



Decorative Tint Over Metallization Coating for Exterior Lighting

1 Scope

1.1 Material Description. This specification covers the material requirements for vacuum-deposited metal coatings with subsequent decorative tinted topcoat that is protected by an outer lens. The metalized finish is created using Physical Vapor Deposition (PVD); i.e., vacuum evaporation, sputter deposition, arc vapor deposition, etc. An organic topcoat is subsequently applied after vacuum deposition to add appearance or color effects.

1.2 Symbols. Not applicable.

1.3 Applicability. These coatings are intended to enhance the appearance of exterior lighting reflectors, bezels and decorative components which are protected by a lens within an assembly.

1.4 Remarks.

1.4.1 Each combination of metallization system, including pretreatment, metal target, and coating must be approved to this specification as a system.

1.4.2 Substrate must be approved to the appropriate GM material specification.

1.4.3 This standard may involve hazardous materials, operations and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 References

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

2.1 External Standards/Specifications.

ASTM D7869	ISO 9001	SAE J1545	SAE J2527
ISO 2808	ISO/IEC 17025	SAE J1945	

2.2 GM Standards/Specifications.

GMW3059	GMW14124	GMW14704	GMW15891
GMW3221	GMW14270	GMW14729	GMW17572
GMW3235	GMW14650	GMW14829	

2.3 Additional References.

- Safety and Industrial Hygiene (S&IH) Technical Standard (TS), S&IH TS 3.4-160-02

3 Requirements

See Appendix A, Table A1 for a listing of part performance requirements. Each test shall be performed in triplicate. Requirements are separated according to the following process stages:

- **Equipment/Construction Approval:** This set of tests is for a new topcoat approval not previously been approved by GM.
- **Color Approval:** These tests are intended for a change in color to an approved coating construction.
- **Approved Paint on Parts (APOPS):** These tests are intended for an approved coating and color in a new facility or applicator or with a different basecoat or metal layering. If the applicator and equipment are unchanged from coating approval, these tests can be skipped.

3.1 Requirements on Test Specimens.

3.1.1 Substrate. Before beginning testing for approval, GM and the supplier (equipment or applicator) shall agree on substrate material and thickness for test panels.

All substrates used must be identified by source, product code and part number where appropriate. The surface shall be smooth, free of surface contamination, flow lines, cracks, sink marks, craters or substrate stratifications which may influence the approved appearance or part properties. Some molding artifacts such as parting lines flash and gate marks can have a deleterious effect on the durability of the finish and must be minimized.

3.1.2 Surface Preparation. The surface must be clean and free of surface defects which would affect performance or appearance. All pretreatments shall be fully identified per specimen.

3.1.3 Production Part Approval Testing. Testing should be conducted for production part approval with appropriate lens material and color used covering the panel.

3.2 All materials supplied to this standard must comply with GMW3059, Restricted and Reportable Substances, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.

3.3 Submission Package. The Metallization APOPS Request Form from GMW17572 (Table A1) must be included in the submission package. All data and documentation generated during the material development must be included and approved by the responsible GM Materials Engineer. An electronic copy must be prepared and distributed to the responsible engineer of the approving region(s). The documentation is to be in English and the local language of the lead GM region.

3.3.1 Material Identification. All coatings used in the submission must be identified by product code, batch number and batch date. Color name must be included where appropriate. All related surface preparation used must also be identified.

3.4 Facilities. Laboratory testing shall be performed by a laboratory that conforms to ISO/IEC 17025 or ISO 9001 or other 3rd party accreditation and is acceptable to the GM Materials Engineer. Supplier shall submit documentation showing proof of accreditation.

3.5 Test Conditions.

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

3.5.2 Unless otherwise specified, samples shall be subjected to testing after a minimum aging period of 72 h following the coating, baking or drying cycle.

3.6 Coating Thickness/Film Build. For each construction approval, the equipment supplier shall establish minimum, target, and maximum values for the thickness of each layer. The topcoat upper and lower boundary conditions of the recommended film build range shall be tested to the requirements in this specification. For part approval, the coating thickness should be confirmed to be within the recommended range.

Note 1: Metallized layer thickness shall be established as part of the equipment/applicator approval process.

3.7 Color. See Appendix A, Table A1.

3.8 Adequacy of Cure. See Appendix A, Table A1. Surface of the part must be within the range of time and temperature specified by the coating supplier for cure, and must be checked per GMW15891. Time in oven or Ultraviolet (UV) exposure and ambient temperature must be regulated to meet this requirement without exceeding over/under cure of certain coatings. The Coating Suppliers Commercial Product Data Sheet shall contain these details.

3.9 Tape Adhesion. See Appendix A, Table A1. No scribe required. Do not allow tape to contact parting line or sharp edge.

3.10 Humidity. See Appendix A, Table A1. If using production parts, orient parts to prevent water pooling on the metallized surface. If necessary, hanging of the parts may be necessary to prevent water pooling. Areas with deep pockets and areas with sharp edges may have some acceptable metal removal due to the design limitation of the topcoat.

3.11 Water Immersion. See Appendix A, Table A1.

3.12 Automotive Environmental Cycle. See Appendix A, Table A1.

Note: If using production parts, orient parts to prevent water pooling on the metallized surface.

3.13 Oven Aging. Samples shall be exposed to 600 h of dry oven aging at 120 °C, followed by tape adhesion per GMW14829 with no scribe. At the end of the test, samples shall show no cracks, blisters or other anomalies. The tape adhesion site shall have a maximum rating of 1.

3.14 Aging at Maximum Use Temperature. This test is meant to determine the durability of the coating in a maximum use temperature for exterior lighting. Choose a suitable substrate. Samples shall be exposed for 96 h of dry oven aging at 150 °C, followed by tape adhesion per GMW14829 with no scribe.

3.15 Fogging Characteristics. See Appendix A, Table A1.

3.16 Accelerated Weathering. For initial coating approval and any color change, material should be tested per SAE J2527 or ASTM D7869 without any lens covering material. At level 1 testing (SAE J2527 2500 kJ/m²) there should be no evidence of blistering, blemishes or delamination. The color change shall not exceed a Delta E* (ΔE*) of 3.0 units as measured per GMW14650. Continue testing to level 2 (SAE J2527, 4500 kJ/m²) to simulate horizontal exposure. Testing should be conducted for production part approval with appropriate lens material and color used covering the panel.

4 Manufacturing Process

4.1 Source Shipment Responsibility. It will be the responsibility of the supplier to ensure that the material is not exposed to temperatures during shipment which would cause the material to fail to meet any of the requirements of this specification.

4.2 Initial Source Approval. No shipment shall be made by any supplier until representative initial production samples have been approved by GM Materials Engineering as meeting the requirements of this specification.

4.2.1 Completed copies of the Material Safety Data Sheet (MSDS) meeting GM information requirements must be submitted with any new submissions or whenever a composition change has occurred.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.

5.4 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements. In addition, product MSDS/SDS submissions must be in compliance with specific country General Motors S&IH TS 3.4-160-02 where available.

6 Approved Sources

Materials supplied to this specification must be approved by General Motors.

A list of approved materials can be found in GM Materials Approved Source List. To access this list, reference GMW14270 for latest location. This GM material file is provided to third parties to reduce redundant testing of materials. If an approved material is used, the part supplier can use the GM material file reference for Production Part Approval Process (PPAP) material approval. If the decision is made to use a not yet approved material, contact GM Materials Engineering for details on the approval process. The material approval process must be completed prior to PPAP start date of the part supplied to General Motors.