

## QUESTION

**Why are zinc and steel deliberately in contact in a hot-dip galvanized system if having dissimilar metals in contact is not recommended?**

## ANSWER

The concern with having dissimilar metals in contact is the anodic metal will be consumed when electrons transfer from that material to the cathodic metal when there is a corrosion cell. This is considered galvanic corrosion, and over time it depletes the anodic metal. The hot-dip galvanized coating uses this property advantageously to protect the underlying steel.

If you consider a piece of galvanized steel when only the galvanized coating is exposed to the environment, the coating provides barrier protection to the underlying steel. When the galvanized coating is breached, whether by dissolution over time or when the galvanized coating is scratched down to the base steel, the surrounding galvanized coating will provide cathodic protection to the base steel. This is galvanic corrosion, however in this case it is good because the galvanized zinc coating is being depleted (corroded) rather than the base steel.

Now, if you consider a piece of galvanized steel connected to another dissimilar metal that is cathodic with respect to the galvanized coating (such as a galvanized bolt fastened with a carbon steel nut), when corrosion occurs the galvanized coating will once again be sacrificed in order to protect the cathodic metal. This situation is bad because now the galvanized coating is being depleted (corroded) for steel other than the base steel, which it was not designed to do. When that happens, the galvanized coating is consumed much quicker than expected, which shortens the service life of the coating. The galvanized coating is applied over steel to protect that steel, not the other non-coated steel that the galvanized steel happens to be in contact with.

There are some instances when zinc is electrically connected to dissimilar metals on purpose, such as on boats or on pipelines. In these cases, the zinc serves as an anode and provides cathodic protection to the steel.

### Arrangement of Metals in Galvanic Series

**CORRODED END:** Anodic or less noble  
(ELECTRONEGATIVE)

Magnesium  
Zinc  
Aluminum  
Steel  
Lead  
Tin  
Nickel  
Brass  
Bronzes  
Copper  
Stainless Steel (passive)  
Silver  
Gold  
Platinum

**PROTECTED END:** Cathodic or More Noble  
(ELECTROPOSITIVE)

*Cathodic Protection from Zinc*