate the potential for corrosion problems

Metal corrosion can occur under any type of thermal insulation by different mechanisms depending on the type of metal which is insulated. The two most common types of corrosion are oxidation (rusting) of carbon steel and chloride stress corrosion cracking which only occurs in 300 series austenitic stainless steel. If the proper precautions are taken, both of these types of corrosion can be prevented.

While dramatically different in nature, these two types of corrosion share one common requirement: WATER. Water, in the form of liquid or vapor, must be present at the outer surface of the metal for corrosion to occur. Therefore, anything that can be done to prevent moisture, even in small amounts, from reaching the metal surface will help prevent corrosion from occurring.

The presence of chloride ions has also been found to exacerbate both types of corrosion but too often the search for the source of chloride ions has been centered incorrectly on the insulation system components. A common misconception regarding polyisocyanurate insulation is that it promotes corrosion due to its high chloride content. While polyisocyanurate foam does contain low levels of chlorine, it is distributed evenly throughout the foam not concentrated at the insulation inner surface where it could contribute to metal corrosion. TRYMER®

Polyisocyanurate Insulation also does not contain any halogenated flame retardants which might be an additional source of damaging ions. The chloride ions that contribute to metal corrosion under insulation come primarily from environmental sources external to the insulation system such as rain water, ocean mist, washdown water, and cooling tower spray. It is this environmental water penetrating the insulation system that is the real danger since it can bring with it a major and virtually inexhaustible supply of ions. Even if the level of chloride ions in such water is low, significant amounts of these ions can accumulate at the metal surface by a repeating cycle of water penetration and evaporation.

Stress corrosion cracking of stainless steel occurs when water and ions are present at the metal surface at temperatures above ambient and mostly only when the surface is above about 140°F and below about 300°F. Oxidative corrosion of carbon steel tends to occur only when the metal temperature is between about 32°F and about 300°F. Since exposure of the insulation system to water from some outside source is inevitable, the key to eliminating corrosion lies in preventing the moisture and ions, even in small amounts, from reaching the metal surface.

While closed cell and water resistant insulations like TRYMER® PIR help to prevent the movement of water and water vapor into the insulation system, no insulation material alone is capable of totally preventing the penetration of moisture to the metal surface so additional lines of defense must be installed. The first must be a properly designed and installed jacket. If process temperatures are lower than ambient (even for a short period of time such as during shut-downs) a high quality continuous

vapor retarder such as Saran™ Film and Tape is also required. ITW can provide installation guidelines for Saran Film and Tape. If a different vapor retarder is used, consult the manufacturer for installation and use instructions. In addition, a regular inspection schedule should be instituted to ensure that the continuity of the vapor retarder is not compromised as a result of maintenance operations or physical damage. Any damage to the vapor retarder should be repaired immediately.

Painting of the metal as a second line of defense should be strongly considered when the metal temperature or other environmental conditions are particularly favorable for corrosion or when corrosion is a particular concern. If this approach is taken, prior to being insulated, the metal surface should be sandblasted to remove any mill scale or existing corrosion and then painted with, for example, an epoxy coating. There are many types of paints available for this purpose, and it is recommended that a paint manufacturer be consulted for the proper choice and application procedure.

In summary, metal corrosion can occur under any insulation material if water or water vapor is present and the metal temperature is in the right range. However, this potential for corrosion can be greatly minimized by a combination of TRYMER® insulation, a properly designed and installed jacket, use of a high quality continuous vapor retarder such as Saran™ Film and Tape, and, in some situations, the proper painting of the metal.

Additional details and recommendations are available by contacting ITW Insulation Systems at 1-800-231-1024.



# Insulation Systems

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**ITW Insulation Systems**

1370 East 40<sup>th</sup> Street  
Houston, TX 77022

**For Sales and Technical Information: 1-800-231-1024**

**[www.itwinsulation.com](http://www.itwinsulation.com)**

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