



Exterior Paint Topcoat Color Qualification

1 Scope

1.1 Material Description. This specification covers the durability and performance requirements for evaluation of pigment combinations or pigmentation changes in all GM Colors in approved basecoat or clearcoat technologies. These materials are identified by color name, color description, e.g., solid, metallic, tricoat, tinted clearcoat, etc., WA-XXXX finish code, supplier code, batch number used for testing, basecoat and clearcoat system number 998XXXX (where applicable), L-number or other regional number, Target Bake Temperatures (T) and target time at substrate temperature.

1.2 Symbols. Not applicable.

1.3 Applicability. This specification covers all rigid and flexible topcoat colors which will be supplied to GM assembly plants or outside part sources. Performance criteria is dictated by the substrate/paint combination (Type and Class of the topcoat). This standard applies to Topcoat Classes 1 and 2 only. See GMW3005. Testing per this specification is required for a change in pigment type or a combination of pigments not previously used together. In addition, a change in the level of a pigment or a change in pigment-to-binder ratio may also require this specification to be completed.

Note: Colors are to be released for production after a minimum of 2 years Florida exposure (must include 2 full summers) with the primary color development supplier and a minimum of 1 year Florida exposure with the secondary color development suppliers and parts paint suppliers. All colors are to complete 5 years of outdoor Florida exposure, up to a maximum of 10 years depending on color usage and performance.

1.4 Remarks. Materials qualified to this standard must meet the performance requirements as outlined in Appendices A and B. Additional testing may be requested in writing, by the responsible GM engineer. The intent of the testing is to ensure that all GM colors, in approved topcoat technologies, will meet specified performance criteria as affected by pigmentation. This testing generally includes evaluation of colorfastness, chip resistance, flexibility and resistance to Ultraviolet (UV) transmission.

Exposure testing is required for colors in all basecoat technologies being supplied. Exposure under all clearcoat technologies is not required for conventional colors, however, tinted clearcoat colors must be exposed in all clearcoat technologies supplied.

Formal reviews of all exposure panels must be held annually and reports generated per Appendices A and B. All panels shall be retained by the supplier and provided for these reviews until completion of 5 years exposure testing up to a maximum of 10 years.

Colors in all basecoat technologies used for fascias must be evaluated on flexible substrates, even though an identical basecoat color is used for body paint technology.

2 References

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

2.1 External Standards/Specifications.

ASTM D279	ASTM D2196	ASTM D3960	ISO 2811
ASTM D823	ASTM D2369-04	ASTM D4212	SAE J1545
ASTM D1200	ASTM D2697-03	ASTM D4287	SAE J2527

2.2 GM Standards/Specifications.

GMW3005	GMW14729	GMW15187	GMW16746
GMW3059	GMW14829	GMW15545	
GMW14700	GMW14873	GMW15777	

3 Requirements

3.1 Documentation. A full description of the material, see Figure A1 in Appendix A, and documentation of performance compliance, see GMW3005 and GMW15777, is required.

3.1.1 Physical Properties. The supplier must document the following items:

- Formula (theoretical) values for weight solids (ASTM D2369-04), volume solids (ASTM D2697-03), and Volatile Organic Compounds (VOC) (ASTM D3960) at viscosity used to spray the test panels.
- Density (ISO 2811).
- Initial and application viscosity for Newtonian fluids (ASTM D4212) or for non-Newtonian fluids (ASTM D2196).

3.1.2. Pigmentation. Pigmentation is to be provided by:

- Detailed chemical name, color description and supplier code.
- Each pigment as a percent of total pigment.
- Average flake size (if applicable).
- Time of completion of the minimum 2 year pigment exposure requirement (if applicable). **Note:** Any pigment not previously used must have 2 years Florida exposure data reviewed and approved prior to use.
- Pigment-to-binder ratio.

Further identification of specific pigment and source must be provided upon request.

3.1.2.1 Pigment Stability Verification. The supplier must document that:

- The pigment is non-bleeding (ASTM D279).
- The pigment is not photochromic. **Note:** Photochromic pigments change color (often reversibly) with temperature and/or UV light.

3.1.2.2 Pigment Hardness. The supplier must document hardness using Mohs Hardness Scale. See 7.1.

3.1.3 UV Fortification Package. Identification of the chemical class, supplier code and amount of screener and/or hindered amine light stabilizers in each color, as a percent of weight solids.

3.2 Test Panel Preparation and Report (ASTM D823). The color must be visually approved and the pigmentation reviewed prior to initiation of testing. All test panels must be documented as to substrate, paint layers, filmbuilds and bakes at substrate temperature. All substrates and primers used must be approved materials per Approved Material List (MATSPC) and must be detailed per Figure A2 in Appendix A. There must be no difference in pigmentation between the color approval/appearance panels and the test panels. It is expected that all test panels are of the same color position. They must be a visual match to the specific Color Standard (from the GM Color Engineer) or as measured per CIELAB (SAE J1545), no greater than:

- L of ± 0.75 from Standard
- a of ± 0.75 from Standard
- b of ± 0.75 from Standard

3.2.1 Color Filmbuild Minimum (L). The filmbuild minimum for all body paint (assembly plant usage) colors will be defined through the laboratory study. These minimums must be equal to or greater than, the technology minimum. See Table 1.

Table 1: Filmbuild Technology Minimum ^{Note 1}

Technology	Minimum Filmbuild
Adhesion Promoter	7.6 μm (0.3 mil)
Primer for Parts	20 μm (0.8 mil)
Powder Primer Surfacer	38 μm (1.5 mil)
Liquid Primer/Primer Surfacer - Waterborne 3-wet non-compressed - Solventborne	15 μm (0.6 mil)
Liquid Monocoat	38 μm (1.5 mil)
Powder Monocoat	38 μm (1.5 mil)
Solventborne Basecoat	15 μm (0.6 mil)
Waterborne Basecoat	10 μm (0.4 mil)
Clearcoat	38 μm (1.5 mil)

Note 1: Additional filmbuild may be required to meet all process and appearance requirements.

3.2.2 Bake Times and Temperatures. Target (T), Low Bake (L) and High Bake (H) limits of the topcoat are to be in agreement with the approved Technology Bake Chart as created in 3.4 of GMW3005. All underlying paint layers are to be prepared at suppliers' Target Bake (T) and filmbuild conditions. See Table 2.

Table 2: Bake Nomenclature

Description	Time	Temperature
Target Bake (T)	t	T °C (T °F)
Low Bake (L)	t – 5 minutes	T °C – 5 °C (T °F – 10 °F)
High Bake (H)	4t	T °C + 15 °C (T °F + 25 °F)

3.2.3 Application Equipment. Document the equipment and parameters used for preparing the test panels See Figure A2 in Appendix A.

3.2.4 Rigid Topcoat Systems for Metal. Use unpolished Cold Rolled Steel (CRS) panels (per GMW3005) with a current approved phosphate and electrodeposition primer. Apply primer surfacer as appropriate for the application. Use the procedure specified in GMW3005, 3.3.1.4 Exterior Topcoat Preparation Procedure.

3.2.5 Rigid and Flexible Topcoat Systems on Plastic. Use Thermoplastic Olefin (TPO) substrate per GMW15187, power washed, with adhesion promoter, as indicated in GMW3005. Topcoats applied direct to substrate must be tested over the specific substrate intended for production.

3.2.6 Control Panels. The supplier is expected to incorporate control procedures into panel preparation such that there are no unusual incidents of contamination at outdoor exposure sites.

3.3 Test Requirements. The test requirements for this specification are defined in Table B1 through Table B4 Appendix B. Where applicable, combined laboratory testing may be performed on the same panel, i.e., chip and humidity/adhesion tests may be performed on upper/lower halves of one panel. Performance testing may not be combined with any panel which is intended for evaluation of appearance, after Florida exposure or Xenon test.

3.3.1 Initial Testing: Includes chip; humidity/adhesion and mandrel bend. Test requirements are detailed in the corresponding GM test specifications. Report as specified in Figures A1 through A4 in Appendix A.

3.3.2 UV Transmission Requirements. Per GMW15545.

3.3.3 Xenon/Accelerated Testing (SAE J2527). Xenon 4500 kJ Weatherometer testing is required on all colors. This testing should be initiated immediately following color match.

3.3.3.1 Acceptability Criteria. For approval, there shall be no more than a slight hue/value change after 4500 kJ.

3.3.4 Florida/Outdoor Exposure Testing (GMW14873). Panels shall be exposed at a south Florida (Miami area), approved exposure site.

3.3.4.1 Acceptability Criteria. For approval, there shall be no hue change after (1) year and no more than slight hue/value change after (2) years.

Note: Measure and document gloss and Distinctness of Image (DOI) on all appearance panels per Figure A4 in Appendix A (optional).

3.3.5 Pigmentation Changes. Significant change in pigmentation (greater than 5% change from approved) that which was initially tested and placed on exposure must be communicated. A Notification of Change (NOC) must be submitted to the responsible GM Color Engineer which will determine if a new test panel/exposure series is required.

4 Manufacturing Process

4.1 Equipment Compatibility. It must be demonstrated that the pigmentation will not cause excessive wear or degradation of typical circulation systems and/or application equipment. Validation of performance in these areas will be expected and anticipated prior to use in any color and will be reviewed separately from the Annual Color Durability Review.

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.

5.5 All materials supplied to this standard must comply with the requirements of the International Material Data System (IMDS) and GMW3059, **Restricted and Reportable Substances**.

6 Approved Sources

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

The appropriate GM Materials Engineering Department (Product Engineering or Manufacturing Engineering) must confirm materials as meeting the requirements of this specification. Only materials/sources listed in the GM Materials File (MATSPC) under this standard number have been qualified by Engineering as meeting the requirements of this standard.