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SAE J1976 JUN89

Outdoor Weathering of Exterior Materials

SAE Standard
Issued June 1989

Submitted for Recognition as
an American National Standard

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
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MATERIALS STANDARD

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OUTDOOR WEATHERING OF EXTERIOR MATERIALS

1. SCOPE:

1.1 This test method specifies the exposure rack(s), black box(es), and instrumentation, which shall be used for the outdoor weathering of materials for automotive exterior applications.

1.2 Exposure test site location(s) shall be as specified by the different automotive manufacturers.

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

1.4 This method includes two procedures:

1.4.1 Procedure A: Exposure in a rack without backing; or, as required, expanded metal backing, at a fixed angle of 5 deg from the horizontal facing due south.

1.4.2 Procedure B: Exposure in an unheated black box at a fixed angle of 5 deg from the horizontal facing due south.

2. REFERENCE DOCUMENTS:

2.1 One or more of the referenced documents may be required for materials evaluation before and after exposure. Evaluation procedures shall be as specified by the different automotive manufacturers:

SAE J400 JAN85, Test for Chip Resistance of Surface Coatings

SAE J1545 JUN86, Instrumental Color Difference Measurement for Exterior Finishes, Textiles, and Colored Trim

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 Effects 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 Specification 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

3. SIGNIFICANCE AND USE:

3.1 This method shall be used to test the weather resistance of all materials for automotive exterior applications except those materials covered by government specifications.

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 subtropical area of south Florida. However, previous studies indicate that exposures of two years or longer do provide closely related results for the sites investigated[1]. Therefore, subtropical site comparison studies should consist of results obtained from a minimum of two years of exposure.

4. LOCATION:

4.1 The racks 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.

5. CONSTRUCTION:

5.1 Panel Exposure Racks (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. 6061 T6 and 6063 T6 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 64 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 Fig. 1.

5.2 Black Boxes (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. Boxes constructed of bright finished metal shall be coated with a high temperature, flat black paint. Care must be taken to insure that the boxes, which have been coated inside, are properly cured prior to placing the test specimens on the exposure area.

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 inside and outside of the boxes.

[1]Unpublished Report, ASTM Committee D01 on Coatings and Related Materials; Subcommittee .27 Accelerated Tests for Protective Coatings; Task Group .10 Accelerated Outdoor Weathering.

5.2.2 Black boxes must have 13 mm (0.5 in) drain holes on 150 mm (6 in) center drilled 13 mm (0.5 in) in from the bottom edge to provide for drainage during rain events.

5.2.3 There are two sizes of black boxes currently in use as illustrated in Figs. 2 and 3. The dimensions of the box used must be included in the exposure report.

5.3 Exposure Racks (General Usage):

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. Material specifications for the various car makers 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).

6.1.3 Relative humidity (daily maximum and minimum).

6.1.4 Total time of wetness.

6.1.5 Solar radiation, T (total).

6.1.6 Solar radiation, UV (total ultraviolet), and

6.1.7 Solar radiation, CSW (centered selected wavelength), optional.

7. TEST SPECIMENS:

7.1 The coating systems for metal, and materials applied directly to coated metal (decorative tapes, logos, side molding, emblems, etc.), are to be applied to 100 x 300 mm (4 x 12 in) SAE J1008-1010 steel panels. The preparation of the panels shall be as specified by the various car makers.

7.2 Materials other than those covered in 7.1 may be of any suitable size, which shall be determined by the evaluation procedures that the specimens will be subjected to after exposure. Test samples or specimens taken from a component or assembly should present an exposure surface that is as flat as possible.

7.3 When required for materials other than steel, 3 mm (1/8 in) holes shall be placed 6 mm (0.25 in) in from each corner of the test specimen to provide a means of affixing the specimen to the exposure rack. The size and placement of the holes may be adjusted to insure the specimen is free to expand or contract during exposure.

7.4 Specific instructions must be obtained from the car maker of interest for mounting procedures and the exposure method for large parts of, or full components and/or assemblies.

7.5 The size and number of test specimens that are to be exposed is more fully covered in material specifications of the various car makers.

8. PROCEDURE:

8.1 As indicated by the car maker, place the test specimen on a 5 deg rack as described in Procedure A, or a 5 deg black box as described in Procedure B.

8.2 The black box exposures are meant to simulate the air heat sink characteristics of an automobile body. The panels to be tested must cover the entire open top side. If the number of panels to be exposed is not sufficient to cover the entire opening, black-painted sheet metal panels must be used to fill all the open areas.

8.3 During exposure, all test panels and/or specimens are to be rinsed monthly by hosing them down with tap water at the end of the morning dew formation.

8.4 Prior to evaluation, coating systems only are to be prepared as follows:

8.4.1 Wash upper 200 mm (8 in) using a soft sponge and a mild liquid detergent, such as Ivory, Joy, or equivalent, and clean tap water solution (ratio 5:95).

8.4.2 Rinse immediately with clean tap water and dry using clean compressed air.

8.4.3 After washing and drying, polish the top 100 mm (4 in) using Original DuPont Formula #7 Auto Polish and Cleaner made by Borden, Inc., or equivalent.

8.5 All other materials, decorative tapes, logos, moldings, emblems, coated fabrics (vinyl top), uncoated plastics, etc., are to be washed only using the procedure described in 8.4.1 and 8.4.2 unless otherwise indicated by the different automotive manufacturers.

9. REPORT (See Fig. 4):

A report containing the following shall be submitted with the exposed samples:

9.1 Exposure site

9.2 Material

9.3 Substrate

9.4 Procedure A or B (include dimension of black box if used)

9.5 Exposure dates

9.6 Solar radiation, T (total)

9.7 Solar radiation, TUV (total ultraviolet)

9.8 Solar radiation, CSW (centered selected wavelength) optional

9.9 Total time of wetness

NOTE: Manufacturer and the type of instrument used to obtain data for 9.6, 9.7, 9.8 and 9.9 shall be included in the report.

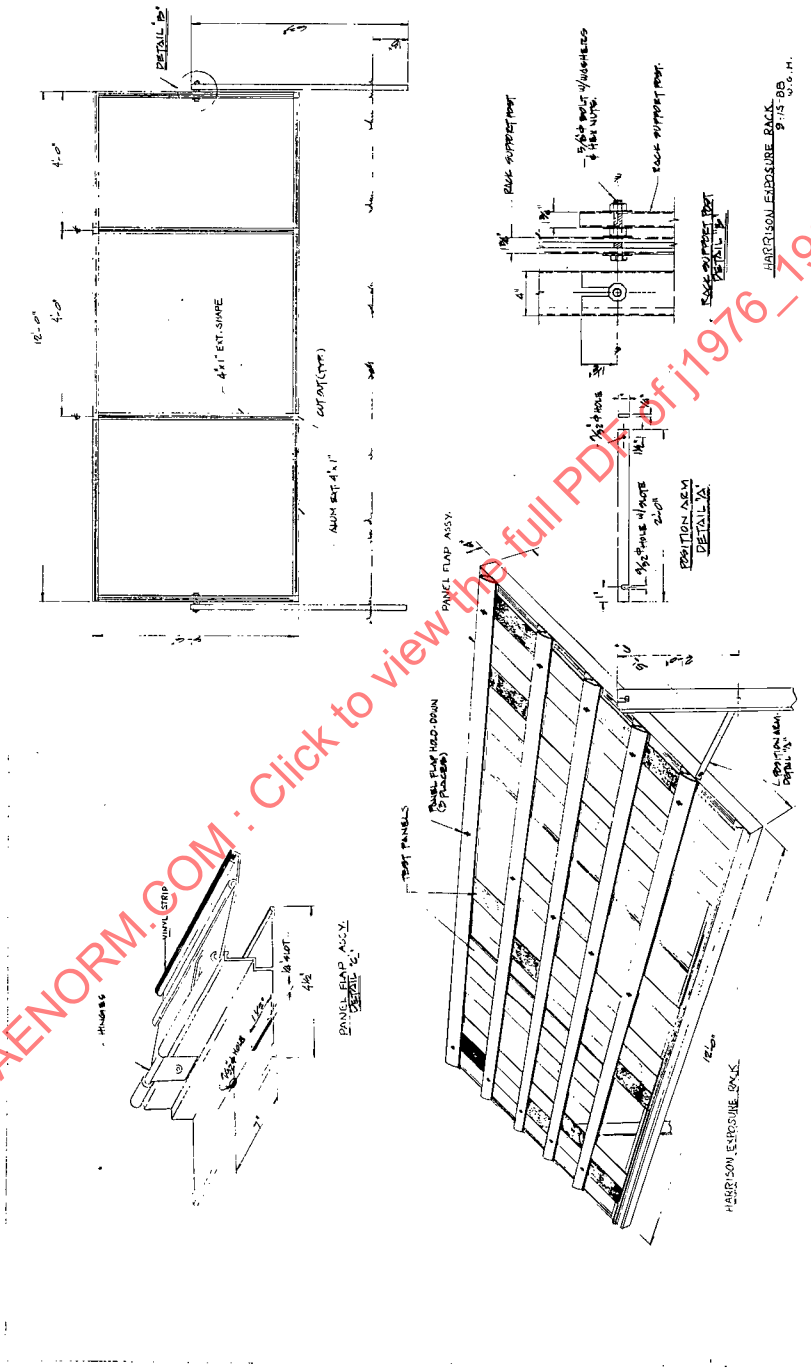
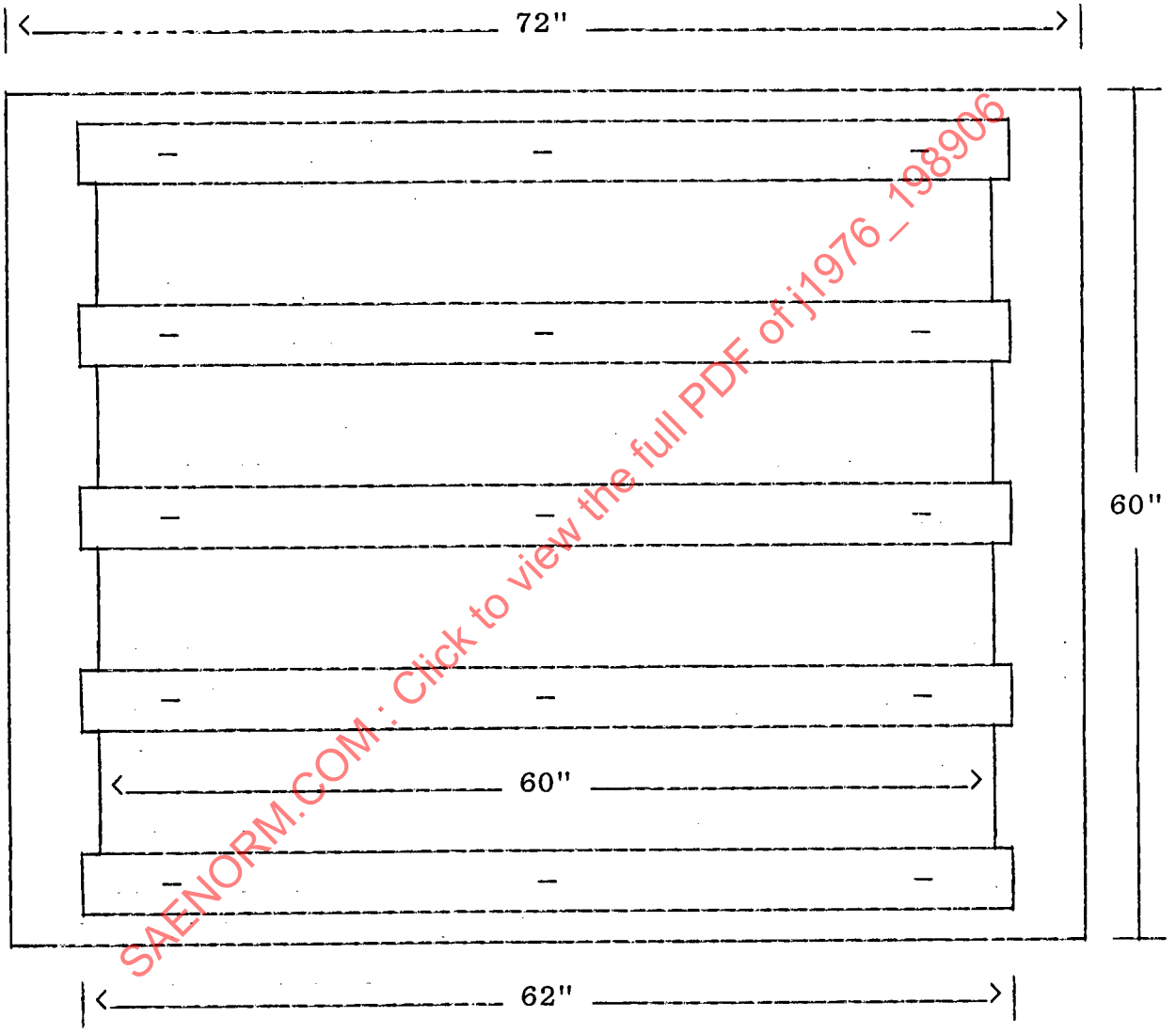
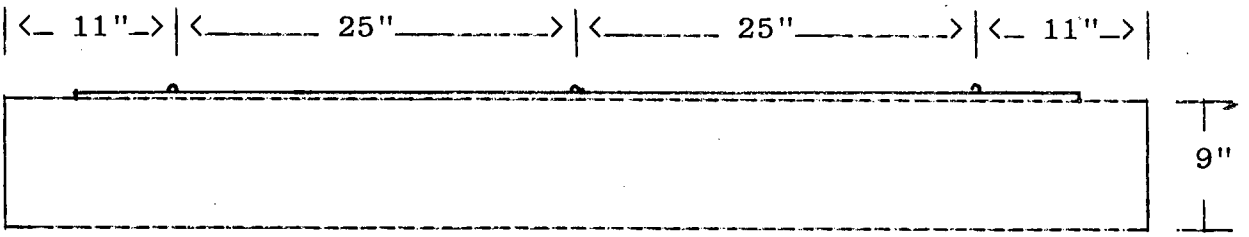


FIGURE 1

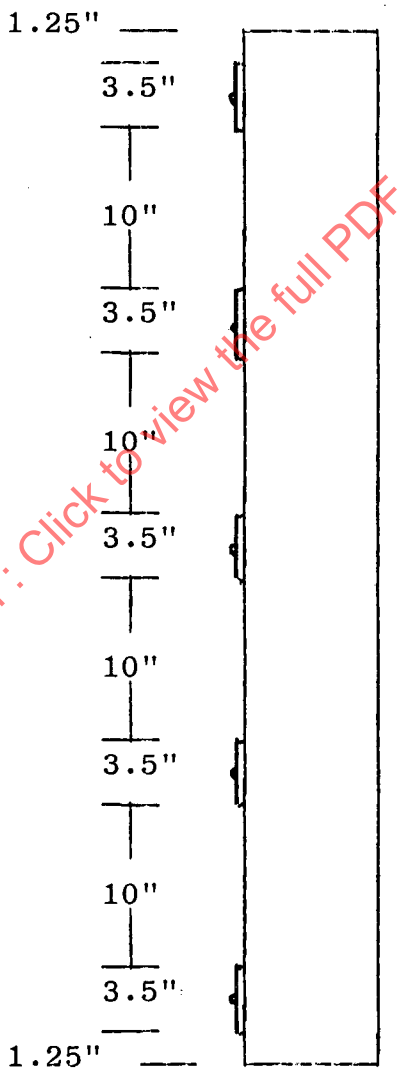


TOP VIEW

FIGURE 2A - Small Black Box



FRONT VIEW



END VIEW

FIGURE 2B - Small Black Box

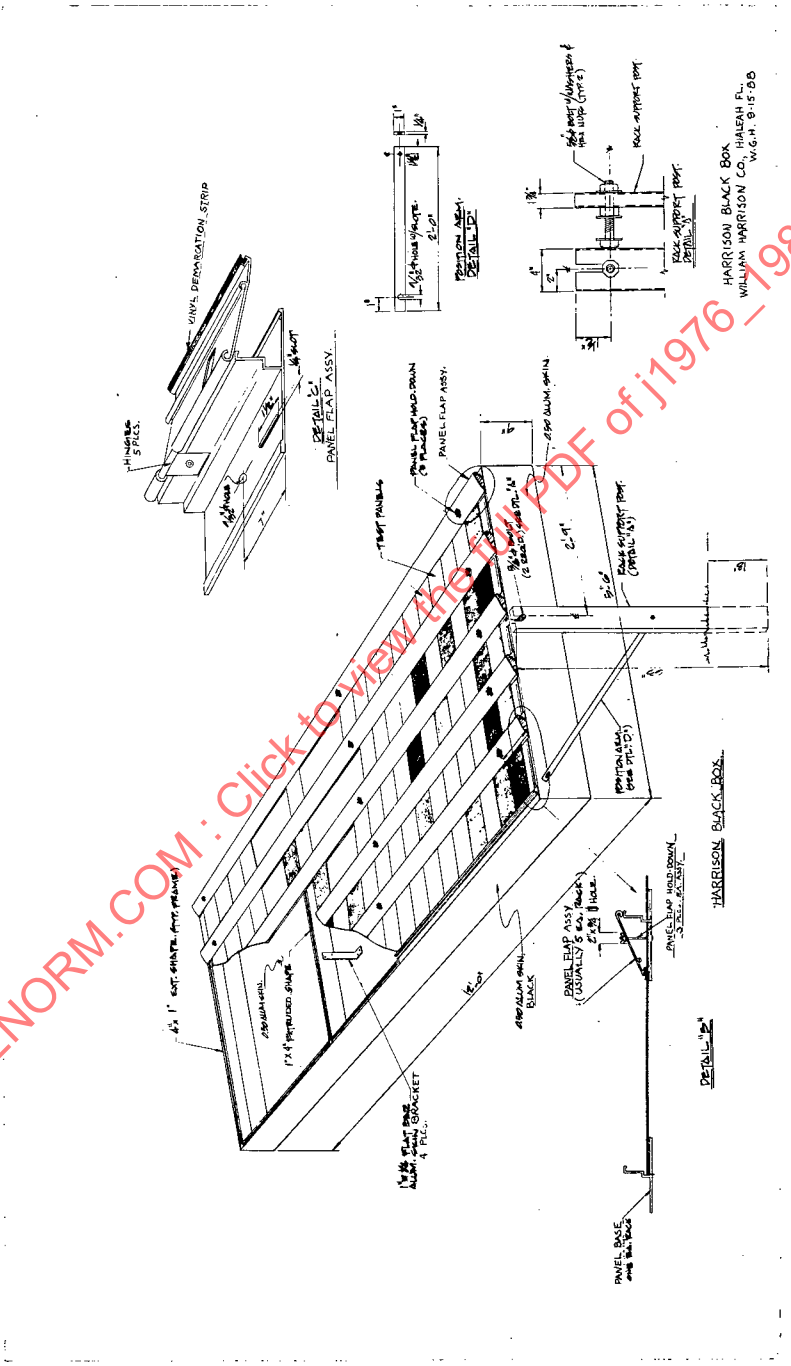


FIGURE 3