



Outdoor Weathering of Automotive Exterior Materials

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard describes the procedures for evaluating the outdoor weathering properties of materials used on the exterior of the vehicle. These include paint materials, miscellaneous finishing materials for components or assemblies, and abrasion resistant optical finishes for lenses.

1.2 Applicability. Materials used on the exterior of the vehicle.

1.3 Remarks.

1.3.1 Specimen exposure should duplicate the most severe conditions that may occur. Unless otherwise indicated by the responsible engineer, Procedure 1 (see 1.3.2) is used for all paint materials (liquid, powder or laminated films), Procedure 2 (see 1.3.3) is used for applied parts and components and special paint or coating evaluations and Procedure 3 (see 1.3.4) is used for clear lens coatings. There will be no substitution of other types of exposure apparatus from that specified by the responsible engineer.

1.3.2 Procedure 1. Black Box exposure at a fixed angle of 5 degrees from horizontal facing due south. The paint or coating is applied to 100 mm × 300 mm metal or plastic panels for exposure. Flexible test samples or small samples such as emblems may be mounted to metal panels by any method which will ensure that they remain attached throughout the specified exposure period.

1.3.3 Procedure 2. Special Tests. These are established on an as-needed basis by the responsible engineer to duplicate end-use conditions. Examples are in-service position of large assemblies or components that cannot be accommodated on the black box; evaluation of coatings or metal treatments (anodizing, chrome plating, etc.) at exposure angles other than 5 degrees south; use of different types of exposure racks and conditions (i.e., 45 degrees south plus salt water spray to duplicate corrosion conditions, or open rack exposure as described in SAE J1976). Other examples are test apparatus that track the sun with mirrors with/without additional water spray.

1.3.4 Procedure 3. Open Rack (direct weathering) at 45 degrees to the horizontal facing south. Requires three (3) year weathering of plastics materials, used for optical lenses and reflectors of motor vehicle lighting equipment, as specified in the Outdoor Exposure Test specified in 49 CFR 571.108.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

49 CFR 571	ASTM D714	ASTM D4214	SAE J1976
ASTM D523	ASTM D1474	SAE J576	
ASTM D610	ASTM D1654	SAE J1545	

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Black Box. Details and drawings per SAE J1976. The box must be painted with flat black high temperature paint. Boxes shall be fitted with a 64 mm shield to provide an unexposed area on the test piece. Boxes should be placed on supports approximately 1.2 m (4 ft) above the ground. Rack location should be on a clean surface, such as a lawn or a hard surface such as concrete or gravel that is typical of the exposure location. Racks should be away from trees and shrubs that could shade the panels or attract birds and insects that could damage test specimens.

3.2.2 General Exposure Racks. For Procedure 2 (see 1.3.3), general exposure racks, as described in SAE J1976, are designed to accommodate any samples, such as odd shapes and sizes, assemblies and other components.

3.2.3 Open Rack. These are standard panel racks described SAE J1976 used for Procedure 3 (see 1.3.4) and for designated specimens or coatings per Procedure 2 (see 1.3.3).

3.3 Test Vehicle/Test Piece.

3.3.1 Instrumentation.

3.3.1.1 Tristimulus Colorimeter or Spectrophotometer. Must meet the requirements of SAE J1545.

3.3.1.2 Gloss Meter. Must meet the requirements of ASTM D523. Report measurement angle and reading.

3.3.1.3 Distinctness of Image (DOI) Meter. Report values.

3.3.1.4 Indentation Hardness Tester. Must meet the requirements of ASTM D1474, Method A. Report Knoop Hardness.

3.3.1.5 Instrumentation, Climatological. Instrumentation shall be located in the immediate area of the exposure racks. Data should be recorded daily and be available as requested.

3.3.1.5.1 Solar radiation, Total Ultraviolet (TUV) 290 nm to 385 nm as measured by a Total Ultraviolet Radiometer (TUV) or equivalent. Reporting shall be in Mega Joules per Meter Squared (MJ/m²).

3.3.1.5.2 Solar radiation, Total (T), as measured by an 8 to 48 Pyranometer (World Meteorological Organization (WMO) Class 2) or Precision Spectral Pyranometer (PSP), (WMO Class 1), or equivalent. Reporting shall be in Mega Joules per Meter Squared (MJ/m²).

3.3.1.5.3 Ambient temperature, daily maximum and minimum. Measurement shall be reported in Celsius.

3.3.1.5.4 Daily maximum and minimum panel temperature measured at 5 degree; South Black Box and 5 degree South Open Rack on painted black; (GM black color identification number WA8555) and white; (GM white color identification number WA8554) panels. Panels must have minimum gloss and DOI of 80. Any prime and topcoat technology is satisfactory, as long as color, gloss, and DOI are maintained to standard. Temperature must be checked on both steel and 3 mm thick plastic panel. Unless otherwise specified, use phase alpha Sheet Molding Compound (SMC) as the plastic substrate. Thermocouples are T-type (copper/constantan) embedded just under the paint surface. For steel panels, solder the thermocouple to the panel prior to painting using tin/lead solder. For plastic panels, drill through the back, to within 250 µm to 450 µm but do not break through the surface. Epoxy the thermocouple in place.

Note: Panels must be replaced as required to maintain original gloss, DOI and color match.

3.3.1.5.5 Relative humidity (daily maximum and minimum).

3.3.1.5.6 Total time of wetness on both black and white panel, steel and plastic substrates described in 3.3.1.5.4.

3.3.1.6 Miscellaneous Materials.

3.3.1.6.1 Deionized or distilled water.

3.3.1.6.2 Solution of a mild liquid detergent, such as unscented liquid Ivory or Joy (or equivalent), and deionized or distilled water at a ratio of 5:95.

3.3.1.6.3 Use GM approved polish materials; see responsible engineer for approved materials.

3.3.1.6.4 Natural or synthetic sponge for washing.

3.3.1.6.5 Non-scratching, lint-free, residue-free wiping cloths, such as Rymplecloth or equivalent.

3.4 Test Time. Dependent on time required by specific application.

3.5 Test Required Information. See 5.3.1.

3.6 Personnel/Skills. Technicians skilled to run tests to requirements.

4 Procedure

4.1 Preparation.

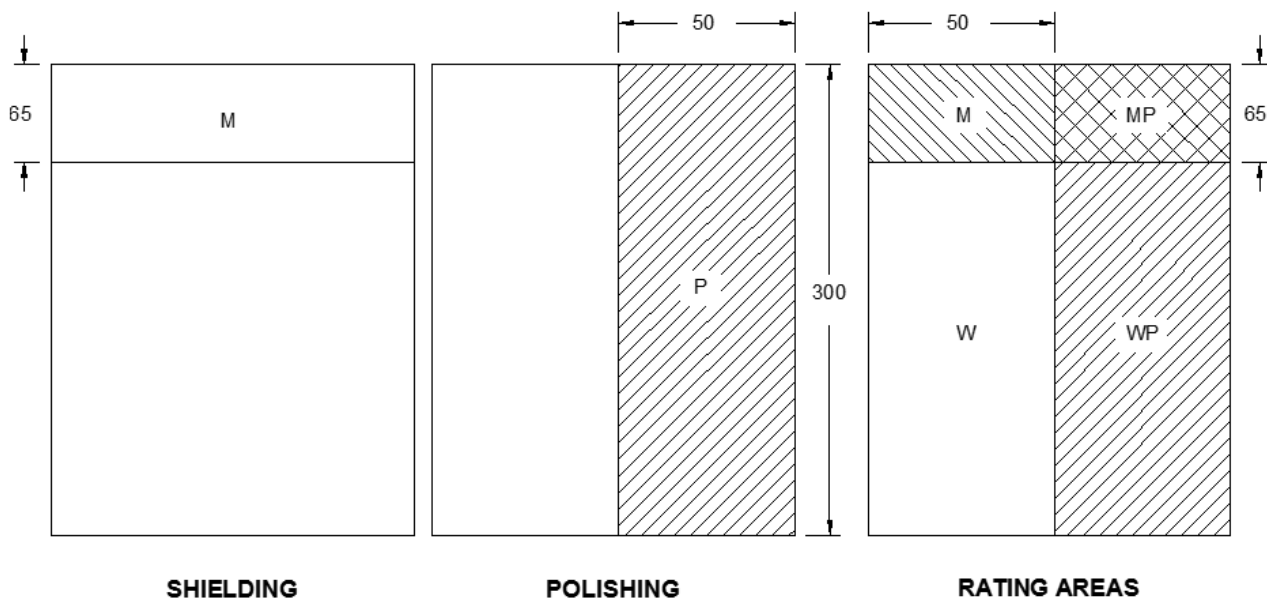
4.1.1 Test Sample Preparation.

4.1.1.1 Exposure Site Location. The exposure site for all exterior paint technology approval and exterior color development approval will be south Florida (Miami area). The exposure site for other testing or use of this standard will be approved by the responsible engineer prior to testing.

4.1.1.2 Test Specimens. All paint or coatings for exposure on typical racks should be applied to 100 mm× 300 mm flat metal or plastic panels. For proper placement in the Black Box, panels must have 300 mm as one dimension. If plastic plaques are smaller than specified, mount them on metal panels of proper dimension.

4.1.1.2.1 Flat Panels. Typical exposure racks will shield a portion of both top and bottom of test samples. Panels for paint material testing (Procedure 1 see 1.3.2) must have a 64 mm section at the top shielded from direct sunlight by the flap that is part of the exposure rack (see Figure 1). For Black Box exposure, ensure that the entire rack surface is covered with panels to maintain maximum temperatures. Non-test panels are used to fill the box if there are insufficient test samples. Any additional instructions or deviations from standard procedure will be provided by the responsible engineer to address requirements of other finishing materials.

Figure 1: Compare View of Shielding, Polishing and Rating Areas (all dimensions in millimeters (mm))



Key: M= Masked, MP = Masked and Polished, P = Polished, W = Washed, WP = Washed and Polished.

4.1.1.2.2 Parts, Components. When testing in accordance with Procedure 2 (see 1.3.3), assemblies, components, or specific test materials may require an expanded metal or solid backing for support or to more closely simulate end user applications. When required, 3 mm holes may be placed 6 mm in from each corner of the specimen to affix it to the rack so that it can freely expand and contract. (Size and placement of the holes may be adjusted to fit a specific sample). Specific instructions must be obtained from the responsible engineer for mounting procedures, exposure method and masking requirements.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

© Copyright 2017 General Motors Company All Rights Reserved