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Standard Practice for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This practice covers the determination of the corrosiveness of aircraft maintenance chemicals on aircraft metals with time under conditions of total immersion by a combination of weight change measurements and visual qualitative determination of change.

1.2 The values stated in SI units are to be regarded as standard. The values in parentheses are for information only.

1.3 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

D329 Specification for Acetone

D1193 Specification for Reagent Water

E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

3. Significance and Use

3.1 Many aircraft maintenance chemicals are used on components and structures which would be adversely affected by excessive dimensional change. This practice screens these chemicals to ensure compliance with specified weight change criteria.

¹ This practice is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.07 on Qualification Testing of Aircraft Cleaning Materials.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Apparatus

4.1 *Wide-Mouth Sealable Glass Jar or Stoppered Flask of Suitable Size*—The glass jar or flask should be so chosen so that the specimens will remain fully immersed in a vertical position during testing and the ratio of area of immersed metal to volume of solution will be in accordance with 8.1.

4.1.1 **Warning**—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 pressure.

4.2 *Specimen-Supporting Device*—A glass or fluorocarbon plastic supporting system designed to keep the specimen fully immersed while ensuring free contact with the solution, and designed to isolate the specimens from each other physically.

4.3 For materials containing low boiling point solvents, a means of preventing evaporation losses shall be used.

4.4 *Constant-Temperature Device*—Any suitable regulated heating device (mantle, hot plate, or bath) may be used to maintain the solution at the required temperature.

4.5 *Thermometer*, having a range from 95 to 155°C (203 to 311°F) and conforming to requirements for Thermometers S67C or S67F in accordance with Specification E2251.

4.6 *Oven*, low temperature explosion-proof, capable of maintaining $38 \pm 3^\circ\text{C}$ ($100 \pm 5^\circ\text{F}$) through $120 \pm 5^\circ\text{C}$ ($248 \pm 5^\circ\text{F}$).

5. Reagents and Materials

5.1 *Acetone*—conforming to Specification D329.

5.2 *Methyl n-Propyl Ketone (MPK)*³.

5.3 *Mineral Spirits, Type II*—conforming to Specification D235.

³ The sole source of supply of Methyl n-propyl ketone (MPK) known to the committee at this time is Eastman Chemical Company, Kingsport, TN, USA. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

6. Test Specimens

6.1 Take test specimens of a given alloy from the same sheet stock, which shall be in new or like-new condition, and measure 50.8 by 25.4 by 1.6 mm (2 by 1 by 0.06 in.) with a 3.2-mm (0.125-in.) diameter mounting hole suitably located at one end of the specimen. Test three replicate specimens in each concentration of maintenance chemical solution in accordance with 8.2.1. Take the total area of the specimen as 28.2 cm² (4.4 in.²).

6.1.1 Identify each panel with Numbers 1, 2, 3, or 4.

7. Precleaning Test Specimens

7.1 Immerse the test specimens in a beaker of mineral spirits, Type II, conforming to Specification D235 at room temperature and swab the surface of the individual specimen thoroughly using clean forceps to hold the test specimen and the cotton swab.

7.2 Shake off excess solvent. Transfer and immerse the test specimens separately several times in a beaker of methyl n-propyl ketone.

7.3 Shake off excess methyl n-propyl ketone and dry in a vacuum desiccator or in a low-temperature oven at 120 ± 5°C (248 ± 5°F) for 15 min. (If oven dried, remove to desiccator and cool to ambient.)

8. Conditioning

8.1 *Ratio of Area of Immersed Metal to Volume of Solution*—The ratio of area of immersed metal to volume of solution shall be 8 mL per cm². Use fresh solution for each set of replicates.

8.2 *Solution Concentration*:

8.2.1 Unless otherwise specified, test the specimens in solutions of the maintenance chemical in the concentrated as-received condition and at the recommended use dilution using water that conforms to Specification D1193, Type IV. In case the maintenance chemical is not soluble to the extent noted, record this fact and continue with the test.

8.2.2 If water is not used as the diluent, record the type and specification of diluent used in the test.

8.3 *Temperature*—Unless otherwise specified, the test temperature shall be 38 ± 3°C (100 ± 5°F).

9. Procedure

9.1 Weigh three of four specimens of the same alloy to the nearest 0.1 mg.

9.2 Immerse three weighed specimens of each alloy in the test solution at the prescribed temperature. Place only specimens of the same alloy in the containing vessel. Maintain at the required temperature for the prescribed exposure period. Retain the fourth specimen of each alloy for comparison purposes.

9.3 At the end of 24 h, remove the test specimens and proceed as follows:

9.3.1 Rinse thoroughly under hot tap water, 49 to 60°C (120 to 140°F). Follow with a rinse in water conforming to Specification D1193, Type IV at room temperature.

9.3.2 Rinse with a stream of acetone, conforming to Specification D329, from a wash bottle and oven dry at 120°C (250°F), desiccate until cooled to ambient, weigh and record.

9.3.3 Then examine for and record on a form as illustrated in Appendix X1 in the 24-h column the following visible changes in comparison with the fourth virgin specimen of each alloy.

9.3.3.1 Discoloration and dulling,

9.3.3.2 Etching,

9.3.3.3 Presence of accretions and relative amounts,

9.3.3.4 Pitting, and

9.3.3.5 Presence of selective or localized attack.

9.4 Immerse the panels in the same test solution for a further 144 h, then repeat 9.3.1-9.3.3.5.

9.5 Reweigh specimens to nearest 0.1 mg, calculate weight loss or gain, and record in 168-h column.

10. Report

10.1 Report the data for each test performed on a form as illustrated in Appendix X1.

11. Keywords

11.1 in concentrate; in use dilution; maintenance chemicals; temperature control; time control; total immersion corrosion; visual corrosive deterioration; weight change criteria

APPENDIX

X1. RECOMMENDED REPORT FORM

X1.1 Report test results on a form as illustrated in Fig. X1.1.