Technical Data

Galvanic corrosion

(Corrosion generated during contact between different metals)

When different metals come in contact and are in an electrically conductive fluid, the metal of lower voltage acts like the anode + (plus) and the higher voltage metal as the cathode – (minus) of a battery, and they constitute a "corrosion cell", with the plus side metal becoming ionized and dissolving (corroded). This type of corrosion is referred to as galvanic corrosion or electrochemical corrosion.

■Conditions conducive to galvanic corrosion (general environment)

1) Large difference in voltage
2) High temperatures and humidity, high acidity
3) The + side metal has small surface area
4) Salt particles exist in the atmosphere

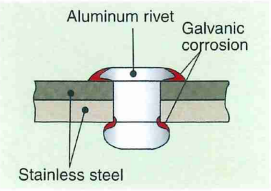
■Acceptable metal combinations

There are limits to acceptable combinations of metal as indicated in the table on page 16 of the MIL-STD-171A standard. Normally, it is desirable for different metals to have less than a 0.1 V difference.

Examples of galvanic corrosion in rivet joints

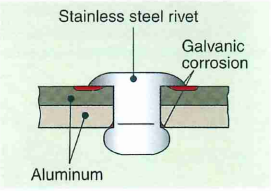
(1) Aluminum rivet and stainless steel material

The aluminum rivet will corrode considerably at the point of contact with the stainless steel material. This is an extremely inappropriate application.



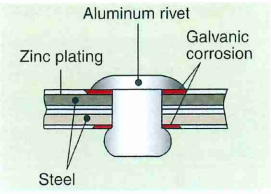
(2) Stainless steel rivet and aluminum material

The aluminum material will corrode at the point of contact with the stainless steel rivet. If, however, the surface area of that material is large, progress of the corrosion will be relatively slow, so this application may be acceptable depending upon environmental conditions.



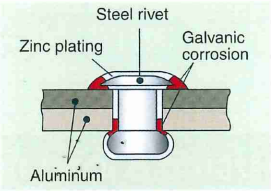
(3) Aluminum rivet and zinc-plated steel material

The zinc plating on the steel material will corrode at the point of contact with the aluminum rivet, and corrosion will then advance on the aluminum rivet. This is a relatively poor application, but may still be applicable for long-term use depending upon environmental conditions.



(4) Zinc-plated steel rivet and aluminum material

The zinc plating on the steel rivet will corrode at the point of contact with the base material, and corrosion will then advance on the aluminum material. However, that advance will be extremely minimal, so this application may be acceptable depending upon environmental conditions.



○The example combinations above apply to joining parts in outside installations, external parts on automobiles, boats, etc.
○In the case of general interiors or electric appliances, even these example combinations may be adequate.
Contact our company representative or technical support if you have any technical questions.

Measures against galvanic corrosion

●Select rivet of the same voltage or only slight difference in voltage from the base material.
●Coat (plating, etc.) the rivet or material with a metal that has the same or only slight difference in voltage from the remaining component.
●Insulate the rivets and base material overall with some type of coating (paint, etc.).
●Employ resin or other material as insulation between the metals (coating, push, etc.).
●Employ some other metal that possesses voltage between that of the two materials to act as insulation between those materials (plating, coating, push, etc.)
●Make sure the rivet has a higher voltage than the base material.

Acceptable metal combinations (as per MIL-STD-171A)

High voltage ↑ / Low voltage ↓

		Electrode potential(V)	Acceptable combinations
1	Ni, Ni plating, Ni-Cu-P (monel metal) Cu-Ni alloy, Ti Cu, Cu plating	-0.15	
2	Ni-Cr alloy Austenite stainless steel (SUS304, etc.)	-0.20	
3	Brass (C2600, etc.), bronze (C5101, etc.)	-0.25	
4	Brass (C2800, etc.), bronze (C5212, etc.)	-0.30	
5	18% stainless steel (SUS430, etc.)	-0.35	
6	Cr plating, 12% stainless steel (SUS410, etc.)	-0.45	
7	Sn plating, solder plating	-0.50	
8	Pb, Pb plating, high Pb alloy	-0.55	
9	Duralumin Al (A5000 series, 7000 series, etc.)	-0.60	
10	Carbon steel, low alloy steel	-0.70	
11	Al other than duralumin (A5000 series, etc.)	-0.75	
12	Al other than Si (A1000 series, etc.) Cd plating	-0.80	
13	Welded Zn plating	-1.05	
14	Zn diecast alloy Zn plating	-1.10	
15	Mg, Mg alloy	-1.60	

● : Negative charge ● : Positive charge – Metals connected by a line indicate acceptable combinations