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Standard Practice for Salt-Accelerated Outdoor Cosmetic Corrosion Testing of Organic Coatings on Automotive Sheet Steel[1]

This standard is issued under the fixed designation D6675; 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.

INTRODUCTION

Corrosion of painted sheet steel of auto bodies is classified according to the initial location and direction of the corrosive attack. When the corrosion starts on the visible exterior surface, mostly at nicks and scratches in the paint, it is called "cosmetic" or "outside in" corrosion. Corrosion initiated at an interior surface or within a closed or semi-closed part is called "perforation" or "inside out" corrosion.

1. Scope

1.1 This practice is designed to assist procedures to be followed when conducting outdoor exposures to evaluate cosmetic corrosion that might occur in steel panels covered with an organic coating that has been damaged. The outdoor exposures described are based on ~~Practice~~Practices G7 and G50 and include periodic wetting of the test specimens with a salt solution.

1.2 The methods of preparing test specimens and the particular exposure requirements of materials are beyond the scope of this practice.

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

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~~safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B117 Practice for Operating Salt Spray (Fog) Apparatus

D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products

[1] This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.27 on Accelerated Testing.

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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.

D610 Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels
D1014 Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates
D1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting
D2201 Practice for Preparation of Zinc-Coated and Zinc-Alloy-Coated Steel Panels for Testing Paint and Related Coating Products
D3170 Test Method for Chipping Resistance of Coatings
G7 Practice for Natural Weathering of Materials
G50 Practice for Conducting Atmospheric Corrosion Tests on Metals
~~G117 Guide for Calculating and Reporting Measures of Precision Using Data from Interlaboratory Wear or Erosion Tests (Withdrawn 2016)[3]~~

3. Significance and Use

3.1 Tests of the type described in this practice ~~may be~~ are used to evaluate the corrosion resistance of organic coatings on metal products exposed to highly salty environments, such as areas subjected to deicing salts or coastal areas. Exposure conditions are complex and changeable. Important factors include climate, time of year, presence of pollution, and so forth. Generally it is difficult, if not impossible, to define or measure precisely all the factors that influence degradation. Repeated exposure testing during different seasons and over a period of at least two years is required to obtain results representative of any given location.

~~3.2 Control specimens must always be used because this is a comparative test.~~

4. Test Site

4.1 *Climate and Location*—~~The~~ Historically, the preferred location for the racks is a cleared, grass covered ~~area.~~ area in a region that potentially promotes corrosion, such as a subtropical or northern temperate climate. Arid (desert) climates have typically been avoided. Other conditions can be agreed upon between the parties involved.

4.2 *Rack Position and Type*—45° open rack facing the equator, direct weathering unless other conditions are agreed upon between the buyer and seller.

NOTE 1—Information on location, rack construction, and position are given in Practices D1014, G7, and G50.

5. Test Specimens

5.1 Methods for the preparation of test panels and substrates are given in Practices D609, D1730 and D2201. Practice D823 covers techniques for producing uniformly coated test panels.

5.2 Control specimens shall always be used when using this practice as a comparative test.

6. Preparation of Test Specimens

6.1 Prior to exposure, the organic coating shall be subjected to damage by scribing, chipping or by a method agreed upon between all interested parties. Applicable methods for scribing are given in Practice D1654 and for chipping in Practice D3170.

7. Procedure

7.1 Attach specimens to an exposure rack facing the equator. Unless otherwise specified, the rack shall be oriented at an angle of 45° to the horizontal. The panels must be electrically insulated from each other and the exposure rack. The use of insulators or painting all sides of the specimens to protect against galvanic corrosion, are suitable methods for achieving ~~this.~~this. Practice G50 details methods for ensuring electrical insulation.

7.2 Unless otherwise specified, twice weekly, at 3 to 4 day intervals, apply the electrolyte solution to test specimens. Unless otherwise specified, use a 5 % aqueous sodium chloride solution prepared in accordance with Practice B117. Use a hand pump atomizer or other means to spray the electrolyte solution. Make sure that each specimen is completely wetted. Since the degree

of atomization and volume of solution can affect the corrosion rate, the details of the solution application must be reported. Make sure to use the same application conditions each time the electrolyte solution is applied.

NOTE 2—This test does not necessarily agree with any other accelerated test, or any other natural exposure conducted in severe locations.[3,4,5,6]

7.3 The application of electrolyte solution should be performed on the scheduled day regardless of the weather conditions such as rain or snow. Unless otherwise agreed upon, spray the panels after the evaporation of the morning dew formation. Do not remove snow and ice from the specimens prior to the electrolyte solution application.

8. Periods of Exposure

8.1 The duration of exposure should be specified on one of the following bases:

8.1.1 Exposure for a specified number of days, months or years. The report shall indicate exact dates of exposure.

8.1.2 Exposure until a specified level of corrosion or degradation has occurred.

8.1.3 Exposure until a specified amount of corrosion or degradation has occurred in a standard specimen exposed with the test specimens.

9. Evaluation of Specimens After Exposure

9.1 Evaluate the specimens in accordance with ~~Test Method~~ Practice D610 ~~and Practice~~, Test Method D1654, and/or Test Method D3170, depending on whether the panels were scribed or chipped as referenced in Section 6.

9.2 Other methods for evaluating test specimens may be used as agreed upon between the buyer and seller.

10. Report

10.1 Report all the following information, if available:

10.1.1 Materials tested and number of specimens obtained,

10.1.2 Preparation of the test panel and description of the paint damage before exposure; scribe, chip or otherwise,

10.1.3 Exposure site location include ground cover, rack materials or construction and position (angle facing the equator) and possible occurrence of natural salt spray,

10.1.4 Type of electrolyte solution, application method, sprayer type and interval,

10.1.5 Duration of exposure,

10.1.6 Exposure dates, and

10.1.7 Results of the evaluation.

11. Keywords

11.1 atmospheric testing; corrosion; exposure tests-exterior

[3] Townsend, H. E., Davidson, D. D., and Ostermiller, M. R., "Development of Laboratory Corrosion Tests by the Automotive and Steel Industries of North America," *Proceedings of the Fourth International Conference on Zinc and Zinc-Alloy Coated Steel Sheet*, Iron and Steel Institute of Japan, Tokyo, 1998, pp. 659–666.

[4] Lutze, F. W., and Shaffer, R. F., "Accelerated Atmospheric Corrosion Testing of AISI Panels," *Automotive Corrosion and Prevention Conference Proceedings, P-250*, Society of Automotive Engineers, Warrendale, PA, 1991, pp. 115–127.

[5] Davidson, D. D., and Sumacher, W. A., "An Evaluation and Analysis of Commonly Used Accelerated Cosmetic Corrosion Tests Using Direct Comparisons with Actual Field Exposure," *Automotive Corrosion and Prevention Conference Proceedings, P-250*, Society of Automotive Engineers, Warrendale, PA, 1991, pp. 205-219.

[6] Simpson, M. W., Van der Linde, W. B., McCune, D. C., and Townsend, H. E., "License-Plate Cosmetic Corrosion Tests of Automotive Coated Steel Sheet," Paper No. 98553 presented at the Symposium on Automotive Corrosion, NACE International, March, 1998.