SURFACE VEHICLE STANDARD

J1976™ MAY2022

Issued 1989-06
Revised 2012-04
Reaffirmed 2022-05

Superseding J1976 APR2012

Outdoor Weathering of Exterior Materials

RATIONALE

This standard is being changed to make Procedure A the default procedure for this test method. Also, the requirement for time of wetness measurements is being removed.

SAE J1976 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 This test method specifies the exposure racks, black boxes, and instrumentation, which shall be used for the outdoor weathering of materials for automotive exterior application.

1.2 All dimensions are nominal unless otherwise noted.

1.3 A list of approved exposure test sites is generally available from specified automotive manufacturers.

1.4 Sample preparation, exposure duration, and performance evaluation procedures not presented in this method are covered in material specifications of the different automotive manufacturers.

1.5 This method includes three procedures:

1.5.1 PROCEDURE A

Exposure in a rack without backing; or, as required, (1) expanded metal backing, or (2) backed plywood at a fixed angle of 5 degrees from the horizontal facing the equator. If a specific Procedure is not specified, the default procedure is Procedure A without backing.

1.5.2 PROCEDURE B

Exposure in an unheated black box at a fixed angle of 5 degrees from the horizontal facing the equator. For non-rigid specimens, see note below.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J1976_202205/

1.5.3 PROCEDURE C

Exposure at angles other than 5 degrees as specified in PROCEDURE A AND PROCEDURE B.

1.5.3.1 Special Tests

These are established on an as-needed basis to duplicate end-use conditions. Examples are in-service position of large assemblies or components that cannot be accommodated in a 5 degrees exposure rack.

NOTE: If required for nonrigid specimens, use expanded metal backing for unbacked exposures. Expose specimens in a rack with plywood backing 13 mm to 19 mm (1/2 in to 3/4 in) that have an end-use application in a backed configuration.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J400 Test for Chip Resistance of Surface Coatings

SAE J1545 Instrumental Color Difference Measurement for Exterior Finishes, Textiles, and Colored Trim

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM G 147 Standard Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests

ASTM D 523 Standard Test Method for Specular Gloss

ASTM D 610 Standard Method for Evaluating Degree of Rusting on Painted Steel Surfaces

ASTM D 714 Standard Method for Evaluating Degree of Blistering of Paints

ASTM D 772 Standard Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints

ASTM D 2794 Standard Method for Resistance of Organic Coatings to the Effect of Rapid Deformation (Impact)

ASTM D 3002 Standard Practice for Evaluation of Coatings for Plastics

ASTM D 3359 Standard Method for Measuring Adhesion by Tape Test

ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test

ASTM D 3924 Standard Specifications for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials

ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

ASTM D 4214 Standard Test Method for Evaluating Degree of Chalking of Exterior Paint Films

ASTM E 313 Standard Test Method for Index of Whiteness and Yellowness of Near-White Opaque Materials

2.1.3 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 9223 Corrosion of metals and alloys - Corrosivity of atmospheres - Measurement of pollution

ISO TS16949 Quality Systems – Automotive Suppliers - Particular requirements for the application of ISO 9001:1994

ISO 17025 General requirements for the competence of testing and calibration laboratories

3. SIGNIFICANCE AND USE

3.1 This method shall be used to test the weather resistance of all materials intended for automotive exterior applications. Those materials covered by government specifications are exempt from this document.

3.2 Since the natural environment varies considerably during any twelve-month period with respect to location, different results may be expected among sites located within the same climate classification or region.

3.2.1 Exposures can be conducted in any type of climate. However, to obtain results from the most severe outdoor environment, exposures are often conducted in locations that receive high levels of solar radiation, temperature, and moisture. Typically, these conditions are found in hot desert and subtropical or tropical climates, such as Phoenix, Arizona and Miami, Florida, respectively. Known attributes of the use environment should be represented by the locations selected for outdoor durability evaluation. For example, if the use environment for the product being evaluated will include freeze/thaw cycling, specimen exposure in a northern temperate climate is recommended. In addition, exposures are often conducted in areas where specimens are subjected to salt air (seashore) or industrial pollutants.

3.2.2 The relative durability of materials in natural exposures can be very different depending on the location of the exposure because of differences in ultraviolet (UV) radiation, time of wetness, temperature, pollutants, and other factors. Therefore, it cannot be assumed that results from exposure in a single location will be useful for determining relative durability in a different location. Exposures in several locations with different climates which represent a broad range of anticipated service conditions are recommended.

3.2.3 Because of year-to-year climatological variations, results from a single exposure test cannot be used to predict the absolute rate at which a material degrades. Several years of repeat exposures are needed to get an “average” test result for a given location.

3.2.4 Solar ultraviolet radiation varies considerably as a function of time of year. This can cause large differences in the apparent rate of degradation in many polymers. Comparing results for material exposed for short periods (less than one year) is not recommended unless materials are exposed at the same time in the same location.

4. LOCATION

4.1 The rack and/or black boxes shall be placed in an area free from objects likely to shade the test specimens during exposure. The area beneath and in the immediate vicinity of the test fixtures should be characterized by low reflectance and be typical of the ground cover in that climatological area. The lowest section of the racks or black boxes shall be at a sufficient height above ground to avoid contact with vegetation and to prevent damage during area maintenance. A minimum height of 46 cm (18 in) above the ground is recommended or at a sufficient height to avoid contact with vegetation and to prevent damage that might occur during area maintenance, whichever is greater.

5. CONSTRUCTION

5.1 Panel Exposure Racks – Procedure A (Coating Systems)

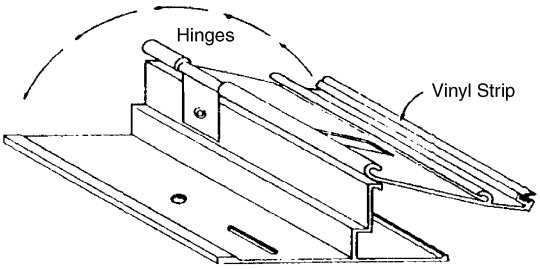
5.1.1 The exposure racks and hardware used in Procedure A shall be constructed of anodized aluminum or an approved equivalent. The racks shall be designed for unbacked exposure.

NOTE: Clear anodized aluminum alloy No. 6061T6 and 6063T6 have been found suitable for construction of racks and frames for use in all geographic locations.

5.1.2 When required, the racks shall be fitted with a 65 mm (2.5 in) shield to provide an unexposed area on the test piece. A typical panel rack and fitted shield for exposing coating systems is shown in Figure 1.

5.1.3 When required, expanded metal backing shall be 0.03 mm (0.012 in) thick, flattened mesh 5005 H34 aluminum expanded metal, with an opening size of 2.7 mm x 6.9 mm (0.106 in x 0.272 in).

5.1.4 For backed exposures, use exterior grade plywood to form a solid surface to which the specimens are directly attached. A minimum of 13 mm (1/2 in) thick exterior grade plywood has been found satisfactory for use in arid environments. A maximum of 19 mm (3/4 in) thick exterior grade plywood has been found satisfactory for use in sub-tropical environments. Medium-density overlay (MDO) or high-density overlay (HDO) are satisfactory substrates and require less frequent replacement than plywood with no overlay. The edges of the plywood should be sealed to prevent delamination. Replace the plywood when there is any evidence of delamination or fiber separation.



Panel Flap Assembly

Harrison Open Backed Exposure Rack

A. 1.52 m – 152 mm x 3.66 m x 102 mm (5 ft 6 in x 12.0 ft x 4 in) aluminum frame anodized welded fabrication.
B. Panel base and flap assemblies (or masks) 12 ft 0 in in length are adjustable for any size panel.
C. Vinyl strip in edge of panel flap insures fine demarcation line.
D. Support post for ground or roof mountings are provided.
E. Arms for frame angle position are adjustable from vertical to five degrees.
F. Fabrications are available for strong panel exposure.

FIGURE 1 - TYPICAL PANEL RACK AND FITTING SHIELD

5.2 Black Boxes – Procedure B (Coating Systems Only)

5.2.1 Black boxes used in Procedure B shall be constructed of corrosion-resistant metal. Exterior surfaces shall be coated with a high-temperature, flat black paint. The interior of boxes constructed of materials with minimal reflectance properties shall remain uncoated.

NOTE: No. 3003 aluminum sheet has been found suitable for black boxes for use in all geographic locations. Krylon High Temperature, flat black bar-b-que paint has been found suitable for painting the outside of the boxes.

5.2.2 The black box shall have a minimum of 4 weep holes for drainage.

5.2.3 There are two sizes of black boxes currently in use as illustrated in Figures 2A, 2B, and 3. The dimension of the box used must be included in the exposure report.

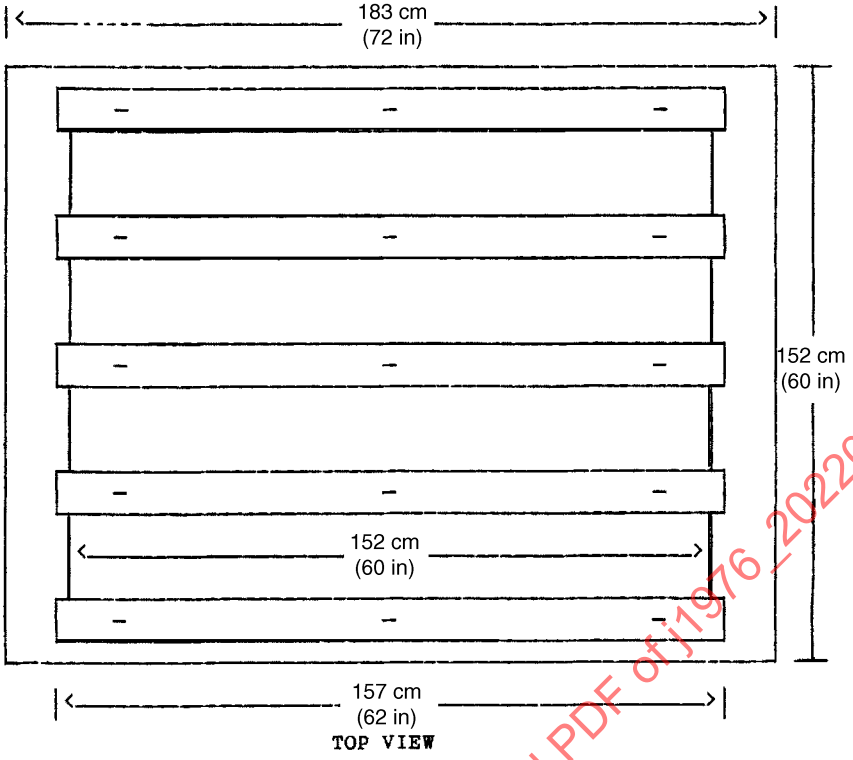
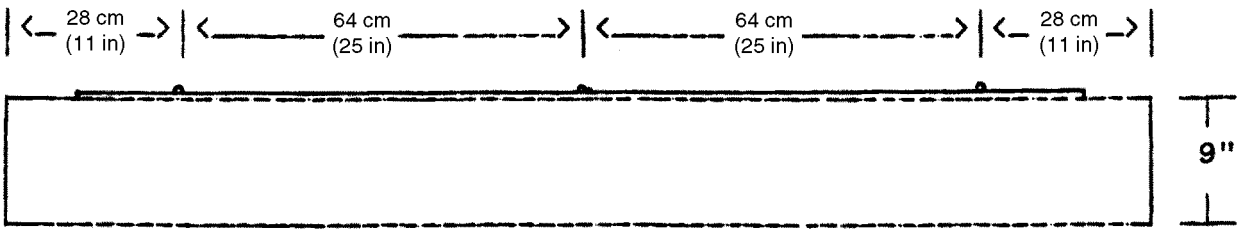
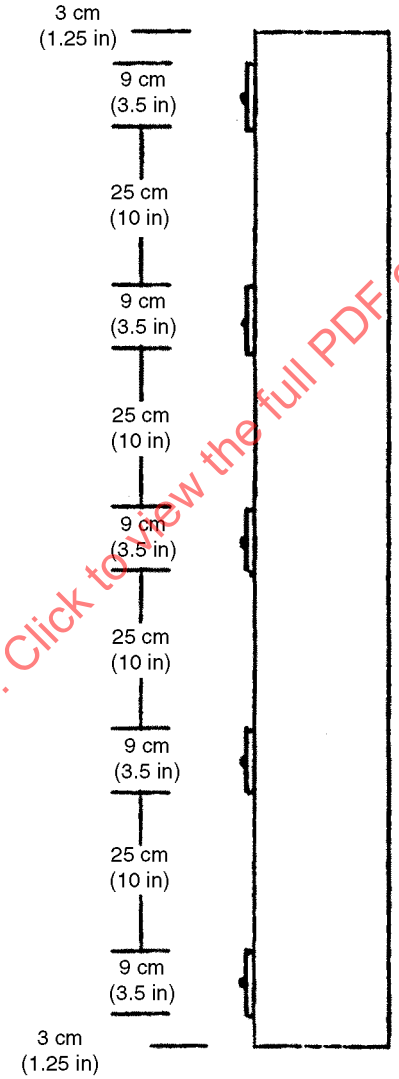


FIGURE 2A - SMALL BLACK BOX

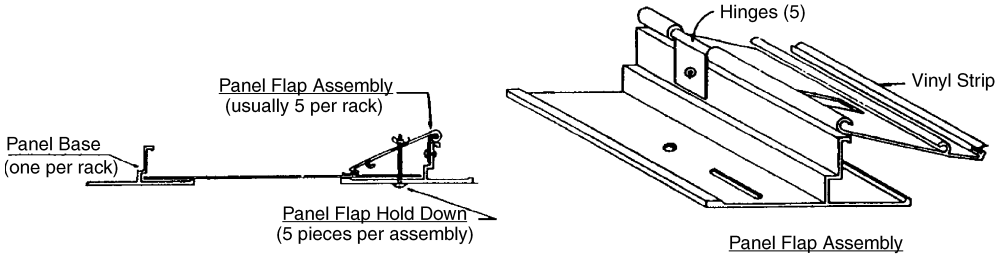


FRONT VIEW



END VIEW

FIGURE 2B - SMALL BLACK BOX



Harrison Black Box

A. 1.52 m – 152 mm x 3.66 m x 229 mm (5 ft 6 in x 12 ft 0 in x 9 in) aluminum anodized frame welded fabrication.
B. Panel base and flap assemblies (or masks) 12 ft 0 in in length are adjustable for any size panel.
C. Vinyl strip in edge of panel flap insures fine demarcation line.
D. Support post for ground or roof mountings are provided.
E. Arms for frame angle position are adjustable from vertical to five degrees.

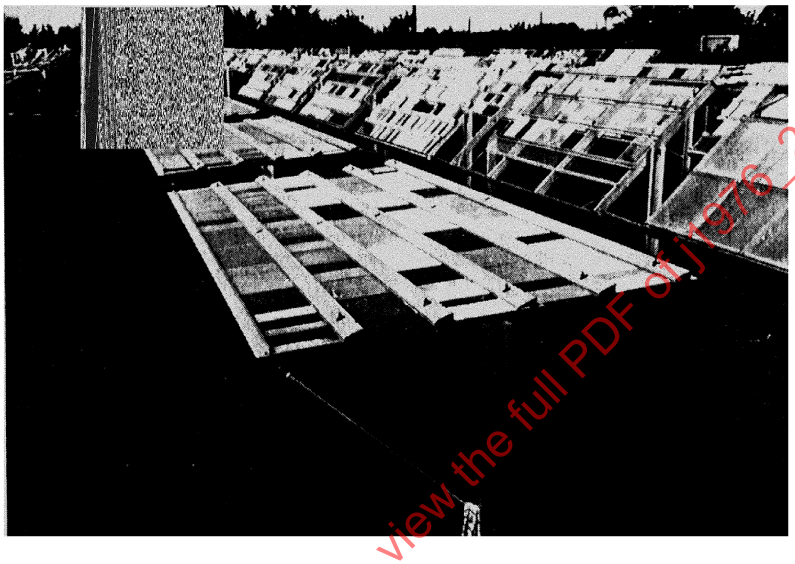


FIGURE 3 - LARGE BLACK BOX

5.3 Exposure Racks – Procedure C (General Usage) - Exposure at angles other than 5 degrees as specified in PROCEDURE A AND PROCEDURE B.

5.3.1 General usage exposure racks used as a part of Procedure A are designed to accommodate any samples, such as odd shapes and sizes, which cannot be placed in the coating system exposure rack described in 5.1. The racks shall be constructed to hold specimens or specimen holders of any convenient size. All racks shall be designed for unbacked exposure or exposure on expanded metal. Materials specifications for the various automotive manufacturers indicate when expanded metal or an approved substitute should be used for exposing materials.

6. INSTRUMENTATION

6.1 Instruments for recording the following climatological data shall be located in the immediate area of the exposure racks. The following data shall be available upon request:

6.1.1 Ambient temperature (daily maximum and minimum).

6.1.2 Black-panel temperature (daily maximum and minimum).

NOTE: (Black panel temp is needed to know how hot a specimen may get. Refer to the applicable OEM material specification.)