

**TECHNICAL UPDATE - TU-4007**

**SUBJECT: Galvanic Corrosion in Traced Bundles**

There have been a number of questions regarding the selection of materials and tapes used in Unitherm Traced Bundles, especially when the reason for material selection involves corrosion. There are a number of types of corrosion that affect materials in our bundles, including galvanic corrosion, crevice corrosion, chemical pitting, intergranular corrosion, stress corrosion cracking, and atmospheric corrosion. This update will deal only with galvanic corrosion, its effects, causes, and relation to material selection. Other types of corrosion will be dealt with in later updates.

Galvanic corrosion can occur when dissimilar metals are in electrical contact in the presence of an electrolyte. The two metals do not need to touch, but there needs to be a path for electrons to move. The metals begin to act like a battery, and one metal is attacked.

This effect can occur in Traced Bundles when two dissimilar metals are cabled together in the core, then the bundle is exposed to an electrolyte, like seawater or salt laden rainwater. The resulting circuit causes one of the materials to be attacked. The attack usually showed up as a furrow or trough along the line of contact between the two metals.

The material corroded and the degree of corrosion are functions of the materials selected and their position in a table known as the Galvanic Series. The Galvanic Series for metals in seawater is shown in Table 1. If a metal high in the galvanic series is cabled with a metal low in the Galvanic Series, and the pair is exposed to an electrolyte, the corrosion will occur in the metal that is higher in the Series. For example, if an aluminum tube was cabled with a copper tube and subjected to seawater, the aluminum tube would suffer the effects of galvanic corrosion.

In our products, if a copper tube bundle was wrapped with an aluminum mylar tape, then the ends were left unsealed so that the bundle is exposed to salt laden rainwater (like you would see along the Florida coast), the aluminum tape would corrode and part of the metal would seem to disappear over a short period of time. This is the reason we use a copper-mylar thermal barrier tape on copper tube bundles.

There are three methods to reduce or eliminate the effects of galvanic corrosion. The first is to select materials that are close together on the Galvanic Series, the second is to insulate the two materials so that there is no electrical path between the two, and the third is to eliminate the possibility of the electrolyte coming in contact with the tubes.

The first method is handled by proper selection of tube materials. If you are approached with an unusual combination of tubes, like aluminum and copper, contact engineering for alternates.

The second method can be accomplished through the use of coating or tapes. This method, though effective, is generally expensive.

The third method is the easiest to accomplish. Simply seal the ends of the bundle so that water and other fluids do not come into contact with the tubes. Without the electrolyte, there is no galvanic corrosion.

