WOUTER WITZEL VALVE TECHNOLOGY

White paper on galvanic corrosion on board of ships

Prevent galvanic corrosion in the shipbuilding industry

What is galvanic corrosion?

Corrosion is an electrochemical process involving the flow of electric current, corrosion can be generated by a galvanic effect which arises from the contact of dissimilar metals in an electrolyte (an electrolyte is an electrically conductive liquid).

In fact three conditions are required for galvanic corrosion to proceed; the two metals must be widely separated on the galvanic series (see Figure 1), they must be in electrical contact and their surfaces must be bridged by an electrically conducting fluid, such as seawater. Removal of any of these three conditions will prevent galvanic corrosion.

The obvious means of prevention is therefore to avoid mixed metal fabrications. Frequently this is not practical, but prevention can also be by removing the electrical contact - this can be achieved by the use of plastic or rubber washers or sleeves, or by ensuring the absence of the electrolyte such as by improvement to draining or by the use of protective hoods. This effect is also dependent upon the relative areas of the dissimilar metals. If the area of the less noble material (the anodic material, further towards the right in Figure 1) is large compared to that of the more noble (cathodic) the corrosive effect is greatly reduced, and may in fact become negligible. Conversely a large area of noble metal in contact with a small area of less noble will accelerate the galvanic corrosion rate. For example it is common practice to fasten aluminium sheets with stainless steel screws, but aluminium screws in a large area of stainless steel are likely to rapidly corrode.

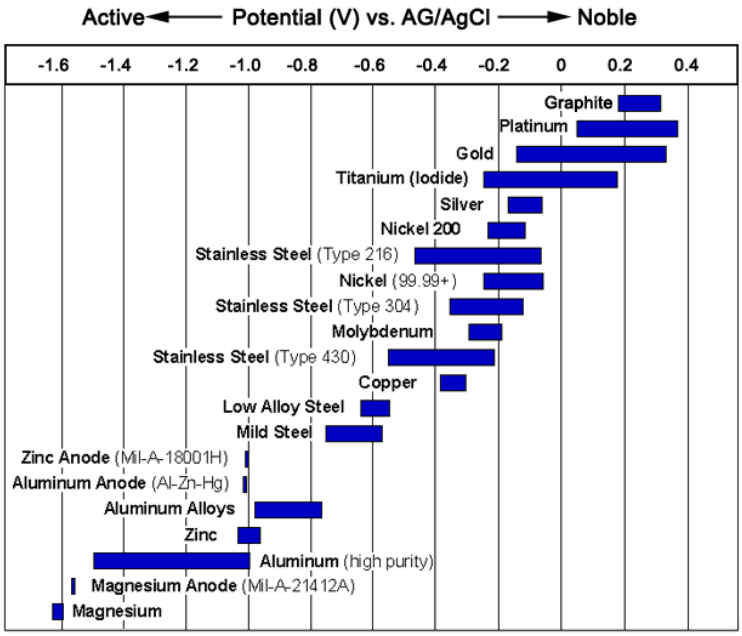

Figure 1: Galvanic Corrosion

Another example is black steel piping with a butterfly valve with Aluminium bronze disc. Black steel is the less noble material (anode) and will reduce the galvanic corrosion rate.

Wouter Witzel EuroValve B.V. · Industrieterrein De Pol 12 · 7581 CZ Losser · P.O. Box 54 · 7580 AB Losser · The Netherlands
T +31 53 53 69 536 · F +31 53 53 69 500 · E info@wouterwitzel.nl · www.wouterwitzel.nl

On the other hand a seawater cooling system with Epoxy piping, titanium cooler and butterfly valves with an aluminium bronze disc will cause galvanic corrosion. This combination has no large area of less noble material and the aluminium bronze is widely separated on the galvanic series compared to titanium.

With our many years of experience we recommend the following:
Cathodic protection uses one or more sacrificial anodes made of a metal which is more active than the protected metal. Metals commonly used for sacrificial anodes include zinc, magnesium, and aluminium. This is commonplace in water heaters. Failure to regularly replace sacrificial anodes in water heaters severely diminishes the lifetime of the tank. Water softeners tend to degrade these sacrificial anodes and tanks more quickly.

Choose metals that have similar potentials. The more closely matched the individual potentials, the lesser the potential difference and hence the lesser the galvanic current. Using the same metal for all construction is the most precise way of matching potentials.

This phenomenon occurs mainly in seawater cooling systems. Due to the fact that Wouter Witzel is always using higher grade stainless steel inserts (Duplex 1.4462 or 1.4517) for the rubberlined butterfly valves, the galvanic corrosion will be reduced to the minimum.

Figure 2: Example galvanic corroded disc