



Standard Test Method for Stress-Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials¹

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INTRODUCTION

Chemical solutions and compounds used for preinspection cleaning or for preservation of titanium alloy aircraft turbine engine parts shall be subject to qualification requirements of this test method.

1. Scope

1.1 This test method establishes a test procedure for determining the propensity of aircraft turbine engine cleaning and maintenance materials for causing stress corrosion cracking of titanium alloy parts.

1.2 The evaluation is conducted on representative titanium alloys by determining the effect of contact with cleaning and maintenance materials on tendency of prestressed titanium alloys to crack when subsequently heated to elevated temperatures.

1.3 Test conditions are based upon manufacturer's maximum recommended operating solution concentration.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see 5.3 and 5.5.

2. Referenced Documents

2.1 ASTM Standards:

D 740 Specification for Methyl Ethyl Ketone²

D 841 Specification for Nitration Grade Toluene²

D 1193 Specification for Reagent Water³

2.2 SAE Aerospace Material Specifications:

AMS 4911 Sheet, Strip and Plate-6AL-4V Annealed⁴

AMS 4916 Sheet, Strip, and Plate-8AL 1MO 1V, Duplex Annealed⁴

3. Significance and Use

3.1 Because of the tendency of prestressed titanium alloy

parts to crack if heated while in contact with certain chemical reagents, it is necessary to ensure that cleaning and maintenance materials will not initiate stress corrosion of titanium alloys under controlled conditions.

4. Apparatus

4.1 *Measuring Device* capable of linear measurement with a ± 0.01 -in. (± 0.25 -mm) tolerance.

4.2 *Press Forming Apparatus*⁵ with 0.56-in. (14-mm) diameter mandrel capable of producing approximately 65° bends in 0.050-in. (1.25-mm) titanium alloy sheet specimens.

4.3 *Beakers or Small Tanks* for containment of cleaning, rinsing, and test solutions, appropriately lined to prevent contamination of the solutions by container materials.

4.4 *Vise*,⁶ capable of precise manipulation at jaw opening of 0.65 in. (16.5 mm).

4.5 *Air Circulation Furnace*⁷ capable of operating at 900°F (480°C) with control to $\pm 20^\circ\text{F}$ (10°C).

4.6 *Magnifier*⁸ capable of 20-diameters magnification.

4.7 *Microscope*⁹ capable of 500-diameters magnification.

4.8 *Bolt*, stainless steel, 0.25-in. (6-mm) diameter with stainless steel washers and nut.

4.9 *Test Specimens, AMS 4911 and AMS 4916 Titanium Alloys*—with specimens prepared from the same sheet stock for each alloy and cut parallel to the rolling direction to the dimensions of Fig. 1. The specimen edges shall not be deburred or otherwise relieved before testing.

4.10 *Cotton Gloves*, white.

5. Reagents and Materials

5.1 *Purity of Reagent*—Reagent grade chemicals shall be

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² *Annual Book of ASTM Standards*, Vol 06.04.

³ *Annual Book of ASTM Standards*, Vol 11.01.

⁴ Available from Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096.

⁵ A laboratory bench hydraulic press ENER PAC Model No. P-39 manufactured by Black Hawk Industrial Products, Butler, WI, has been found satisfactory.

⁶ A standard sheet metal worker's vise with a 3-in. jaw has been found satisfactory.

⁷ A Blue M Electric Co. POM-6680F-1 furnace has been found satisfactory.

⁸ A Bausch and Lomb Stereo Zoom 4 Model KVB-73 has been found satisfactory.

⁹ A Bausch and Lomb Micro Zoom Catalog No. 31-19-30-02 has been found satisfactory.