



Limited Durability Two-Component Urethane Clearcoat Over Epoxy Base Exterior Exposed Weave Carbon Fiber

1 Scope

This specification covers the qualification and performance requirements of non-durable Two (2) Component (2K), high solids (40% volume to 55% volume solids as sprayed), and urethane clearcoat direct over exterior epoxy based exposed weave carbon fiber substrate.

1.1 Material Description. Clearcoat (CC) is a rigid, two (2) - component urethane or urethane blends.

1.2 Symbols. Not applicable.

1.3 Applicability. These clearcoats are designed to be applied directly to GM approved epoxy based exposed weave carbon fiber substrates.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ISO 2808	ISO/TS 16949	SAE J2527
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2.2 GM Standards/Specifications.

9984801	GMW14124	GMW14873	GMW15777
GMW3005	GMW14270	GMW15433	GMW15931
GMW3059	GMW14865	GMW15545	

2.3 Additional References.

- Advanced Product Quality Plan (APQP)
- Bake Chart
- Individual Part Drawings
- Jacksonville Rating System

3 Requirements

3.1 Submission. The submission requirements of GMW3005 must be completed prior to approval of the product. The supplier must clearly define the usage target.

3.2 Durability Performance. Materials approved to this standard must meet all of the minimum requirements of GMW3005, Type B, Class five (5).

3.2.1 Class five (5) performance, in regards to this material specification, is defined as no loss of film integrity after one (1) year in testing environment and a minimum etch rating is six (6) per Jacksonville Rating System, or equal to typical Original Equipment Manufacturer (OEM) body system controls for a given exposure test.

3.3 Scratch Resistance (GMW14865). Control to be used is a typical OEM body topcoat system.

3.4 Processing Requirements. The general processability must be demonstrated to be production capable and documented in the submission per GMW3005. Documentation of panel preparation must include all sanding procedures. The baseline process contains the following elements (see 3.4.1 thru 3.4.8).

3.4.1 Carbon fiber substrate material must be sanded before painting.

3.4.2 Substrate material must be cleaned prior to painting. Power washing per 9984801 is required.

3.4.3 To achieve minimum film build requirements, the clearcoat will require at least two separate clearcoat applications of 40 μm to 45 μm (1.6 mil to 1.8 mil) with bake and sanding to degloss the clearcoat between each application layer.

3.4.4 Flash. Flash is typically one (1) minutes to two (2) minutes between wet coats of clearcoat. Flash prior to oven is typically eight (8) minutes to 10 minutes.

3.4.5 Bake. Clearcoats that are approved to this specification have a typical bake range of 60 °C to 135 °C (140 °F to 275 °F). Time at substrate temperature typically varies from 20 minutes to 90 minutes.

3.4.6 Reprocess. One additional recoat is allowed (three (3) applications and three (3) bake cycles), with sanding required prior to the recoat application. Evaluation of recoats beyond what is allowed requires additional testing per agreement with the responsible paint engineer.

3.4.7 Chemical Requirements. All reducers must be urethane grade or equivalent.

3.4.8 Special Handling. Clearcoat may require a dry nitrogen blanket to prevent the entry of moist air. Isocyanate materials in the activator components will react with water, alcohols and certain other materials; therefore, precautions must be taken to ensure that none of these are present or introduced into storage containers or circulating systems containing materials noted.

3.5 Panel Preparation. Panels are to be prepared using an approved Type B exposed weave carbon fiber materials and processing. Carbon fiber substrates typically include materials approved to GMW15931, provided that the basis for the paintability approval includes application of this clearcoat directly to the substrate and weathering test results meet requirements described in 3.2.1. Additional controls may be required per agreement with the responsible paint engineer.

3.6 Compatibility. Compatibility with associated materials is evaluated for Type B usage per GMW3005.

3.7 Film Build (ISO 2808). The clearcoat must meet all specified appearance and durability requirements at a minimum total film of 75 μm (3.0 mil) applied in two (2); 37.5 μm (1.5 mil) clearcoat applications, with bake and sanding between clearcoat layers.

3.8 Ultraviolet/Visible Transmission through Cured Paint Film (GMW15545). Panels must be prepared per the conditions in Table 1 at required clearcoat film builds. Report data as specified in GMW15545 for CC Only at target bake conditions. Requirements are as specified in Table 1.

Table 1: Sample Preparation and Performance for Ultraviolet Transmission ^{Note 1}

Layer	Film Build	Bake	Criteria
CC Only	62.5 μm (2.5 mil) (info only)	20 minutes at Target Bake	a and b
CC Only	75 μm (3.0 mil)	20 minutes at Target Bake	a and b

Note 1: a = $\leq 0.1\%$ transmission from 290 nm to 360 nm, b = $\leq 1.5\%$ transmission at 380 nm.

3.9 Film Build Latitude. The specific clearcoat film build range for individual technologies must be established by designed experiment or a matrix ranging from 60 μm (2.4 mil) to 125 μm (5.0 mil) applied in two (2) coats of 30 μm (1.2 mil) to 62.5 μm (2.5 mil), with bake and sanding between clearcoat layers. Performance criteria are Xenon weatherometer, Florida exposure, initial adhesion, humidity and adhesion, and chip resistance as outlined in GMW3005.

3.10 Appearance. The material must meet or exceed company specifications for gloss, Distinctness of Image (DOI), orange peel, and uniformity as designated in GMW15777.

3.11 Film Build Zones. Film build requirements for Zone D or any deviations to Zone A thru Zone C will be specified on Individual Part Drawings.

3.12 Bake Window. Cure charts must be developed as specified in GMW3005 to define technology limits for each product. Once developed and approved, the Bake Chart is signed by Vehicle Systems Engineering and is the only acceptable document for defining cure.