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Standard Test Method for Sandwich Corrosion Test[1]

This standard is issued under the fixed designation F 1110; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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

1. Scope

1.1 This test method defines the procedure for evaluating the corrosivity of aircraft maintenance chemicals, when present between faying surfaces (sandwich) of aluminum alloys commonly used for aircraft structures. This test method is intended to be used in the qualification and approval of compounds employed in aircraft maintenance operations.

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

1.3 *This standard may involve hazardous materials, operations, and equipment. 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.* Specific hazard statements appear in Section 9.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 1193 Specification for Reagent Water

D 1748 Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet

G 46 Guide for Examination and Evaluation of Pitting Corrosion

2.2 *Industry Standards:*[3]

SAE-AMS-QQ-A-250/4 Al Alloy 2024, Plate and Sheet

SAE-AMS-QQ-A-250/5 Al Alloy Alclad 2024, Plate and Sheet

SAE-AMS-QQ-A-250/12 Al Alloy 7075, Plate and Sheet

SAE-AMS-QQ-A-250/13 Al Alloy Alclad 7075, Plate and Sheet

2.3 *Military Specification:*

MIL-A-8625 Anodic Coatings for Aluminum and Al Alloys[4]

3. Terminology

3.1 *Definition of Term Specific to This Standard:*

3.1.1 *sandwich corrosion test*—a comparative accelerated environmental test of the corrosivity of liquid or solid materials present between faying surfaces of structural aluminum alloys commonly used in aerospace construction.

4. Summary of Test Method

4.1 Aluminum coupons having clad or anodized nonclad surfaces are sandwiched together with a filter paper saturated with the test material between the coupons. The sandwiched coupons are cycled between warm ambient air and warm humid air for 7 days. The coupons are then inspected to determine whether corrosion more severe than that caused by reagent water has occurred on the surfaces exposed to the test material. This test method is used for solutions of dry granular material or for liquid materials.

5. Significance and Use

5.1 The data generated by this test method shall be used to determine whether aircraft structural aluminum alloys are liable to be corroded or damaged by application of the test material during routine maintenance operations.

5.2 Interpretation of the sandwich corrosion test results is based on a comparison of the appearance of faying surfaces of three

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[1] This test method 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.

[3] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

[4] Available from Department of Defense Single Stock Point (DODSSP); http://dodssp.daps.dla.mil

sets of coupons. One set of test coupons is exposed with reagent water only in the faying surfaces, to establish the baseline (controls) against which the panels exposed to the test material are compared. Disregard corrosion at cut edges of the test coupons.

5.3 The relative corrosion severity rating system is provided in order to allow a numerical classification of the test results and to eliminate the necessity for elaborate weight loss measurements. Pitting corrosion, which is rated 4—extensive (severe) corrosion, may involve only a negligible weight loss.

5.4 Relative corrosion severity rating system:

Appearance/Corrosion:
0—No visible corrosion and no discoloration present
1—Very slight corrosion or very slight discoloration, and/or up to 5 % of area[A] corroded
2—Discoloration and/or up to 10 % of area[A] corroded
3—Discoloration and/or up to 25 % of area[A] corroded
4—Discoloration and/or more than 25 % of area[A] corroded, and/or pitting present

[A] "Area" refers to area under the filter paper, or if no filter paper is used, the area where the test material was applied.

6. Interferences

6.1 It is possible that tap water containing large amounts of dissolved solids, especially chlorides, will cause relative severe corrosion of the aluminum control panels. For this reason, reagent water is specified. For comparative purposes, a set of aluminum test panels, with the locally available tap water applied to the filter paper, is sometimes run along with the reagent water panels.

6.2 Filter paper made from glass fibers is not recommended since, in practice, corrosion of the control panels has often been found.

7. Apparatus

7.1 *Humidity Test Cabinet*, as specified in Test Method D 1748 or equal, capable of maintaining 95 to 100 % relative humidity at 37.7 ± 1°C (100 ± 2°F).

7.2 *Oven*, forced air circulation, capable of maintaining 37.7 ± 1°C (100 ± 2°F).

7.3 *Microscope*, binocular, 10× to 40×.

8. Reagents and Materials

8.1 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Specification D 1193, Type IV.

8.2 *Aluminum Alloy Coupons*:

8.2.1 Aluminum alloy coupons shall conform to the following industry standards:
SAE-AMS-QQ-A-250/4, 2024-T3 nonclad
SAE-AMS-QQ-A-250/5, 2024-T3 Alclad
SAE-AMS-QQ-A-250/12, 7075-T6 nonclad
SAE-AMS-QQ-A-250/13, 7075-T6 Alclad

8.2.2 *Coupon Size*—The recommended coupon size 50 by 100 by 1.0 to 1.5 mm (2 by 4 by 0.04 to 0.06 in.) has been found to provide suitable results for comparative tests. Smaller sizes are not recommended, because of the increased variations due to edge effects. Larger coupons are acceptable, but the space requirements for testing and storage shall be taken in consideration.

8.3 ~~Anodize~~Unless otherwise specified, anodize the nonclad coupons in accordance with Military Specification MIL-A-8625, Type 1 (Chromic Acid) followed by a hot water seal.

8.4 *Filter Paper*—Use Whatman No. 5 or equal filter paper made from cellulose, 11 or 13 cm. Filter paper is not required when the material being tested is a solid. In case no filter paper is used, the area covered by the test material shall also be approximately 25 by 75 mm (1 by 3 in.).

9. Hazards

9.1 The materials used for aircraft maintenance sometimes contain flammable solvents, strong acids or alkalis, or other toxic compounds. Take suitable precautions to prevent personal injury from these hazards. When the composition of the test material is not known, consult the manufacturer to determine whether any hazards exist.

9.2 Exercise special care in handling the chromic acid solution, specified in 8.3, for its etching properties.

10. Sampling

10.1 Agitate or thoroughly mix the test material to assure uniformity. Where dilution of the material is required, use reagent water or the solvent specified by the product manufacturer. Apply sufficient test material to saturate the area between the metal coupons.

11. Test Specimen

11.1 Prepare three sets of test panels. A test panel set shall consist of eight individual test coupons, sandwiched together in pairs of coupons of the same alloy and the same surface treatment, to provide four test coupon sandwiches for each test condition. Identify each coupon by impression stamping or other suitable permanent method.

11.2 Clean the panels by solvent wiping, or vapor degreasing. Do not use acid or caustic cleaners. Remove ink stamped markings from the panels. Do not use abrasive materials to clean the panels.

11.3 Prepare the test panel sets as follows for each alloy: