



Designation: D 1654 – 92 (Reapproved 2000)

Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments¹

This standard is issued under the fixed designation D 1654; 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 covers the treatment of previously painted or coated specimens for accelerated and atmospheric exposure tests and their subsequent evaluation in respect to corrosion, blistering associated with corrosion, loss of adhesion at a scribe mark, or other film failure.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- B 117 Practice for Operating Salt Spray (Fog) Testing Apparatus²
- D 610 Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces³
- D 714 Test Method for Evaluating Degree of Blistering of Paints⁴
- D 870 Practice for Testing Water Resistance of Coatings Using Water Immersion⁴
- D 1014 Practice for Conducting Exterior Exposure Tests of Paints on Steel⁴
- D 1735 Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus⁴
- D 2247 Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity⁴
- D 2803 Guide for Filiform Corrosion Resistance of Organic Coatings on Metal⁴
- D 4141 Practice for Conducting Accelerated Outdoor Expo-

sure Tests of Coatings⁴

D 4585 Practice for Testing Water Resistance of Coatings Using Controlled Condensation⁴

D 4587 Practice for Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus⁴

G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵

G 26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵

G 85 Practice for Modified Salt Spray (Fog) Testing⁶

G 87 Practice for Conducting Moist SO₂ Tests⁶

2.2 ANSI Standard:

B94.50 Single-Point Cutting Tools, Basic Nomenclature and Definitions for⁷

3. Significance and Use

3.1 This method provides a means of evaluating and comparing basic corrosion performance of the substrate, pretreatment, or coating system, or combination thereof, after exposure to corrosive environments.

4. Apparatus

4.1 *Scribing Tool*—A straight-shank tungsten carbide tip, lathe cutting tool (ANSI B94.50, Style E) or carbide-tipped pencil-type tool is recommended. Any other type of scribing instrument such as a scalpel, razor blade, knife, or other sharp pointed tool is unacceptable unless agreed upon between the producer and the user.

4.2 *Straightedge*—Any straightedge of sufficient length and rigidity to guide the scribing tool in a straight line.

¹ This method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.25 on Evaluation of Weathering Effects.

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

³ *Annual Book of ASTM Standards*, Vol 06.02.

⁴ *Annual Book of ASTM Standards*, Vol 06.01.

⁵ Discontinued; G 23 replaced by G 152 and G 153; G 26 replaced by G 155. See 2000 *Annual Book of ASTM Standards*, Vol 14.04.

⁶ *Annual Book of ASTM Standards*, Vol 03.02.

⁷ Available from American National Standards Institute, 13th Floor, 11 W. 42nd St., New York, NY 10036.

4.3 *Air Source*—A source of compressed air capable of delivering at least 10 ft³/min (4.72 L/s) at 80 psi (552 kPa).

4.4 *Air Gun*—An air dusting gun and nozzle combination⁸ to meet the following specification:

Air Consumption, ft ³ /min (m ³ /min)	Pressure, psi (kPa)	Nozzle Diameter, in. (mm)
8.4 (0.24)	80 (550)	0.12 (3.0)

4.4.1 A guard consisting of barriers, baffles, or screens is required to protect the operator and other individuals near the area where the air is being used. The guard must be placed between the air nozzle and the operator. A device such as a sand-blasting cabinet has been found to be acceptable.

NOTE 1—The use of an air gun without a guard is in violation of the U. S. Occupational Safety and Health Administration regulation.

4.5 *Scraping Tool*—A rigid spatula, knife, or similar instrument with no sharp edges or sharp corners.

4.6 *Scale*—Any rule with 1-mm divisions.

5. Preliminary Treatment of Test Specimens

5.1 Scribed Specimens:

5.1.1 Where specified or agreed upon, prepare each specimen for testing by scribing it in such a manner that the scribe can be exposed lengthwise when positioned in the test cabinet. This position will allow solution droplets to run lengthwise along the scribe.

5.1.2 Scribe the specimen by holding the tool at approximately a 45° angle to the surface. Position the tool so that only the carbide tip is in contact with the surface. Pull the scribing tool to obtain a uniform V-cut through the coating that is being tested. Inspect the tool frequently for dulling, chipping or wear and replace or repair as needed. The scribe should be of sufficient length to cover the significant test area, but should not contact the edge of the specimen. The scribe must penetrate all organic coating layers on the metal, leaving a uniformly bright line of burrs. The extent of scribe penetration through metallic coatings should be agreed upon between the producer and user. Quality of the scribe may be observed with the aid of low-power magnification. Note, mark, and describe defects, coding, and flaws that may affect results.

5.1.3 Scribe lines other than those of a single, straight nature may be used if agreed upon between the producer and the user.

5.1.4 Expose scribed specimens in accordance with 6.1 and rate in accordance with Section 7.

5.2 *Unscribed Specimens*—Specimens coated with paint undercoats, oils, or waxes may be evaluated without a scribe. Expose such specimens in accordance with Section 6 and rate for corrosion of the general surface in accordance with Section 8.

5.3 *Cut Edges*—Cut edges of panels may be exposed during testing, or protected by wax, tape, or other means as agreed upon between the producer and the user. If left unprotected, method of shearing panel edges should be agreed upon between the producer and user, noting whether edges are oriented in the “burr up” or “burr down” configuration.

⁸ Spray gun and nozzles, Model No. AA23LTP0020 have been found satisfactory and may be obtained from Spray Systems Co., North Avenue at Schmale Road, Wheaton, IL 60187. Equivalents may be used.

5.4 *Deformation*—Deformation of test panels prior to exposure, if desired, should be agreed upon between the producer and user.

6. Exposure of Test Specimens

6.1 Expose test specimens in accordance with one or more of the following test methods or practices: B 117, D 610, D 714, D 870, D 1014, D 1735, D 2247, D 2803, D 4141, D 4585, D 4587, G 23, G 26, G 85, G 87, or any other applicable test method, as agreed upon between the producer and the user. The length of test and evaluation intervals should be agreed upon prior to exposure of specimens.

7. Procedure A—Evaluation of Scribed Specimens

7.1 *Method 1 (Air Blow-Off)*—Rinse each specimen after completion of the exposure period, using a gentle stream of water at a temperature up to 110°F (45°C). Holding the nozzle at approximately a 45° angle, blow along the entire scribe line, disturbing the surface adjacent to the scribe mechanically by the air nozzle to ensure an opening for the air blast. Complete the air blasting within 15 min of specimen removal from the exposure cabinet. If the air blasting cannot be completed within the prescribed time, immerse the specimens in water at room temperature or store in a plastic bag to avoid any drying effect.

7.2 *Method 2 (Scraping)*—Rinse the specimen after completion of the exposure period, using a gentle stream of water at a temperature up to 110°F (45°C). Scrape the specimen vigorously with an instrument described in 4.5 while under the gentle stream of the rinse water. Hold the scraper with its face perpendicular to the specimen surface and parallel to the scribe, moving it back and forth across the scribe to remove the coating that has been undercut and has suffered loss of adhesion only, not to remove the coating that still has adhesion. Complete the scraping within 15 min of specimen removal from the exposure cabinet. If scraping cannot be completed within the prescribed time, immerse the specimens in water at room temperature or store in a plastic bag to avoid any drying effect.

NOTE 2—Rinsing, scraping, or air blow off may not be appropriate in all cases, such as for interim ratings in continuing tests. Alternative methods may be used if agreed upon between the producer and the user.

7.3 *Rating*—Rate the corrosion or loss of paint extending from a scribe mark as prescribed in Table 1. Record the representative mean, maximum, and minimum creepage from

TABLE 1 Rating of Failure at Scribe (Procedure A)

Representative Mean Creepage From Scribe		
Millimetres	Inches (Approximate)	Rating Number
Zero	0	10
Over 0 to 0.5	0 to 1/64	9
Over 0.5 to 1.0	1/64 to 1/32	8
Over 1.0 to 2.0	1/32 to 1/16	7
Over 2.0 to 3.0	1/16 to 1/8	6
Over 3.0 to 5.0	1/8 to 3/16	5
Over 5.0 to 7.0	3/16 to 1/4	4
Over 7.0 to 10.0	1/4 to 3/8	3
Over 10.0 to 13.0	3/8 to 1/2	2
Over 13.0 to 16.0	1/2 to 5/8	1
Over 16.0 to more	5/8 to more	0