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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test)[1]

This standard is issued under the fixed designation B 368; 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 method prescribes the conditions required in copper-accelerated acetic acid-salt spray (CASS) testing for specification purposes. The standard does not specify the type of test specimen or exposure periods to be used for a specific product, nor the interpretation to be given to the results.

1.2 This method is applicable to evaluating the corrosive performance of decorative copper/nickel/chromium or nickel/chromium coatings on steel, zinc alloys, aluminum alloys, and plastics designed for severe service. It is also applicable to the testing of anodized aluminum. The suitability of this test and correlation of results with service experience should be determined before it is specified for coating systems or materials other than those mentioned in this paragraph.

NOTE 1—The following standards are not requirements. They are referenced for information only: Practices B 537 and E 50, Specifications B 456 and B 604, and Test Method B 602.

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.* For more specific safety precautionary information see 8.1.1.

2. Referenced Documents

2.1 *ASTM Standards:*

B 117 Practice for Operating Salt Spray (Fog) Apparatus[2]

B 162 Specification for Nickel Plate, Sheet, and Strip[3]

B 456 Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium[4]

B 537 Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure[4]

B 602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings[4]

B 604 Specification for Decorative Electroplated Coatings of Copper/Nickel/Chromium on Plastics[4]

D 1193 Specification for Reagent Water[5]

E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals[6]

3. Significance and Use

3.1 The CASS test is widely employed and is useful for specification acceptance, simulated service evaluation, manufacturing control, and research and development. It was developed specifically for use with decorative, electrodeposited nickel/chromium and copper/nickel/chromium coatings. Use of the test has improved the quality of electroplated parts and led to the development of new and superior electroplating processes.

4. Apparatus

4.1 The apparatus required for the CASS test consists of a fog chamber, a salt-solution reservoir, a supply of compressed air, one or more atomizing nozzles, specimen supports, provision for heating the chamber, and necessary means of control.

4.2 The size and detailed construction of the apparatus are optional, provided the conditions meet the requirements of this method. The construction of the apparatus is described in the appendix of Test Method B 117. For the CASS test, however, the requirements for air pressure and temperature are typically 0.08 to 0.12 MPa and 60 to 65°C, respectively. The actual air pressure will be that required to produce the proper collection rate (see 8.3.1).

4.3 The apparatus shall be constructed so that drops of solution that accumulate on the ceiling or cover of the chamber do not fall on the specimens being tested. Drops of solution that fall from the specimens shall not be returned to the solution reservoir for respraying.

4.4 Materials of construction shall not affect the corrosiveness of the fog, nor be themselves corroded by the fog.

[1] This method is under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on General Test Methods.

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[2] *Annual Book of ASTM Standards*, Vol 03.02.

[3] *Annual Book of ASTM Standards*, Vol 02.04.

[4] *Annual Book of ASTM Standards*, Vol 02.05.

[5] *Annual Book of ASTM Standards*, Vol 11.01.

[6] *Annual Book of ASTM Standards*, Vol 03.05.

5. Test Solution

5.1 Prepare the salt solution by dissolving 5 parts by weight of salt in 95 parts of water conforming to Specification D 1193, Type IV. The salt shall be sodium chloride (NaCl), ACS reagent grade, or equivalent. The pH of this solution shall be between 6.0 and 7.0. Impurities or contam-ination of either the salt or the water, or both, should be suspected if the pH is outside of this range (Note 2).

5.2 Add 0.25 g of reagent grade copper chloride ($CuCl_2 \cdot 2H_2O$) to each litre of the salt solution; dissolve and mix thoroughly.

5.3 The pH of the salt-copper solution shall be adjusted to the range of 3.1 to 3.3, as measured on a sample of the collected spray, by the addition of glacial acetic acid, ACS reagent grade, or equivalent (Note 3). The pH measurement shall be made electrometrically at 25°C. Before the solution is atomized, it shall be free of suspended solids (Note 4).

NOTE 2—A solution having a specific gravity of 1.030 to 1.040, when measured at a temperature of 25°C, will meet the concentration requirement. It is suggested that a daily check be made.

NOTE 3—The initial solution may be adjusted to a pH of 3.0 to 3.1, with the exception that the pH of the collected fog will be within the specified limits. Adjustment of the initial pH for makeup solution is based upon the requirements to maintain the required pH of the collected samples. If less than 1.3 or more than 1.6 mL of the glacial acetic acid are required per litre of sodium chloride and copper solution to attain the specified pH, some discrepancy in the system may be suspected (the purity of the water or salt, or both; the accuracy of the pH meter; the general cleanliness of the system; etc.).

NOTE 4—The freshly prepared salt solution may be filtered or decanted before it is placed in the reservoir, or the end of the tube leading from the solution to the atomizer may be covered with a double layer of cheese cloth to prevent plugging of the nozzle.

6. Air Supply

6.1 The compressed air supply to the nozzle or nozzles for atomizing the test solution shall be free of oil and dirt (Note 5). Pressure shall be adequate to provide a specified condensate rate. Pressure of 0.10 ± 0.02 MPa has been found satisfactory (Note 6).

NOTE 5—The air supply can be freed of oil and dirt by passing it through a water scrubber or at least 60 cm of suitable cleaning material, such as sheep's wool, excelsior, slag wool, or activated alumina. Commercial filters for compressed air may be used.

NOTE 6—Atomizing nozzles may have a critical pressure, at which an abnormal increase in the corrosiveness of the salt fog occurs. If the critical pressure of a nozzle has not been determined with certainty, control of fluctuation in the air pressure within ±0.0007 MPa by installing a pressure regulator valve minimizes the possibility that the nozzle will be operated at its critical pressure.

7. Test Specimens

7.1 The type and number of test specimens to be used, as well as the criteria for the evaluation of the test results, shall be defined in the specifications covering the material or product being tested or shall be mutually agreed upon between the purchaser and the supplier.

8. Procedure

8.1 *Preparation of Test Specimens*—Clean metallic and metallic coated specimens. Unless otherwise agreed upon, clean decorative copper/nickel/chromium or nickel/chromium coatings immediately before testing by wiping significant surfaces with a cotton pad saturated with a slurry containing 10 g of pure magnesium oxide powder (ACS reagent grade) in 100 mL of distilled water. Upon rinsing in warm running water, be sure that the clean surface is free of water break. Anodized aluminum parts may be cleaned with inhibited 1,1,1-trichloroethane or other suitable organic solvent (see 8.1.1). Do not clean organic and other nonmetallic coated specimens. Other methods of cleaning, such as the use of a nitric-acid solution for the chemical cleaning or passivation of stainless steel specimens, are permissible when agreed upon between the purchaser and the supplier. Take care that the specimens after cleaning are not recontaminated by excessive or careless handling. Protect the cut edges of plated, coated, or multilayered materials and areas containing identification marks or in contact with the racks or supports with a coating that is stable under the conditions of the test, such as wax, stop-off lacquer, or pressure-sensitive tape.

8.1.1 **Caution**—1,1,1-Trichloroethane should be used in a well-ventilated area away from open flames.

8.2 *Positioning of Specimens*—Position the specimens in the CASS test chamber during the test so that the following conditions are met:

8.2.1 Support or suspend the specimens 15 ± 2° from the vertical and preferably parallel to the principal direction of horizontal flow of fog through the chamber, based upon the dominant surface being tested. Support or suspend automobile parts, however, so as to expose all significant surfaces at the general level of the condensate collectors. If the position on the automobile is vertical, place the part in an incline position 15° from vertical to allow surface wetting by the condensate. If the position on the automobile is facing down, rotate the part approximately 180° to test the significant surface. If there are several significant surfaces at different angles, expose each surface of one or more specimens.

8.2.2 Make sure the specimens do not come in contact with each other or any other metallic material or any material capable of acting as a wick.

8.2.3 Place each specimen so as to permit free settling of fog on all specimens.

8.2.4 Make sure the salt solution from one specimen does not drip on any other specimen.

8.2.5 Place the specimens in the chamber just prior to bringing the test chamber to the required temperature and turning on the air, since storage in an idle chamber overnight, or for other significant length of time, can affect test results.

NOTE 7—Suitable materials for the construction or coating of racks and supports are glass, rubber, plastic, or suitably coated wood. Bare metal should not be used. Specimens are preferably supported from the bottom or the side. Slotted wooden strips are suitable for the support of flat panels. Suspension from glass hooks or waxed string may be used as long as the specified position of the specimens is obtained. If necessary, such suspension may be made by means of secondary support at the bottom of the specimens.

8.3 *Conditions in the Salt-Spray Chamber*—Maintain the exposure zone of the CASS test chamber at a temperature of 49± 1°C during the exposure period (Note 8). After closing the test chamber, bring the temperature to 49°C before the fog is