SAE Aerospace
An SAE International Group

AEROSPACE INFORMATION REPORT

SAE AIR4160 | REV. A

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Superseding AIR4160

Alternatives to Cadmium Plating

RATIONALE

AIR4160A has been reaffirmed to comply with the SAE five-year review policy.

FOREWORD

Changes to this Revision are format/editorial only.

INTRODUCTION

Due to the unique properties of cadmium, there does not appear to be a substitute material that provides the same advantages and corrosion protection. However, a number of alternative surface treatments are available. Each has relative merit as compared to cadmium.

The data found in Table 1 are intended as a guide and do not necessarily include all possible surface treatments or processes. Each treatment is compared to cadmium and rated according to the criteria below:

Ratings:

A = Equal to or more desirable than cadmium
B = Slightly less desirable than cadmium (specific material selections and applications should be investigated)
C = Significantly less desirable than cadmium
D = Property is not applicable

1. SCOPE:

To document and provide access to information obtained by an industry survey.

1.1 Purpose:

1.1.1 The purpose of this information report is to summarize and document data regarding possible alternatives to the use of cadmium plating on hardware typical of the aerospace hose and fitting industry.

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2. REFERENCES:

LaQue and Copson, Corrosion Resistance of Metals and Alloys,
Second Edition ACS Monograph Series No. 158,
(Reinhold Publishing Company, 1965), p 230.

Uhlig Corrosion Handbook,
Sponsored by the Electrochemical Society,
(John Wiley and Sons Inc., 1948), p 814.

"Plating and Surface Finishing",
Journal of American Electroplaters and Surface Finishers Society,
(April 1987) Column: "Finishers Think Tank", p 10.

3. ZINC:

3.1 There is evidence that zinc coatings at 150 °F and higher reverse their roll in the galvanic circuit and become cathodic. That is, instead of being sacrificial, zinc becomes noble and the steel corrodes. See Section 2 for references on the phenomenon.

3.2 The use of zinc coatings, particularly at elevated temperatures, may cause corrosion. Users of this information document are cautioned to consider the environment temperature when considering this material.

PREPARED BY SAE COMMITTEE G-3,
AEROSPACE COUPLINGS, FITTINGS, HOSE AND TUBING ASSEMBLIES

TABLE 1 - Comparison Chart

Property	(Pure) Zinc	(Pure) Aluminum	MIL-C-81751 Aluminum Ceramic	Electroless Nickel 0.0003 to 0.0005 Thick	Tin-Zinc Alloy
Corrosion Resistant Marine Environment	C	A	A	C	B
Corrosion Resistant Industrial Environment	A	A	A	B	A
Galvanic Protection of Steel	A	A	A	D	A
Dimensional Control	A	A	A	A	A
Lubricants 0.0003-0.0005 thick (torque tension)	C	C	A	C	A
Lubricant (Heavy Load)	B	C	C	A	B
Compatibility with Aluminum	B	A	A	C	B
Temperature Resistance	A	A	A	A	A
Reliability (Threads, etc.)	A	A	A	A	B
Solderability	B	C	C	A	A
Process Hydrogen Embrittlement	A	A	A	A	A
Adhesive Bonding	B	A	B	A	B
Painting	A	A	A	A	B
Contact Resistance	B	A	C	B	B
Freon Cleaning Compatibility	D	A	A	A	D