Q: I went to take some pictures of my latest galvanizing project and noticed the galvanized steel was in contact with another metal I did not recognize. Should I be concerned about a decreased service life of the galvanized steel due to the dissimilar metals being in contact?

A: The purpose of galvanizing steel is for the zinc coating to sacrifice itself in place of the base steel corroding. If the galvanized coating undergoes accelerated corrosion due to being in contact with dissimilar metals, it is not functioning as it was intended. There are times when it is necessary to attach galvanized steel to dissimilar metals due to design or existing structures. So what is the recommended way of attaching the galvanized parts in a way that will not decrease the service life of the galvanized steel?

CORRODED END Anodic or less noble
Magnesium
Zinc
Aluminum
Cadmium
Steel
Lead
Tin
Nickel
Brass
Bronzes
Copper
Nickel-Copper Alloys
Stainless Steels (passive)
Silver
Gold
Platinum
Cathodic or most noble PROTECTED END

Figure 1: Galvanic Series

Let us take a step back and look at the background of why dissimilar metals in contact can create a problem. First, we must take a look at the galvanic series of metals, as seen in ***Figure 1***. This is a listing of different types of metals and their corresponding electrical potentials in a salt water solution. Metals with a lower (more negative) electrical potential will sacrifice themselves for metals with a higher (more positive) electrical potential. When dissimilar metals are in contact, the metal with a lower electrical potential is called the anode, and the metal with a higher electrical potential is called the cathode. The anode provides protection to the cathode, and in the process of providing this protection, the anode material is sacrificed.

When dissimilar metals are in contact, an electrical system called a bimetallic couple, as seen in ***Figure 2***, can form. The bimetallic couple creates a connection between the anode and cathode that causes a current to flow between the two, thereby protecting the cathode. If the connection was not present, the anode and the cathode would corrode at their natural rate based on the surrounding environment. There are four components of a bimetallic couple;the anode, the cathode, the electrolyte and a return path for the current. All four of these components are necessary for corrosion or sacrificial action to take place at the anode. An electrolyte can consist of any substance such as sea water or condensation that resides on the surface of the anode and cathode. Different electrolytes provide varying conductance of electrical current and will thus cause more or less corrosion depending on the degree of conductance. The return path for current is the connection of the dissimilar metals.

To prevent galvanic corrosion between dissimilar metals, the two metals of the bimetallic couple must be electrically isolated from each other.

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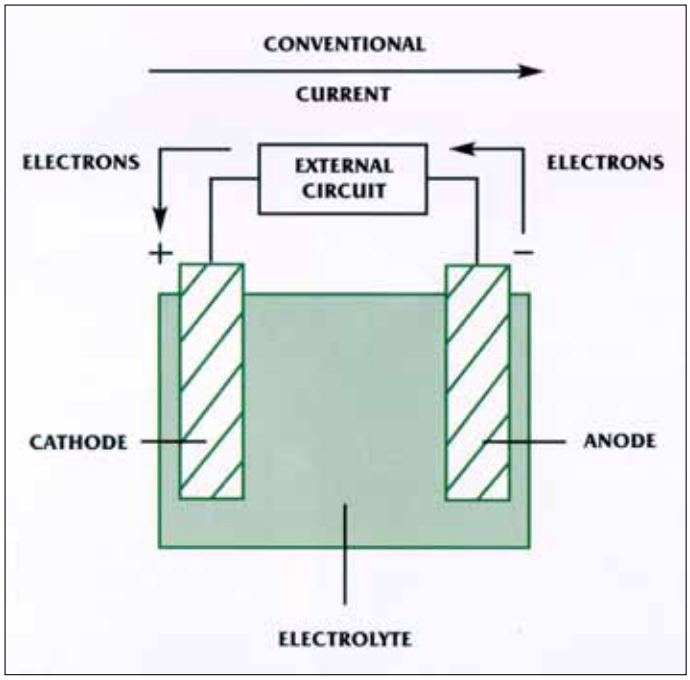

Figure 2: Bimetallic Couple

Figure 2 shows the four components necessary for corrosion or sacrificial action to take place at the anode.

Ask Dr. Galv: Dissimilar Metals

Since there will always be an anode and cathode if you have dissimilar metals (due to dissimilar electrical potentials), you can't eliminate those components of the bimetallic couple. Unless you can shield the external exposure of the dissimilar metals completely, you can not eliminate the possibility of getting an electrolyte on their surfaces. The one component you can isolate from the bimetallic couple is the return current path. This can be done by shielding the dissimilar metals from one another by placing a nonconducting material between them. This prevents the formation of a bimetallic couple by preventing current from flowing from one metal to the other.

Some common methods to isolate dissimilar metals include painting the surfaces or using gaskets. Common materials for gaskets include rubber, plastic or ceramics. The intended service life of the metals must be considered when choosing an isolation material. The service life of the isolation material must be chosen appropriately because if it disintegrates, the dissimilar metals could contact each other and create a bimetallic couple.

Shielding dissimilar metals from one another ensures your galvanized coating will function as designed and protect the base steel from corrosion for many years. Including isolation materials between dissimilar metals before a structure has been erected will save your customer money since he will not have to incur excessive costs to take apart the structure, apply the isolation material and then erect the structure again. Although informing your customer of this is not necessarily your responsibility, it will go a long way to keeping your customers happy.