



Performance Requirements for Exterior Plastic Parts

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 covers the performance requirements of plastic parts used in exterior automotive applications. The parts may be functional assemblies or may be a subassembly of, or attached to, metallic, decorative or functional parts.

Note: For coated (painted, etc.) parts, not all tests are required. See Appendix A, Table A1 for the specific requirements. Additional requirements for coated or painted plastic parts or parts which incorporated metals in their construction are given in the relevant performance requirements.

1.2 Applicability. All exterior plastic parts that are molded-in-color, painted or hard coated.

1.3 Remarks. Not limited to only plastic parts. Can be used for rubber, textile, foam, etc., if applicable. When possible, test components as an assembly.

2 References

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

2.1 External Standards/Specifications.

ASTM D523	ISO 4892-1	ISO 7724-1	SAE J1767
ISO 105-A02	ISO 4892-2	SAE J1545	SAE J2527
ISO 3865			

2.2 GM Standards/Specifications.

9982223	GMW3221	GMW14688	GMW15719
9982224	GMW14093	GMW14700	GMW16955
GMW3059	GMW14162	GMW14729	GMW17084
GMW3116	GMW14334	GMW14864	GMW17456

2.3 Additional References.

- Component Technical Specification (CTS)
- Subsystem Technical Specification (SSTS)

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities.

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

3.1.1.2 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.

3.1.2 Equipment. See 4.1 through 4.12 and 4.14.

3.1.3 Test Vehicle/Test Piece. Unless otherwise specified in the relevant test procedure for the property concerned, either the complete component or a section of that component shall be used for test pieces. Unless otherwise specified in the appropriate test procedures, at least three (3) test pieces shall be tested. For test procedures that require a complete component, components shall be randomly selected from a minimum of 50 parts if not otherwise agreed to by the responsible GM Materials Engineer.

Note: If regrind is to be used, all test parts, surrogate parts and/or plaques must be manufactured with the maximum amount of regrind the supplier intends to use. The maximum amount allowed for injection molded parts shall be RE20HS = 20% maximum Home Scrap regrind. Home Scrap regrind as defined in GMW3116 as scrap that is reused back into the same part. If no Regrind (RE) suffix appears on the drawing/math file, no regrind is approved for use.

3.1.4 Test Time. See 4.1 through 4.12 and 4.14.

3.1.5 Test Required Information. See 4.1 through 4.12 and 4.14.

3.1.6 Personnel/Skills. See 4.1 through 4.12 and 4.14.

3.2 Preparation. See 4.1 through 4.12 and 4.14.

3.3 Conditions.

3.3.1 Environmental Conditions. Unless otherwise stated in respective test procedures, all samples shall be conditioned prior to each required test according to GMW3221, Code A.

3.3.2 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.

3.4 Instructions. See 4.1 through 4.12 and 4.14.

3.5 Data. See 4.1 through 4.12 and 4.14.

3.6 Safety.

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. The test report shall have the same outline and numbering as this test specification.

Note: If surrogate data is to be used, there must be documentation stating; actual surrogate part, molding process, approved material (GM specification, Supplier, and Product code), color, grain, gloss, and amount of regrind.

4 Requirements and Procedure

4.1 Weather-Ometer Resistance (SAE J2527/ISO 4892-1, ISO 4892-2). Reference Table 1 for exposure limits. A class shall be called out based upon the part application (typical examples are provided).

Note: Only for unpainted parts with exposure to direct or indirect sunlight. If the entire part cannot be exposed, the GM Materials Engineer shall determine the location of the test samples.

4.1.1 International Organization for Standardization (ISO) Procedure. Test as per the conditions of ISO 4892-1 and ISO 4892-2.

- Inner and outer filter: Borosilicate
- Radiant exposure: 0.50 W/m² at 340 Nm
- Test Program Cam No. 7
- Light Only: 102 minutes ± 0.5 minutes
- Light and Spray: 18 minutes ± 0.5 minutes
- Black Standard Temperature: 80 °C ± 3 °C

4.1.1.1 Visual Evaluation. Wash weather specimens prior to measuring and making observations. Wash with scrubbing action, using a sponge that is saturated with a solution consisting of soap and deionized water at 23 °C ± 3 °C.

Table 1: Exposure Limit Guidelines

Application	Class ^{Note 1}	Test Method	Radiant Energy
Parts exposed to direct sunlight above the belt line with large horizontal surfaces (e.g., tonneau covers, cargo box trim, fascia uppers, step pad or top cap, vinyl roof/simulated convertible, rear end spoilers/horizontal appliqué, decorative decals, emblems, nameplates, ornamentation, and anti-chip film).	1	SAE J2527	≥ 4500 kJ/m ²
		ISO 4892-1 ISO 4892-2	≥ 5400 kJ/m ²
Parts exposed to direct sunlight above the belt line with midsize horizontal surfaces and parts that have both vertical and horizontal surfaces (e.g., cowl vents, body mounted pillar and license plate appliqué, grilles, wheel opening moldings, ditch moldings, glass trim, and roof/luggage racks).	2	SAE J2527	≥ 3500 kJ/m ²
		ISO 4892-1 ISO 4892-2	≥ 4200 kJ/m ²
Other parts exposed to direct sunlight above the belt line and all parts exposed to direct sunlight below the belt line (e.g., body side moldings, lower body claddings, rocker moldings, mud guards, assist steps, bumper systems, antenna housing, sunroof assembly, and mirror housing).	3	SAE J2527	≥ 2500 kJ/m ²
		ISO 4892-1 ISO 4892-2	≥ 3000 kJ/m ²
Hidden parts not exposed to direct sunlight.	4	SAE J2527	≥ 1250 kJ/m ²
		ISO 4892-1 ISO 4892-2	≥ 1500 kJ/m ²
Parts with no exposure to direct sunlight.	5	SAE J2527	0 kJ/m ²
		ISO 4892-1 ISO 4892-2	
Hidden parts only exposed when door/closure open (e.g., sill plate moldings).	6	SAE J2527	≥ 275 kJ/m ²
		ISO 4892-1 ISO 4892-2	≥ 300 kJ/m ²

Note 1: In case no class is assigned, Class 3 applies as the default standard for the radiant energy. To ensure timely Production Part Approval Process (PPAP), at the discretion of the responsible GM Materials Engineer, surrogate parts or plaques may be weathered instead of actual production parts (Regional validation timing constraints will dictate this). If allowed, surrogate parts or plaques must have been processed similarly to the production parts (e.g., injection molded or vacuum formed, same material, same color, same grain, same gloss, and amount of grind).

4.1.1.2 Examination with Microscope (Enlargement: 50×). Test pieces shall show no cracks, no pores or other damages of surface.

4.1.2 SAE International Papers. Test as per the conditions of SAE J2527 Method A with extended filters.

4.1.2.1 Inspect per 4.1.1.1 and, if needed 4.1.1.2.

4.1.3 Requirement. Exposed parts shall not exhibit any indications of surface tackiness or embrittlement, change in hardness, blooming, blistering or other factors that might affect the function or appearance of the part.

4.1.3.1 Color Change. The color change of Delta E* (ΔE^*) shall not be greater than 3.0 units ($E^* \leq 3.0$ is allowed) or less than a rating of three (3) to four (4) according to ISO 105-A02 grey scale. The color change shall be measure per ISO 7724-1, or SAE J1545 and SAE J1767 (CIELAB color space, 10 degrees observer, metering orifice ≤ 25 mm, illuminant D65 and Specular Component Included (SCI)), or CIE L*a*b*, D65 illuminant and SCI. Visual color change that is considered objectionable shall override the Delta E* measurement. The part must not exhibit objectionable color change.

4.1.3.2 Gloss Change. On each part, measure gloss per ASTM D523, using 60 degree geometry. If the 60 degree gloss of the original unweathered sample is higher than 70 units, 20 degree geometry should also be used to measure the gloss in this area, both before and after exposures. If the part is intended for high gloss > 70 , the classification is based on the 20 degree geometry measurement. Semi-gloss is considered 10 to 70, then the classification is based on the 60 degree geometry measurement. The gloss retention shall be 80% or greater for Class 1, 75% or greater for Class 2, 60% or greater for Class 3, and 50% or greater for Class 4.

Note: This test is only required for smooth, high gloss, molded-in-color parts.

4.2 Resistance of Material to Heat Aging. Test parts in the free-state, shipping rack or fixture representing vehicle mounting position, shall be exposed for $168 \text{ h} \pm 2 \text{ h}$ (7 days) in an air-circulating oven operating at:

- Above belt line parts: $85 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$
- Below belt line parts: $75 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$

Note: This test is required for all parts (molded-in-color, painted or hard coated).

4.2.1 Requirement. Test parts shall show no significant surface changes, particularly changes in color or gloss, no embrittlement, no increase in hardness, no objectionable shrinkage or other changes detrimental to serviceability. The part shall also be assembled to the vehicle or checking fixture after heat age test without any issues.

4.3 Dimensional Stability. Test parts shall be assembled to jigs or formers so as to simulate as closely as possible, actual service conditions. The test setup shall be reviewed by at least one (1) of the following:

- GM Design Release Engineer
- GM Validation Engineer
- GM Materials Engineer

The complete test assembly shall then be subjected to the test cycle per 4.3.1.

4.3.1 The test cycle may be commenced at any of the individual stages, provided the full cycle is sequentially completed.

- $17 \text{ h} \pm 0.5 \text{ h}$ at $-30 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$
- $72 \text{ h} \pm 1 \text{ h}$ at $85 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$ (Class 1, Class 2 or Class 3) or $75 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$ (Class 4 or Class 5)
- $24 \text{ h} \pm 1 \text{ h}$ Humidity (per GMW14729)
- $7 \text{ h} \pm 0.5 \text{ h}$ at $-30 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$
- $24 \text{ h} \pm 1 \text{ h}$ Humidity (per GMW14729)
- $24 \text{ h} \pm 1 \text{ h}$ at $22 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$

Note: This test is required for all parts (molded-in-color, painted or hard coated).

4.3.2 Requirement. Test pieces shall show no cracking crazing, appreciable color changes, discoloration, cloudiness, blistering, objectionable shrinkage, deformation, loss of adhesion to the substrate between layers of the composite or other changes detrimental to serviceability. Test pieces shall comply with the dimensions specified on the drawing after completion of the test (parts must be checked on the checking fixture before and after exposure). Measurements shall be made after each stage of the cycle. The measurements shall be taken