



Thermal Cured Abrasion Resistant Coating For Lighting Applications

1 Scope

1.1 Material Description. This specification covers the requirements for a clear, weatherable, thermally cured hardcoat for exterior applications. The coatings in this specification are for protective purposes on plastics.

1.2 Symbols. Not applicable.

1.3 Applicability. Exterior lighting lens covers or other applications where polycarbonate substrates require a protective coating to allow usage in an exterior environment.

1.4 Remarks. These thermally cured coatings are part of a total painted product system and must meet the requirements set forth in this specification and those shown on engineering drawings.

1.4.1 The substrate must be approved to the appropriate GM material specification and listed in a GM Materials Approved Source List.

1.4.2 This specification shall be used in conjunction with the Approved Paint on Plastics System (APOPS), a section of the GM Materials Approved Source List, for suppliers, which lists approved substrate, cleaning, priming, and topcoat combinations.

1.4.3 APOPS per GMW14797 is required for the Production Part Approval Process (PPAP) for all applications referencing this specification.

1.4.4 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 D1003	ASTM D7869	ISO 4892	SAE J576
ASTM D1044	IATF 16949	ISO/IEC 17025	SAE J2527

2.2 GM Standards/Specifications.

GMW3059	GMW14334	GMW14729	GMW15891
GMW3221	GMW14650	GMW14797	GMW17414
GMW14124	GMW14700	GMW14829	GMW17456
GMW14270	GMW14704	GMW15777	

2.3 Additional References.

Approved Paint on Plastics System (APOPS)
Engineering Drawings
GM Materials Approved Source List
Material Specification
Qualification Procedure Section in the APOPS

3 Requirements

3.1 Requirements on Test Specimens. Unless otherwise specified, the materials shall be tested under standard conditions per GMW3221, Code A.

3.1.1 Facilities. For a new supplier to GM, all testing shall be performed in an accredited laboratory. Laboratory accreditations to ISO/IEC 17025 are acceptable. A current supplier planning to use a non-certified to ISO/IEC 17025 approved laboratory shall receive laboratory approval, prior to testing, from the GM Engineer responsible for the specific technology. Generally, the unaccredited laboratory should be in a facility that has a quality system approval to IATF 16949.

3.1.2 Test Piece. The number of samples for each test shall be three (3) per coating and per film build, unless the responsible engineer and supplier agree on a different number for specific tests prior to the start of testing. All substrates, pretreatments and coating layers shall be fully identified with source, product code and film build per specimen.

3.1.2.1 At minimum, the boundary conditions of the recommended film build range shall be tested to the requirements in this specification.

3.1.2.2 For initial source approval of the coating, the test specimens can be panels or component parts. If test panels are used, the recommended panel size is 100 mm × 150 mm.

3.1.2.3 The substrate must be clean and free of surface defects which would affect performance or appearance.

3.2 Application. Reduce and apply uniformly to achieve dry film thickness that will meet material and process specifications when used over clear lenses, pad print inks, or paints for decorative and blackout purposes.

3.2.1 Environmental Conditions. Unless otherwise specified, painted samples shall be subjected to testing after a minimum aging period of 72 h to 96 h following the baking or drying cycle. A shorter aging period may be used, provided it is recognized that this represents a more severe condition of test and that results obtained at different aging times fewer than 72 h are not a good basis for comparing the relative performance characteristics of paint finishes.

3.3 Cure. Surface of the part must be within the range of time and temperature specified by the supplier for cure. Temperature in oven and ambient temperature must be regulated to meet this requirement without exceeding over/under bake specifications. Cure must be checked per GMW15891.

3.4 Appearance. The panel appearance must exceed all requirements designated in GMW15777, Exterior Painted Parts Appearance Requirements, and GMW17414, Exterior Plastic Lens Quality Appearance Requirements.

3.5 Approval. For coatings to be initially approved per this specification, an extended production run must be made to confirm process, appearance, cost, and quality criteria. When testing is satisfactorily completed per the preceding requirements, approval to this specification will be given. The abrasion resistant coatings covered by this specification must be evaluated and approved for each specific lamp design.

3.6 APOPS. For specific system approval refer to the Qualification Procedure Section in the APOPS.

3.7 Requirements on Delivery. It will be the responsibility of the supplier to insure 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.

3.8 Performance Requirements. For a coating to be initially approved as a source, samples must meet the requirements of Table 1 and Table 2. For modifications outside the formulation limits of a previously approved technology, testing may be added or deleted by the responsible Materials Engineer.



Table 1: Performance Requirements

Performance Properties	Test Method	Additional Description	Minimum Requirement
Solvent Rub Method for Determining Cure of Painted Metal or Plastic Substrates	GMW15891	The coating supplier shall indicate the appropriate solvents and rating designation as part of the submission package. The submission package shall contain processing and testing details recommended for appropriate cure.	Maximum Rating of Zero (0).
Tape Adhesion Test for Paint Finishes	GMW14829 Method A	Cross-hatch at 1 mm spacing, six (6) cuts in each direction, tape choices: 3M610, 3M670 or 3M898	100% retention.
High Humidity and Tape Adhesion	GMW14729 Method A or Method B	240 h High Humidity Method A (38 °C) optional Method B (40 °C) followed by GMW14829 Method A	No evidence of blistering or other appearance change after exposure, 100% adhesion retention.
Automotive Environmental Cycle and Tape Adhesion	GMW14124 Cycle A	Cycle A (15 cycles of 1 h ambient, 20 h at GMW14729, 3 h at -30 °C ± 2 °C), followed by GMW14829 Method A	No evidence of blistering or other appearance change after exposure, 100% adhesion retention.
Oven Aging and High Humidity and Tape Adhesion	NONE for oven	Following Exposures prior to rating 70 °C for 7 days; 1: Remove and allow to recover to room temperature 2: Wipe with VM&P naphtha ^{Note 1} looking for visual changes against a control sample 3: Cross hatch per GMW14829, Method A on ½ side 4: GMW14729 for 96 h, then GMW14829	No evidence of blistering or other appearance change after exposure, 100% adhesion retention.
Water Immersion Test and Tape Adhesion	GMW14704	240 h at 38 °C ± 2 °C, followed by GMW14829 Method A	No evidence of blistering or other appearance change after exposure, 100% adhesion retention.
Stone Impact Resistance of Coatings	GMW14700 Method B	Not applicable.	Minimum rating of seven (7) per GMW17456 Appendix B. Maximum Chip Diameter 2.0 mm.
Taber Abrasion	ASTM D1044	500 cycles, 500 g load, CS-10F calibrated wheel.	Report Maximum Haze Percent per ASTM D1003
Chemical Resistance to Fluids ^{Note 2}	GMW14334 Code B	None	Rating two (2), no swelling, no dissolution, no change in gloss, no discoloration, no wrinkling (creasing) and no blistering.