

SAE-ARP1511

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AEROSPACE RECOMMENDED PRACTICE

ARP 1511A

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CORROSION OF LOW-EMBRITTLING CADMIUM PLATE

BY

AIRCRAFT MAINTENANCE CHEMICALS

1. SCOPE: This recommended practice defines a procedure for evaluating, by quantitative measurement of weight change, the corrosive effects of aircraft maintenance chemicals on low-embrittling cadmium plate used on aircraft high-strength steels under conditions of total immersion.

2. APPLICABLE DOCUMENTS:

2.1 Aerospace Material Specifications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

AMS 6350 - Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C)
(SAE 4130)

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D1193 - Reagent Water

2.3 U.S. Military Specifications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

MIL-S-18729 - Steel Plate, Sheet, and Strip, Alloy 4130, Aircraft Quality

3. APPARATUS:

3.1 A wide-mouth, sealable, glass jar or stoppered flask having a capacity so chosen that specimens will remain fully immersed in a vertical position during the test and the ratio of area of immersed metal to the volume of solution will be as specified in 7.1.

3.1.1 Some aircraft maintenance chemicals, when heated, have high vapor pressures or may produce gases during testing. Suitable precautions should be taken to prevent the containing vessel from exploding or the vessel should be so chosen as to withstand the resulting pressures.

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3.2 Constant Temperature Device: Any suitable regulated heating device (mantle, hot plate, or both) may be employed for maintaining the solution at the required temperature.

4. SAFETY PRECAUTIONS:

4.1 The solvents used in cleaning test specimens are flammable and harmful if inhaled. Keep away from sparks and open flames. Avoid breathing vapors and prolonged or repeated contact with skin. Use with adequate ventilation.

4.2 The materials used for aircraft maintenance may contain flammable solvents, acids, alkalis, or other toxic compounds. Suitable precautions should be taken to prevent personnel injury.

5. TEST SPECIMENS: Shall be made from low-alloy steel conforming to AMS 6350 or to MIL-S-18729, Condition N; shall be 0.048 x 1 x 2 in. (1.20 x 25 x 50 mm); and shall be cadmium plated as in 5.1 to a thickness of 0.0005 - 0.0007 in. (12.5 - 17.5 μ m). Three replicates shall be prepared for testing each concentration of maintenance chemicals solutions specified in 7.2.

5.1 Cadmium Plating of Test Specimens:

5.1.1 Degrease the test specimens followed by abrasive blasting with No. 180 $\emptyset$ aluminum-oxide grit. Rinse the specimens free of abrasive using reagent water conforming to ASTM D1193, Type III.

5.1.2 Without drying, plate the specimens for approximately 3 - 4 min. at a current rating of 60 amp per sq ft $\pm$ 5 (645 A/m² $\pm$ 55) in the following low-embrittlement cadmium cyanide bath to provide a plate thickness of 0.0005 - 0.0007 in. (12.5 - 17.5 μ m):

Cadmium (as CdO)	4.5 oz/gal (35 g/L)
Total Sodium Cyanide (NaCN)	14 oz/gal (105 g/L)
Sodium Carbonate (Na ₂ CO ₃)	2 oz/gal (15 g/L)
Ratio NaCN to CdO	3.1:1 -
pH	12
Temperature	24°C $\pm$ 2 (75°F $\pm$ 4)
Free Caustic (NaOH)	2.5 oz/gal (20 g/L)

5.1.3 Rinse plated specimens in cold, running, tap water. Rinse with a stream of hot distilled or deionized water. Dry specimens for 60 min. $\pm$ 5 at 110°C $\pm$ 2 (230°F $\pm$ 4). Ensure that the test specimens are neutral and do not contain caustic or cyanide residues.

5.1.3.1 Cyanides are very toxic and corrosive to skin. Suitable precautions in the handling and use of cyanides should be taken to avoid personnel injury. Use with adequate ventilation and keep away from acids.

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6. PRECLEANING TEST SPECIMENS:

- 6.1 Using a stiff non-metallic brush, clean off loose cadmium plate. Immerse the test specimens in a beaker of 1, 1, 1, trichloroethane maintained at $65^{\circ}\text{C} \pm 3$ ($150^{\circ}\text{F} \pm 5$) and swab the surfaces of each individual specimen thoroughly using clean forceps to hold the test specimen and the cotton swab.
- 6.2 Shake off excess solvent. Transfer and immerse the test specimens separately several times in a beaker of methyl ethyl ketone.
- 6.3 Shake off excess methyl ethyl ketone and dry in an oven at $110^{\circ}\text{C} \pm 2$ ($230^{\circ}\text{F} \pm 4$) for 60 min. ± 5 .

7. TEST CONDITIONS:

- 7.1 Ratio of Area of Immersed Metal to Volume of Solution: Shall be 25 mL of solution per sq in. (6.45 cm^2) of specimen surface.
- 7.2 Solution Concentration:
- 7.2.1 Test the specimen in solutions of the maintenance chemicals in the
Ø concentrated as-received condition and at the recommended use dilution using reagent water conforming to ASTM D1193, Type III, to dilute the maintenance chemicals under test, unless otherwise specified.
- 7.2.1.1 For solid materials, concentrated condition shall mean in a saturated solution of the solid material.
- 7.2.1.2 In case the material is not soluble at the recommended dilution, record this fact and continue with the test.
- 7.2.2 If water is not used as the diluent, record the type and specification of diluent used in the test.
- 7.3 Temperature: Shall be $35^{\circ}\text{C} \pm 1$ ($95^{\circ}\text{F} \pm 2$), unless otherwise specified.
- 7.4 Test Duration: Shall be 24 hr ± 0.25 , unless otherwise specified.

8. TEST PROCEDURE:

- 8.1 Using clean forceps to handle the specimen, weigh the cleaned, dry, test specimen to the nearest 0.1 milligram.
- 8.2 Transfer the specimens to the vessel containing the preheated maintenance chemical solution. Maintain at the required temperature and expose for 24 hr ± 0.25 .
- 8.2.1 No other material which might influence corrosion of the specimen shall contact the specimen during the test.