LAMTEC®
CORPORATION

Technical Bulletin # 4
Vapor Retarders - Preventing Foil Corrosion

As a foundation for a discussion about insulation facing and corrosion, specifically FSK corrosion, it is important to define and classify the different types of corrosion. The information below was taken from a publication titled, *"Guidelines For The Use Of Aluminum With Food And Chemicals*", published by the **Aluminum Association**.

Types of Corrosion: Corrosion is defined as the deterioration of a metal by chemical or electrochemical reaction with its environment. This deterioration takes place in different ways, depending upon the corrosive media, temperature, presence of other metals, and other factors.

Uniform Corrosion: Uniform corrosion is the term applied when the metal surface corrodes evenly over the entire area.

Pitting: Pitting is a localized form of corrosion that usually occurs randomly in the form of small pits of craters, roughly hemispherical in shape. Pits usually become covered with a mound or nodule of corrosion product which tends to stifle further corrosion. As a result, the rate of penetration of a pit tends to diminish with time. Some pitting usually can be tolerated if the wall thickness is adequate.

Galvanic Corrosion: Galvanic or dissimilar metal corrosion is the corrosion that takes place when different metals or alloys are coupled together electrically in the presence of an electrolyte. The severity of corrosion depends upon several factors, one being the position of the dissimilar metals in the galvanic series in the list below:

GALVANIC SERIES

Magnesium alloys
Zinc
Aluminum-zinc alloys
Aluminum-magnesium alloy
Aluminum, 1100, 3003, Al-Mg-Si alloys
Cadmium
Aluminum-Copper alloys
Mild steel, cast and wrought iron
Chromium
Lead-Tin solders
Lead
Tin
Brass
Copper
Bronze
Nickel
Stainless steel

In this series, any material tends to be corroded by contact with any other metal beneath it. The extent of the corrosion also depends upon the conductivity of the electrolyte; it can become negligible in solutions of low conductivity such as high purity water. Despite its low position in the series, stainless steel can be safely coupled to aluminum in many environments because the steel is highly polarized. In high chloride environments, stainless steel can cause substantial corrosion of contacting aluminum.

5010 River Road Mount Bethel, Pennsylvania 18343-5610 U.S.A.
Phone: (570) 897-8200 Fax: (570) 897-6081 Web: www.lamtec.com

Deposition Corrosion: Deposition corrosion is a form of corrosion in which ions of heavy metals, such as copper, lead, mercury, tin, nickel and cobalt are electroplated onto aluminum; the resulting couple of dissimilar metals leads to further corrosion. Copper is the heavy metal most commonly encountered in practice because of the use of copper equipment. Mercury ions are less common, but even more detrimental.

Poultice Corrosion: Poultice corrosion is a form of corrosion that takes place when moisture is absorbed by porous materials, such as insulation, wood, cloth, cork and paper in contact with aluminum. The corrosion reaction is the result of differences in oxygen concentration in the electrolyte in adjacent regions of the material. These differences lead to a concentration cell and the region on the aluminum, which is oxygen-starved, corrodes.

The information above will serve as a foundation for the discussion to follow involving corrosion and vapor retarders.

All aluminum foil based vapor retarders, both single and double sided, can corrode if the foil is allowed to remain in contact with water for an extended period of time. Water and /or condensed moisture on the surface of the foil is the single largest cause of corrosion. When water remains in contact with aluminum foil, the metal begins to corrode and stains appear on the surface.

High quality aluminum foil vapor retarders are designed to resist corrosion and will not corrode under conditions of high humidity if used in a properly designed systems. Vapor retarders that comply with ASTM C1136 are exposed to an accelerated aging procedure in which the facing is maintained at 120ºF and 95% relative humidity for a period of 30 days. After exposure, the facings must not show pitting or surface corrosion.

Corrosion can also occur on aluminum foil faced vapor retarders if they are exposed to corrosive chemicals or are used in corrosive environments. It is important that the adhesives used to laminate fiberglass insulation to the facing be non corrosive. Experience has shown that highly acidic or basic adhesives can contribute to foil corrosion. Fire retardant salts are extremely corrosive to aluminum foil and should not be used in laminating adhesives.

When laminating vapor retarders to fiberglass insulation, the potential for corrosion exists if excessive amounts of water based adhesives are used. In rolls of faced insulation, water from the adhesive becomes trapped in the fiberglass matrix between the vapor retarder layers. The wet fiberglass, in contact with the aluminum foil, creates an ideal environment for Poultice Corrosion. The best way to avoid this type of corrosion is to limit the amount of water in the insulation roll. This can be accomplished in the following ways:

- Keep the adhesive application rate as low as possible, do not exceed 20 dry grams/sqm. of adhesive.
- Make sure the package is ventilated so moisture can evaporate and not condense on the foil.
- Use high solids water based adhesive
- Try to dry the adhesive as much as possible before packaging the rolls.
- Make sure the rolls are stored properly at the job site and do not get wet.

These suggestions should prevent corrosion from occurring in the insulation package.
For corrosion to be prevented at the job site and after installation, the factors listed below should be considered:

Corrosion from Concrete

- Aluminum foil facings can corrode if held in close proximity to freshly poured concrete. It is important to properly ventilate confined areas where concrete is curing. Foil faced products should never be in direct contact with concrete.

- **Corrosion on Duct Wrap Insulation (Low Temperature Applications)**
    - Condensation can form on the surface of the foil if the "R" value of the underlying insulation is inadequate. It is important to factor in the compressibility of the fiberglass when designing an insulated duct system. Surface temperature and dew point calculations should be run using a fiberglass thickness compression factor of 25%. In other words, assume the thickness of the installed fiberglass to be 75% of nominal.
    - Disruptions in the vapor retarder such as poorly sealed seams and holes can result in condensation within the fiberglass. Wet insulation has a lower "R" value which translates to colder surface temperatures. Colder surface temperatures increase the probability of surface condensation and corrosion.
    - Sheet metal air duct joints and seams must be sealed thoroughly prior to the installation of the insulation. Failure to do so will negate some of the benefits of the insulation and reduce the surface temperature of the vapor retarder thus increasing the possibility of surface corrosion.
- **Galvanic Corrosion:**
    - Aluminum foil is also subject to Galvanic or dissimilar metal corrosion. This is corrosion that takes place when different metals or alloys are coupled together electrically in the presence of an electrolyte. This source of corrosion must be considered whenever the aluminum foil is in direct contact with a bare metal other than aluminum.

In summary, corrosion can develop, on both single and double sided foil products, if the foil comes in contact with water or other corrosive chemicals. This can occur under the following conditions:

Laminating adhesive application rate too high.

- Laminating adhesive not properly dried.
- Packaged material not properly ventilated.
- Insufficient insulation thickness.
- Improper system design resulting in condensation on the surface of the vapor retarder.
- Vapor retarder is exposed to curing concrete in an unventilated space.
- Improper selection of laminating adhesives.

High quality vapor retarders, such as FSK facings produced by Lamtec Corporation, are designed to be corrosion resistant. At Lamtec, precautions are taken to assure that foil faced products do not corrode when used in properly designed systems. Every roll of aluminum foil is tested for critical properties. Our adhesive chemistry is designed to inhibit corrosion and our facings are tested for corrosion in accordance with ASTM C1136.