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Standard Test Method of Aerated Total Immersion Corrosion Test for Metal Cleaners¹

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1. Scope

1.1 This test method covers the means of determining the corrosive effects of "metal cleaners for use in mechanical equipment," on all metals other than aluminum and its alloys, under conditions of aeration and total immersion, by quantitative measurement of weight change or by qualitative visual determination of change. The test is designed for the determination of the effects of the cleaner on metals being cleaned and is not for determination of the life of the cleaner or of the containing equipment.

1.2 When the test is used to assist in the choice of material for a specific use, the test conditions should simulate the conditions of use as closely as practicable.

1.3 Where no further processing subsequent to cleaning is indicated, a test for the effect of residual cleaner on the corrosion behavior of the material may be required.

1.4 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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. Material Safety Data Sheets are available for reagents and materials. Review them for hazards prior to usage.

2. Referenced Document dards/astm/5d7da659-8acd-4ef

2.1 ASTM Standard:

D 1280 Method of Total Immersion Corrosion Test for Soak Tank Metal Cleaners²

3. Apparatus

3.1 Test Tubes fitted with a sintered-glass diffusion disk at the bottom, connected to a tubulation, for the purpose of saturating the solutions under test with air. The section containing the solution under test shall be 38 mm in diameter by 300 mm in length, and shall have a capacity of about 300 mL. The tubes shall be chosen so that the specimens will remain fully immersed during the test, the ratio of area of immersed metal to the volume of the solution will be as prescribed in 7.1, and sufficient space will be provided for foam formation.

3.2 Source of Filtered Low-Pressure Air, for aerating the test solution. The air used should be bubbled through sodium hydroxide solution (30 g NaOH/litre), maintained at room temperature, in order to remove carbon dioxide, and then through water, at or near the temperature of test, in order to reduce evaporation in the test cell.

3.3 Condensers, Allihn-type, having jackets 200 to 250 mm in length. Condensers are not required for tests run at room temperature.

3.4 Stoppers or Joints—The connection between test tube and condenser optionally may be either standard-taper joints or rubber stoppers preboiled in aqueous caustic soda to remove free sulfur and boiled in a sufficient number of changes of distilled water until neutral.

3.5 Constant-Temperature Device-Any suitable means may be employed for maintaining the solutions actively at the boiling point for tests conducted at that temperature. For tests made at other temperatures, a suitable constant-temperature bath shall be provided to maintain the required temperature within ±2°F (1°C). For control testing at room temperature, it is suggested that the solution be maintained at 95 \pm 2°F (35 \pm 1°C), which, being slightly above most room temperatures, is easy to maintain by heat input.

4. Apparatus for Residual Cleaner Corrosion Test

4.1 Coating Apparatus for producing a uniform film of cleaner on the surface of the test specimens.³

4.2 Humidity Chamber for exposing the contaminated specimens at a temperature of 95°F (35°C) and 90 % relative humidity.

5. Test Specimens

5.1 Selection of Samples—The samples selected for corrosion testing shall be identical in composition, metallurgy, and surface finishing with the metal at the stage where cleaning will be applied in practice.

5.2 Size and Number of Specimens—The test specimens shall have an area between 0.300 and 0.375 dm² and a length not to exceed 200 mm. (A specimen 18 by 85 by 1 mm in thickness would have an area of 0.327 dm².) At least two, and preferably four, replicates shall be tested in each concentration of cleaner solution prescribed in 7.2. The number of replicates under test shall be reported.

6. Preparation of Test Specimens

6.1 Immediately prior to their use in the test, clean the test specimens as directed in the Apparatus Section of Method D 1280.

7. Test Conditions

7.1 Ratio of Area of Immersed Metal to Volume of Solu-

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² Annual Book of ASTM Standards, Vol 15.04.

³ The Fisher-Payne Dip Coater has been found satisfactory for this purpose.

∰ D 1374

tion—The ratio of the area of the immersed metal to the volume of solution shall be less than 1.5 dm²/litre of solution. (A specimen 18 by 85 by 1 mm in thickness would require 220 mL of solution, and a specimen having an area of 0.375 dm² would require 250 mL of solution.) Use fresh solution for each set of replicates, and record the ratio used.

7.2 Solution Concentration:

- 7.2.1 In the absence of the manufacturer's recommendations, test the specimens in solutions of the cleaner of concentrations of 0.25, 0.5, and 2.0 % by weight, made up from stock solutions which shall be freshly prepared in 2000-g quantities, according to the manufacturer's recommended procedure. Boil the solutions for 30 min, unless otherwise specified. In case the cleaner is not soluble to the extent noted in the stock solutions indicated, record this fact, but nevertheless continue the test with the specified total amounts of cleaner present in the test tubes. A blank test of either two or four replicates shall be made in freshly boiled distilled water.
- 7.2.2 When the manufacturer's recommendations are available, make the test at the following relative concentrations (based on the average concentrations suggested), recording the percentages these represent: one half the concentration recommended, the concentration recommended and twice the concentration recommended. Make a blank test of either two or four replicates in freshly boiled distilled water, submitting them otherwise to exactly the same procedure followed for the specimens immersed in cleaner solution.

7.3 Water—The water used in preparing the water-soluble cleaner solutions shall be freshly boiled distilled water.

- 7.4 Temperature—When the manufacturer's recommendations are available, make the test at $20 \pm 2^{\circ}F$ ($11 \pm 1^{\circ}C$) below and $20 \pm 2^{\circ}F$ ($11 \pm 1^{\circ}C$) above the average recommended temperature, or at $180 \pm 2^{\circ}F$ ($82 \pm 1^{\circ}C$) if it is lower, the temperature being recorded in any case. In the absence of the manufacturer's recommendations, make the test at $180 \pm 2^{\circ}F$ ($82 \pm 1^{\circ}C$).
- 7.5 Aeration—Aerate the solution by passing air through the solution at the rate of 200 mL/litre·min. The volume of air should be measured and controlled as accurately as possible, preferably within ±10 %. For 250 mL of solution, 50 mL of air per minute would be required.

8. Procedure for Quantitative Weight Loss Test

8.1 Conduct the quantitative weight loss test as directed in Method D 1280.

9. Procedure for Qualitative Surface Corrosion Test

9.1 Proceed as for the quantitative weight loss test, except that drying and weighing the specimens before the test shall be omitted, and the removal of corrosion products may be dispensed with unless the corrosion is severe enough to obscure observation.

10. Procedure for Residual Cleaner Corrosion Test

10.1 Conduct the residual cleaner corrosion test as directed in Method D 1280.

11. Report

- 11.1 Quantitative Weight Loss Test—Report the following data for each test performed:
 - 11.1.1 Temperature,
 - 11.1.2 Specimens, size and number,
 - 11.1.3 Cleaner concentrations,
- 11.1.4 Metal, alloy, surface treatment, and metallurgical state,
 - 11.1.5 Ratio of surface area to volume of solution,
- 11.1.6 Aeration rate, in millilitres of air per litre of solution per minute,
- 11.1.7 Type of cleaner and other conditions of test peculiar to type,
- 11.1.8 Weight loss, in milligrams per square decimetre per hour,
 - 11.1.9 Range in weight loss values, and
- 11.1.10 Appearance before and after removal of corrosion products, with regard to the following: (1) Discoloration, (2) Dulling, (3) Etching, (4) Presence of accretions and relative amounts and areas, (5) Type of pitting—wide, medium, or narrow, and (6) Presence of selective or localized attack.
- 11.2 Qualitative Surface Corrosion Test—Report the same information as for the quantitative weight loss test 11.1, except to omit 11.1.8 and 11.1.9.

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