

# AEROSPACE RECOMMENDED PRACTICE

**SAE** ARP1481

REV. A

Issued Revised Reaffirmed 1978-05 1998-09 2004-08

Supersedes ARP1481

Corrosion Control and Electrical Conductivity in Enclosure Design

1. SCOPE:

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 SAE Aerospace Recommended Practice (ARP) presents a compatibility table (see Figure 1) 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:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-M-3171

Magnesium Alloy, Processes for Corosion 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

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, man	NICKEL	0 4 0 4 4 4 4 0 0 4 0 4 4 4 4 4 4 4 4 4
MUINATIT	NONE	00004440000444440004040040404040404040
	CARBON ADHESIVE	
	ZINC PAINT TO SILVER ADHESIVE	4 4 4 0 4 4 0 4 4 0 4 4 0 0 4 4 4 0 0 4 0 0 4 0
MISCELLANEOUS	SILVER PAINT	
	BEBALLIUM COPPER	
	STAINLESS STEEL	UUUUUU A A OU A O A A A A U A A A A A A
	SILVER ELASTOMER 3	
	MONEL	P O O O O D Y D Y D Y D Y D Y D Y D Y D Y
<b>⊘</b>	TIN PLATED	
GASKETS	ALUMINUM	44044444004444400440×04444×4444040××000
	SOLDER (LEAD-TIN)	0000444440044444440044400444444444
	eorb	×××<<<00<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0<<0><0>
	SILVER	×××<<×0040××<004×=0040×=0=4×=00<
COPPER ALLOYS	NIT	
	NIT	
AND PH STEELS	CADMIUM (PASSIVATED)	
HIGH NICKET	DASSIVATED	
RESISTANT STEELS	CADMIUM (PASSIVATED) TIN	4440044044044404044000044444444444000000
CORROSION	PASSIVATED/	
Notsoddos	SILVER	X > X > D > D X > X C D > D D D D D Y D D X D X D X D X D X D X D
	CH VED	
	NIT	444044444444444444444444444444444444444
	снвомілм	444044444040440444444444444444444444444
	ELECTROLESS NICKEL	04040404040004004040044004000404000880
0f4-I2IA	NICKEL	
	CADMIUM, CLEAR CHROMATE	
ALLOY STEEL	CADMIUM, COLORED CHROMATE	44444404444444444440040040U4440U4440U4
CARBON AND	CADMIUM, BARE	0440r440460r44000004x0040044xx4400000x4xx4
	NIT	44404444444444444444444444444444
	снвомілм	444444444444444444444444444444444444444
	CADMIUM, CLEAR CHROMATE	
	CADMIUM, COLORED CHROMATE	
SEBIES	CADMIUM, BARE	
2000, 7000	MIL-C-5541, CLASS 3 ELECTROLESS NICKEL	
ALUMINUM ALUMINUM	MIL-C-5541, CLASS 1A	444444444444444444444444444444444444444
	CHROMIUM	**************************************
	CADMIUM, CLEAR CHROMATE	888 PCC PCC PP P P P P P P P P P P P P P
j	САВМІОМ, СОГОВЕВ СНВОМАТЕ	A A A A A A A A A A A A A A A A A A A
CASTING 356	38A8 .D3TAJ4 MUIQAJ	
e000 SEBIES	EFECTBOLESS NICKEL	D < D < D < A D < A D < A D O < D < A < A D U < A D U U < A D D < A C D O O O O O O O O
3000, 5000.	MIL-C-5641, CLASS 3	
CLAD, 1000,	MIL-C-5541, CLASS 1A	
MUMIMUJA	NONE	
	SA TOME	MIL-C.5641.CLASS 1A MIL-C.
		ALUMINUM NG CCLAD, 1000, MM CCELLANEOUS SERIES CASTING 386 CG

FIGURE 1

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### LEGEND/NOTES

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

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# 2.2 Definitions:

- 2.2.1 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.
- 2.2.2 CORROSION FREE COUPLE: A corrosion free couple is one that will maintain an impedance less than 2.5 m $\Omega^2$  at 1.4 kg/cm $^2$  (200 psi).
- 2.2.3 TABLE SYMBOLS: The following is a more complete definition of the symbols used in the table:
  - a. The couple is completely compatible and will function without further care.
  - b. Couple should be sealed only if exposed to salt environment.
  - c. If the couple is exposed for over 10% of its life-time to atmospheres above 85% relative humidity (RH), the exposed edges of the couple should be sealed with sealing compound or primers. If expsoures are less than 10% of the life at 85% RH, the couple may be considered as category B.
  - d. The couple is compatible and will function without further care if the use environment is generally below 85% relative humidity (RH) and use temperature below 160 °F (71 °C). If exposure exceeds these limits, the couple should be sealed.
  - e. Couple is sufficiently corrodible to require sealing at all times.
  - f. Material is inherently corrodible and the corrosion product will cause loss of couple conductivity.

# 2.2.4 EXPLANATIONS:

- 2.2.4.1 Increase in Corrosion: This table is about dissimilar materials. Some materials, by themselves, will corrode in a given environment. If corrosion will not increase because of the presence of the other element, it is listed as acceptable in this table.
- 2.2.4.2 Material Recommendations: It should be mentioned that the table in no way endorses the use of a specific material or finish in shielding design beyond that which the inherent physical properties of the materials themselves merit.
- 2.2.4.3 Use of Magnesium: It is recognized that magnesium is used in a number of applications. It is so corrodible that the only finish that has been found to be satisfactory is a minimum of 1 mil tin plate or reflow tin. In completely controlled environments, MIL-M-3171 Type 3 chemical coatings may be used. However, the initial resistance will be higher than tin and may increase with time.