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AEROSPACE RECOMMENDED PRACTICE

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ARP 1481

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CORROSION CONTROL AND ELECTRICAL CONDUCTIVITY IN ENCLOSURE DESIGN

1. INTRODUCTION

Corrosion control is always of concern to the designer of electronic enclosures. The use of EMI gaskets to provide shielding often creates requirements that are in conflict with ideal corrosion control. This ARP presents a compatibility table which has as its objective a listing of metallic couples that are compatible from a corrosion aspect and which still maintain a low contact impedance.

2. REFERENCES

- MIL-M-3171 - Magnesium Alloy, Processes for Corrosion Protection
- MIL-C-5541B - Chemical Conversion Coatings on Aluminum and Aluminum Alloys - June 30, 1970
- MIL-C-81706 - Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys - June 30, 1970
- MIL-STD-889 - Dissimilar Metals

3. BACKGROUND

The table of dissimilar materials has been developed through experience and testing in "use" atmospheres. No attempt was made to measure half-cell voltages of materials nor was any attempt made to develop an electromotive force series. Each couple on the table has been used successfully in design as indicated by the code letter which will be further explained. Successful usage means that each couple will remain, within measureable tolerance (10%), at the same electrical conductivity as the installed conductivity over long use periods. Corrosion which may occur will not degrade the couple structurally or electrically. MIL-STD-889 is designed to provide structural integrity. This table provides more restrictive control since corrosion will degrade electrical conductivity long before any structural damage occurs.

4. DEFINITIONS

- 4.1 MIL-C-5541 Class 1A and 3 - Chromate Conversion Coatings: The military specification controls the engineering requirements of these coatings. Class 1A is intended as a base for painting, while Class 3 is a controlled surface resistivity. Chemical materials for applying the coatings are contained in the qualified parts list (QPL) of MIL-C-81706.
- 4.2 Corrosion Free Couple: A corrosion free couple is one that will maintain an impedance less than 2.5 milliohms/square at 1.4kg/cm² (200 psi).

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LEGEND/NOTES

- A - COMPATIBLE
- B - REQUIRES SEALING ONLY IF EXPOSED TO SALT ATMOSPHERE OR HIGH HUMIDITY. EDGE PRIMING MAY BE SATISFACTORY
- C - REQUIRES SEALING IF EXPOSED TO HUMID ENVIRONMENT
- D - COMPATIBLE IN ENVIRONMENT OF CONTROLLED TEMPERATURE AND HUMIDITY ONLY
- E - REQUIRES SEALING REGARDLESS OF EXPOSURE
- F - BECAUSE OF THE INHERENT CORRODABILITY OF THE MATERIAL, THE COUPLE SHOULD NOT BE USED OR MUST BE SEALED.
- X - NOT USABLE
- ① REQUIRES 25.8 CM² AT 1.4 KG/CM² (4 IN² AT 200PSI)
- ② NORMALLY PLATED WITH CADMIUM OR TIN
- ③ BASED ON OPEN FLANGE DESIGN, IF MATERIAL IS IN A CAPTIVE (SELF-SEALING) CONFIGURATION, THE CATEGORY MOVES UP AS MUCH AS TWO STEPS.
- ④ THE GASKET MATERIALS MAY TAKE VARIOUS MANUFACTURED SHAPES AND CONFIGURATIONS, BUT ARE LISTED HERE BASED ONLY ON THEIR MATERIAL CONTENT.

MATERIAL FINISH	
ALUMINUM CLAD 1000, 3,000, 5,000, 6,000 SERIES CASTING 356	NONE MIL-C-5541, CLASS 1A MIL-C-5541, CLASS 3 ELECTROLESS NICKEL CADMIUM PLATED, BARE CADMIUM, COLORED CHROMATE CADMIUM, CLEAR CHROMATE CHROMIUM
ALUMINUM 2,000, 7,000 SERIES	MIL-C-5541, CLASS 1A MIL-C-5541, CLASS 1A ELECTROLESS NICKEL CADMIUM, BARE CADMIUM, COLORED CHROMATE CADMIUM, CLEAR CHROMATE CHROMIUM TIN
CARBON AND ALLOY STEEL AISI-410	CADMIUM, BARE CADMIUM, COLORED CHROMATE CADMIUM, CLEAR CHROMATE NICKEL ELECTROLESS NICKEL CHROMIUM TIN LEAD SILVER
CORROSION RESISTANT STEELS HIGH NICKEL AND PH STEELS	PASSIVATED CADMIUM (PASSIVATED) TIN PASSIVATED CADMIUM (PASSIVATED) TIN
COPPER ALLOYS	TIN SILVER GOLD SOLDER (LEAD-TIN)
GASKETS ③	ALUMINUM TIN PLATED MONEL SILVER ELASTOMER ③ STAINLESS STEEL ② BERYLLIUM COPPER ②
MISCELLANEOUS	SILVER PAINT ① ZINC PAINT ① SILVER ADHESIVE CARBON ADHESIVE
TITANIUM	NONE NICKEL

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