



Non-Decorative Plastic Powder Coatings

1 Scope

This specification covers plastic powder coatings that are fused on application to properly prepared metal substrates to form a continuous, durable coating for purposes such as wear resistance or squeak prevention. The powders may be applied by electrostatic spray, fluidized bed, or a variation thereof.

1.1 Material Description. Six (6) types are covered by this specification, as follows:

- **Type I:** A thick epoxy coating for usages such as seat belt anchor plates, to provide corrosion resistance and prevent metal edges from cutting the webbing.
- **Type II:** A thinner epoxy coating used on various seat parts and other parts where prevention of metal-to-metal contact is required and where some degree of wear resistance is necessary.
- **Type III:** A thick nylon 11 or nylon 12 coating used on parts which are susceptible to high wear, to prevent squeaks, or to provide a thermal barrier.
- **Type IV:** A thinner nylon 11 or nylon 12 coating.
- **Type V:** A polyester coating for usages such as seat tracks, where some degree of wear resistance is necessary.
- **Type VI:** An alloy of Acid Modified Polyolefins used on parts which are susceptible to wear, to prevent squeaks.

Note: Some nylons must use a primer to meet the performance requirements of this specification.

1.2 Symbols. Suffix codes are to be added to the drawing notes to indicate location on the vehicle and if the coating is exposed to sunlight:

- **Exterior (EX)** = Exterior applications - includes underhood and underbody.
- **Interior (IN)** = Interior applications.
- **Ultraviolet (UV)** = Applications exposed to sunlight whether interior or exterior.

1.3 Applicability. These coatings are typically used for corrosion resistance, seat belt anchor plates, prevention of metal-to-metal contact such as on seat parts, protection from wear, etc.

Note: Epoxies should not be used in applications where they are exposed to sunlight.

1.4 Remarks. Appropriate suffix codes of materials approved under this specification shall be part of the approved sources documentation per Section 6.

2 References

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

2.1 External Standards/Specifications.

ASTM D870	ISO 105-A03	ISO 4892-2
ASTM D6677	ISO 4892-1	SAE J2527

2.2 GM Standards/Specifications.

9984123	GMW3221	GMW14333	GMW17332
9986321	GMW3286	GMW14700	
GMW3059	GMW3402	GMW14701	
GMW3208	GMW14162	GMW14729	

3 Requirements

Unless otherwise indicated, the requirements shall pertain to all types and suffix codes.

3.1 Chemical Requirements. Component surfaces may use a pretreatment: e.g., zinc phosphate per 9984123 or thin film per 9986321 to meet performance requirements.

3.2 Physical Requirements.

3.2.1 Resin. Type I and Type II shall be epoxy. Type III and Type IV shall be nylon 11 or nylon 12. Type V shall be polyester. Type VI shall be an alloy of acid modified polyolefins.

3.2.2 Appearance. The coating must be smooth, uniform and continuous with no evidence of voids, craters, sags, blisters, or other surface defects in the area specified to be coated.

3.2.3 Thickness.

3.2.3.1 Unless otherwise specified on the part drawing:

- Type I shall be 0.25 mm thick minimum.
- Type II shall be 0.025 mm thick minimum.
- Type III shall be 0.38 mm $\pm$ 0.12 mm thick.
- Type IV shall be 0.15 mm $\pm$ 0.08 mm thick.
- Type V shall be 0.127 mm $\pm$ 0.025 mm thick.
- Type VI shall be 0.32 mm thick minimum.

3.2.3.2 Due to the thickness of these coatings, they should not be used in fastened joints.

3.3 Performance Requirements. The following tests are to be performed at conditions per GMW3221 Code A, 22 °C $\pm$ 3 °C and 50% $\pm$ 5% Relative Humidity (RH) unless otherwise specified. Testing shall be performed on parts or representative coated panels. Coated test panels shall only be used for initial material qualification and approval. Testing for parts approval (e.g., Production Part Approval Process (PPAP)) must be performed on actual parts.

3.3.1 Cure (Type I, Type II and Type V only). There shall be no softening of the coating or evidence of tackiness when a rag saturated with a solvent recommended by the powder supplier is placed on the coating for approximately 30 s.

3.3.2 Adhesion and Humidity.

3.3.2.1 Suffix Codes EX and EX/UV. Parts or panels shall be exposed for 96 h to humidity per GMW14729. After exposure, there shall be no blistering or appearance change. Parts shall rate six (6) or better when tested per the procedure in Appendix B, Table B1.

3.3.2.2 Suffix Codes IN and IN/UV. Parts or panels shall be exposed for 24 h to humidity per GMW14729. After exposure, there shall be no blistering or appearance change. Parts shall rate six (6) or better when tested per the procedure in Appendix B, Table B1.

3.3.3 Neutral Salt Spray.

3.3.3.1 Suffix Code EX. There shall be no more than 10% blistering or peeling of the powder coating after 168 h neutral salt spray exposure per GMW3286.

3.3.3.2 Suffix Code EX/UV. There shall be no more than 10% blistering or peeling of the powder coating after 336 h neutral salt spray exposure per GMW3286.

3.3.3.3 Suffix Codes IN and IN/UV. After 96 h exposure in neutral salt spray per GMW3286, there shall be no red rust or white corrosion on coated panels or parts.

3.3.4 Water Soak. Parts or panels shall be soaked for 127.5 minutes $\pm$ 7.5 minutes in Deionized Water at 38 °C $\pm$ 1 °C per ASTM D870. After exposure, there shall be no defects or metal corrosion. Samples shall rate six (6) or better when tested per the procedure in Appendix B, Table B1.

3.3.5 Resistance to Stone Impact (Suffix Code EX). Samples shall rate seven (7) or higher after testing per GMW14700, Method C.

3.4 Additional Requirements. The following tests are for new material approvals only. They shall be conducted on coated panels.

3.4.1 Compatibility (Type I Only). The coating material must not stain, degrade or have any other detrimental effect on polyester seat belt webbing when tested per 3.4.1.1.

3.4.1.1 A light colored sample of seat belt webbing shall be placed in contact with the coating and placed in a closed container for two (2) weeks at $93\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ in an air circulating oven. A control sample of webbing not in contact with the coating shall be placed in a similar container and exposed at the same time and temperature. After exposure, comparison and evaluation of detrimental effects shall be made versus the control.

3.4.2 Environmental Resistance. After exposure and impact per the procedure in Appendix A, A1, the coating must show no chipping, cracking, blistering, softening, effect on adjacent materials, effect on corrosion resistance of the metal, staining, etc., objectionable change in color, or other detrimental effects (mushrooming without cracking when impacted is acceptable).

3.4.3 Resistance to Wear. Coated panels shall be subjected to 1000 cycles with CS17 wheels and a 1000 g load on the Taber Abraser, per GMW3208. Weight loss of Type I and Type II shall be 0.06 g, maximum. Weight loss of Type III, Type IV, Type V, and Type VI shall be 0.025 g, maximum.

3.4.4 Interior Finish Durability (Suffix Code IN/UV Only).

3.4.4.1 Test for Colorfastness to Light per GMW14162/D/601.1 kJ/m². After exposure, coated panels shall show no objectionable gloss or color change, chalking, or other visible surface deterioration.

3.4.4.2 Effect of Cleaners. Coated panels shall be tested per GMW3402 Procedure B, Codes 1, 2, 3, 4, and 5. There shall be no discoloration of the surface or transfer of color to the cloth. The white cheesecloth shall have a rating better than Grade 4 on the Chromatic Transference Scale per ISO 105-A03.

3.4.5 Exterior Finish Durability (Suffix Code EX/UV Only). Coated panels shall be exposed in xenon arc weatherometer per ISO 4892-1 and ISO 4892-2 as specified in 3.4.5.1 or per SAE J2527 Extended UV Filters as specified in 3.4.5.2. Evaluate per 3.4.5.3.

3.4.5.1 ISO Procedure. Test as per the conditions of ISO 4892-1 and ISO 4892-2, as shown in Table 1. Panels shall be exposed for $\geq 3000\text{ kJ/m}^2$.

Table 1: ISO Procedure Conditions

Parameter	Requirement
Inner- and Outer filter	Borosilicate
Radiant Exposure	0.50 W/m^2 at 340 Nm
Test Program Cam Number 7	102 minutes $\pm$ 0.5 minutes light only 18 minutes $\pm$ 0.5 minutes light and spray
Black Standard Temperature	$+80\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$

3.4.5.2 SAE Procedure. Test as per the conditions of SAE J2527 Extended UV Filters.

3.4.5.3 Evaluation. After exposure, there shall be no indications of surface tackiness or embrittlement, blooming, blistering, change in hardness, color or gloss, or other factors which might affect the function or appearance of the part.

3.4.6 Resistance to Various Environmental Inputs (Suffix Code EX).

3.4.6.1 Temperature Resistance. After test panels are baked at $100\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for $24\text{ h} \pm 1\text{ h}$, there shall be no evidence of coating breakdown.

3.4.6.2 Fuel Resistance. Coated panels shall meet requirements of GMW14333, A, Rating 2. Adhesion shall be tested using the method in Appendix B, Adhesion Test. Panels shall rate eight (8) or better.

3.4.6.3 Oil Resistance. Test panels shall be immersed in engine oil per GMW17332 and then exposed for $24\text{ h} \pm 1\text{ h}$ in a drying oven at $+100\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$. Evaluate after cooling to $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. There shall be no discoloration, change in gloss, shrinkage, swelling, dissolution, wrinkling or creasing, blistering, distortion, or cracking.

3.4.6.4 Chemical Spot Test. Panels shall be tested per GMW14701, Method 1 and Method 2, using 10%, 1.0%, and 0.1% solutions by weight of Analytical Reagents of the following:

- Acetic Acid
- Hydrochloric Acid