



Exterior Non-Weatherable Primers for Plastics

1 Scope

This standard covers the minimum performance requirements for an exterior non-weatherable adhesion promoters and primers used on plastic substrates. This standard is to be used in conjunction with an appropriate 998xxxx painted product specification for primer technology approval. Primers covered by the standard may be either one component or multi-component materials.

1.1 Material Description. This primer is part of the total painted product system and must provide a smooth, adhesion-promoting coating direct to substrate or in-mold coating and to subsequent coatings.

1.2 Symbols. Qualified to this Material Specification. This primer is part of the total painted product system and must meet requirements set forth in the specifications for other materials with which it is, or will be, used. This specification shall be used in conjunction with the Approved Paint on Plastics System (APOPS), a section of the GM Approved Materials Source List file which lists approved substrate, cleaning, priming and topcoat combinations. APOPS test requirements are defined in GMW14797.

1.3 Applicability. Adhesion promoters and primers covered under this specification are typically applied as liquids. Primers approved to these specifications are applied directly onto a plastic substrate or over an in-mold coating. Approved primers are used under an approved topcoat system. In some applications, a primer surfacer may be applied to the parts primer prior to topcoat applications. Primers tested to this specification are not approved for a wet-on-wet application with topcoat. The primer may or may not be conductive type for electrostatic spray application.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ASTM D523	ASTM D1474	ASTM D3960	ISO 2811
ASTM D1186	ASTM D1475	ASTM D4212	ISO 9001
ASTM D1200	ASTM D2369	IATF 16949	SAE J2527

2.2 GM Standards/Specifications.

9984801	GMW14700	GMW15119	GMW17065
GMW3059	GMW14729	GMW15545	GMW17405
GMW14124	GMW14797	GMW15777	
GMW14270	GMW14829	GMW15891	
GMW14333	GMW14873	GMW16746	

2.3 Additional References. None.

3 Requirements

3.1 Requirements on Test Specimens.

Primer qualification will be done with General Motors approved substrates and paint systems. Representative parts/plaques must pass laboratory testing. The primer must also undergo a limited plant tryout. Qualification of a primer under this specification does not imply approval for production parts. Qualification means only that the

primer has production feasibility. Production approval will be given only after a successful plant trial with a specific part and process.

3.2 Submission Requirements.

3.2.1 Submission Letter. Prior to qualification testing, the supplier must submit a letter to General Motors Vehicle Systems Material and Facilities Engineering with the following information:

- Purpose of the submission
- Description of the primer chemistry
- Comparison to current, approved technologies
- Site of origin
- History of product evolution
- Material Safety Data Sheet (MSDS)
- Key data for evaluating environmental impact (Volatile Organic Compounds (VOC), Weight Percent (%), Volume%, etc.)

Note: Additional information may be required for unique technologies. Specifics will be established per discussion with the responsible engineer at the onset of test initiation.

3.2.2 Material Identification. All paint layers used in the submission must be identified by product code and batch. Color name, GM WAXXXX and Black-and-White hiding must be included where appropriate. All related paint materials used for compatibility test must also be similarly identified. In addition, substrates used must be identified by source, code and part number where appropriate.

3.2.3 Process Identification. A baseline target and target range for both film build and bake must be established up-front for the submission. Actual target and range will be finalized after full evaluation of film build and cure interactions. Application and spray parameters used for the submission must be identified. Target and variance for mix ratio of two-component materials must be specified.

3.2.4 Health and Environmental Issues. Each primer technology will be reviewed for health and environmental impact.

3.2.5 Submissions Package. Two (2) submission package books must be prepared for distribution. All test results, Key Product Characteristics (KPC), photographs and approval related data are to be included as a record of the product being evaluated.

3.2.6 Plant Specific or Mini Submissions. Some approvals may require plant specific or mini submissions when only minor changes are made to previously approved primer material or if the primers are to be used in plants that will be receiving the material for the first time. Tests may be added or deleted according to the type and amount of material modifications; these shall be determined prior to testing by the responsible Manufacturing Engineering Vehicle Systems Paint engineer.

3.2.7 Production Part Approval Process (PPAP) Requirements. Product approval is required under established guidelines outlined in ISO 9001 or International Automotive Task Force (IATF) IATF 16949. At product approval, the supplier is expected to have reviewed to GM's satisfaction, specific documentation outlined in Advanced Product Quality Planning (APQP) (i.e., Design Failure Mode and Effects Analysis (DFMEA), Potential Failure Mode and Effects Analysis (PFMEA), KPCs, Key Control Characteristics (KCC), the Master Services Agreement (MSA) and Manufacturing Control Plans).

3.3 Product Information.

3.3.1 Physical Constants. Data on all physical constants must be provided as-formulated and as-sprayed, if different. All reducing solvents used in the technology approval must be identified as shown in Table 1.

3.3.2 Formulating Range. The formulating range of all ingredients must be specified at the time of submission. Information on the technology's ingredient formulation ranges for the various resin systems, pigments, flow control agents, additives and manufacturing KCCs must be provided as part of the submission package. If a product change is proposed outside of the technology formulation limits, the responsible engineer must be notified. All ingredient ranges, key manufacturing control limits and Certificate of Analysis (COA) ranges must pass standard gage Repeatability and Reproducibility studies.

3.3.3 Infrared (IR) Chemical Fingerprint. The supplier must provide infrared data to document the fingerprint of the recommended formula. All materials subsequently supplied under the designated specification/material

code must correspond to the reference spectrum when compared under the same conditions. GM may conduct infrared spectrophotometry analysis of the materials supplied to the specification. Analyses may also be performed on topcoat that is removed from representative panels with film thickness and bake at target levels. The IR spectra established for initial approval shall constitute a reference standard and shall be part of the submission package.

Table 1: Product Information Required

Product Information	Test Reference
Formula Volume Solids	Theoretical Calculation per ISO 2811
Formula Weight Solids	Theoretical Calculation per ISO 2811
Formula VOC	Theoretical Calculation
Analytical Weight (Wt) Solids	ASTM D2369
Analytical VOC	ASTM D3960
Viscosity (Cup)	ASTM D4212/ASTM D1200
Viscosity Profile	Document Method Used
Black/White Hiding	Per hiding chip
Density	ASTM D1475
% Wt Hazardous Air Pollutants (HAP)	Theoretical Calculation
Resistivity (wet)	Specify meter used

3.3.4 Ultraviolet/Visible (UV/VIS) Light Transmission through Cured Paint Film (GMW15545). Panels must be prepared as a system per the conditions in Table 2 and processed at target bake on four (4) core technology colors: White, Medium Red Metallic, Light Metallic (typically Silver or Light Blue), and Black. Prepare a set of panels per the conditions in Table 3, processed at target bake for information only. Data shall be the following:

- $\leq 0.05\%$ transmission time from 290 nm to 390 nm
- Straight line from 0.05% transmission at 390 nm to 0.10% transmission at 430 nm
- Straight line from 0.10% transmission at 430 nm to 0.80% transmission at 500 nm

Table 2: Film Build for Preparation of Ultraviolet (UV) Test Samples

A		B	
Primer		Adhesion Promoter (AP)	
Baked PS + BC + CC	Film Build	Baked AP + BC + CC	Film Build
1: Primer Surface (PS) - Waterborne - Solventborne	Note 2 15 µm (0.60 mil) 20 µm (0.80 mil)	1: Adhesion Promoter (AP) - Waterborne - Solventborne	Note 2 15 µm (0.60 mil) 20 µm (0.80 mil)
2: Basecoat (BC) - Waterborne - Solventborne	Note 1 Note 1	2: Basecoat (BC) - Waterborne - Solventborne	Note 1 Note 1
3: Clearcoat (CC) - One Component (1K) - Two Component (2K)	38 µm (1.50 mil) 38 µm (1.50 mil)	3: Clearcoat (CC) - One Component (1K) - Two Component (2K)	38 µm (1.50 mil) 38 µm (1.50 mil)

Note 1: Film build to be a minimum of color and appearance range per color, as specified by the GM Color Development Engineer.

Note 2: If a new primer technology or primer color is used, prepare a primer wedge sample and hold the basecoat and clearcoat to the minimums shown in Table 2.

Note: 1K = One-component 2K = Two-component AP = Adhesion Promoter BC = Basecoat CC = Clearcoat PS = Primer Surface (conventional bake).

If UV/VIS transmission of the system does not pass at technology minimums, rerun the UV test at 2 µm basecoat film build increments until it passes.

Table 3: Sample Preparation for Individual Layer

Film Build
Waterborne Primer 15.2 µm (0.6 mil)
Solventborne Primer 20.3 µm (0.8 mil)
Solventborne or Waterborne Adhesion Promoter 7.6 µm (0.3 mil)

3.4 Processing Requirements. The supplier must provide the recommendation for application. Required data shall include equipment, spray distance, fluid flow rate, temperature and humidity. Any precautions for material handling or limits for processing must be noted. The processing parameters for optimizing appearance and durability characteristics must be specified.

Processability includes the development of charts for various parameters that affect performance and long-term durability, establishment of key process control limits (bake, film build, application parameters), and understanding the impact of the material on plant facilities, such as booth cleaning and water treatment.

3.4.1 Surface Preparation. The plastic substrate(s) shall be cleaned per 9984801 prior to primer application.

3.4.2 Application. The supplier shall provide the recommended spray viscosity, reduction solvent(s), spray non-volatiles and weight per liter (or weight per gallon).

3.4.3 Sag Resistance (GMW15119). Sag resistance of the new primer shall be compared to a currently approved control primer. The control material will be defined by the responsible engineer.