

		Material Specification	GMW15978
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Sealer - Global, Pumpable, Paintable, Abrasion Resistant -
Generic Qualification

1 Scope

This specification details the requirements of a paintable Polyvinyl Chloride (PVC) abrasion resistant anti-chip coating/sealer. The purpose of this material is to protect the metal substrate from stone damage that could result in corrosion. The material is applied in the paint shop after electrocoat (e-Coat) and baked. It must be capable of being either robotically or manually applied and is used to coat the rocker panels, underside of floor pan and underbody seams of vehicles to provide a high level of chip and abrasion resistance.

In addition, the material may be used as a sealer to seal exterior body joints against water, dust, air intrusion and corrosion.

The material must be compatible with primer surfacer and topcoat systems.

1.1 Material Description. The material must be a smooth and homogeneous mixture free of air, lumps, unmixed particles, or foreign materials.

1.1.1 It must be capable of being dispensed with approved and validated production displacement pumping and application equipment.

1.1.2 It must not have a noxious or toxic odor in either the uncured or cured state.

1.1.3 In addition, the material must not adversely affect those personnel handling it.

1.1.4 The material must adhere to all approved production e-Coat.

1.1.5 It must not have corrosion causing ingredients.

1.2 Symbols. Not applicable.

1.3 Applicability. Coating of exterior surfaces of the rocker panels, floor pan and underbody seams after e-Coat in the paint shop.

1.4 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ASTM D412	ASTM D2369	IATF 16949	SAE J1524
ASTM D1475	EN ISO 1524	ISO 2813	SAE J1864
ASTM D2196	EPA Method 24	ISO 3219	

2.2 GM Standards/Specifications.

9986286	GMW3019	GMW14124	GMW15481
9986287	GMW3022	GMW14270	GMW15487
9986595	GMW3025	GMW14444	GMW16701
9986606	GMW3059	GMW14700	GMW16853
GMW3005	GMW3154	GMW14729	GMW17405
GMW3016	GMW3205	GMW14829	GMW17468

2.3 Additional References.

The supplier shall work with the GM Design Responsible Engineer to comprehend these requirements.

- Advanced Product Quality Planning (APQP)
- Z4 DIN

3 Requirements

Specific material requirements and appropriate test procedures are listed under the individual properties and summarized in Table 11. All bake schedules are specified in time at substrate temperature.

3.1 Requirements on Test Specimens.

3.1.1 Specific Gravity, ASTM D1475. Typically, 1.4 sp.g. ± 0.2 sp.g.

3.1.2 Odor (GMW3205). The anti-chip/sealer must not emit a toxic or noxious odor. The material must not impose any adverse effects on personnel handling it. Also, after cure, the material must not have a perceptible odor. In addition, the ED50 value (i.e., odor value at 50% dilution in dynamic triangle olfactometer testing) of the sealer odor may be requested at the time of approval.

3.1.3 Volatile Organic Compound (VOC) Determination (EPA Method 24, see 2.2, using ASTM D2369). Target is 35.9 kg/m³ (0.3 lb/gal) or less. However, the final VOC of the product, including all weights, calculations and runs, are to be identified and reported as data in the submission book.

3.1.3.1 Condensing Volatiles Test (GMW3016). Three percent (3%) maximum allowed when baked as follows and tested per GMW3016.

- a. 9986286/9986595/9986606: Baked for 20 minutes at 165 °C ± 5 °C.
- b. 9986287: Baked for 20 minutes at 130 °C ± 5 °C.

3.1.4 Viscosity. The viscosity shall be determined and reported using the following three methods (see 3.1.4.1 thru 3.1.4.3).

3.1.4.1 Castor-Severs (Pressflow) Viscosity (SAE J1524).

- a. Orifice: 1.32 mm.
- b. Pressure: 414 kPa.
- c. Sample Weight: 20 g.
- d. Sample Test Temperature: 25 °C ± 0.5 °C.

The 72 h Castor-Severs Viscosity Requirements are shown in Table 1.

Table 1: 72 h Castor-Severs Viscosity

Key Product Characteristic (KPC) requirement at 72 h from batch manufacture, the Castor Severs (Press-Flow) Viscosity shall be:	
9986286	4 s to 8 s
9986287	
9986595 (SGM Region)	8 s to 25 s
9986606 (SGM Region)	7 s to 10 s

3.1.4.1.1 In addition, when stored in proper conditions, the rate at which the viscosity increases with age should not exceed the following guidelines:

- Viscosity at 90 days ≤ 72 h value +20%. (9986286/9986287/9986606)
- Viscosity at 30 days ≤ 72 h value +20%. (9986595)
- Viscosity at 60 days ≤ 72 h value +40%. (9986595)
- Viscosity at 90 days ≤ 72 h value +60%. (9986595)

3.1.4.1.2 The 90 day Aging Castor-Severs Viscosity Requirements are shown in Table 2.

Table 2: 90 day Aging Castor-Severs Viscosity Requirements

At the end of the sealer 90 day shelf life, the sealer Castor-Severs (Press-Flow) Viscosity shall not exceed:	
9986286	10 s
9986287	
9986595 (SGM Region)	40 s
9986606 (SGM Region)	12 s

3.1.4.1.3 The initial and aging viscosity data shall be provided in both numerical and graphed format in the material submission book.

3.1.4.2 Brookfield Viscosity, ASTM D2196.

- a. **Spindle Size:** number seven (7).
- b. **Rotational Speed:** 20 rpm.
- c. **Rotation Time to Reading:** one (1) minute.
- d. **Sample Test Temperature:** 25 °C ± 0.5 °C.

3.1.4.2.1 The 72 h Brookfield Viscosity Requirements are shown in Table 3.

Table 3: 72 h Brookfield Viscosity Requirements

Key Product Characteristic (KPC) requirement at 72 h from batch manufacture, the Brookfield Viscosity shall be:	
9986286	50 000 cps to 70,000 cps
9986287	
9986595 (SGM Region)	50 000 cps to 150 000 cps
9986606 (SGM Region)	35 000 cps to 50 000 cps

3.1.4.2.2 The 90 day Aging Castor-Severs Viscosity Requirements are shown in Table 4.

Table 4: 90 day Aging Brookfield Viscosity Requirements

At the end of the sealer 90 day shelf life, the sealer Brookfield Viscosity shall not exceed:	
9986286	90 000 cps
9986287	
9986595 (SGM Region)	170 000 cps
9986606 (SGM Region)	70 000 cps

3.1.4.2.3 The initial and aging viscosity data shall be provided in both numerical and graphed format in the material submission book.

3.1.4.3 Determination of the Viscosity Using a Rotational Viscometer (Rheometer) (ISO 3219 and Z4 DIN Cup and Spindle).

- a. Run test per program in Table 5 using the Z4 DIN cup/spindle setup.
- b. Rotation Speed: 0 s⁻¹ to 130 s⁻¹.
- c. Sample Test Temperature: 25 °C ± 0.5 °C.

Table 5: Rotational Viscometer (Rheometer) Program

Test	Time	Start Speed	End Speed
Wait Period	300 s	0 s ⁻¹	0 s ⁻¹
Ascending	120 s	0 s ⁻¹	130 s ⁻¹
Hold Cycle	180 s	130 s ⁻¹	130 s ⁻¹
Descending	120 s	130 s ⁻¹	0 s ⁻¹

3.1.4.3.1 The relative viscosity, descending Bingham viscosity, and yield point (all KPC requirements) at 72 h after batch manufacture shall be as shown in Table 6.

Table 6: 72 h Rotational Viscosity (Rheometer) Requirements

Key Product Characteristic (KPC) requirement at 72 h from batch manufacture, the Relative Viscosity, Descending Bingham Viscosity and the Yield Stress shall be as follows:			
GM Part Number	Relative Viscosity:	Descending Bingham Viscosity:	Yield Stress:
9986286	3.0 Pa s to 5.0 Pa s	0.95 Pa s to 2.5 Pa s	260 Pa to 500 Pa
9986287			
9986595 (SGM Region)	1.5 Pa s to 5 Pa s	0.8 Pa s to 2.5 Pa s	200 Pa to 450 Pa
9986606 (SGM Region)	1.5 Pa s to 3.5 Pa s	0.8 Pa s to 2.5 Pa s	80 Pa to 300 Pa

3.1.4.3.2 In addition, when stored in proper conditions, the viscosity variation with age shall not exceed the values shown in Table 7.

Table 7: The 90 day and 30 day Aging Rotational Viscosity (Rheometer) Requirements

At the end of the sealer 90 day and 30 day shelf life, the sealer Rotational Viscosity (Rheometer) shall not exceed:				
GM Part Number	At Aging Time:	Relative Viscosity:	Descending Bingham Viscosity:	Yield Stress:
9986286	At 90 days	Should not exceed 20% of 72 h data	Should not exceed 10% of 72 h data	Should not exceed 20% of 72 h data
9986287				
9986595/9986606 (SGM Region)	At 30 days	Should not exceed 10% of 72 h data	Should not exceed 10% of 72 h data	Should not exceed 10% of 72 h data

3.1.4.3.3 The measured and calculated data, along with the curves generated, shall be included as data in the submission book.

3.1.5 Particle Size (EN ISO 1524). 200 µm maximum.

3.2 Performance Requirements.

3.2.1 Adhesion (GMW3019). One (1) full set of test panels must be prepared, per the bakes in Table 8 and Table 3, using approved production technology from each approved source of e-Coat from all GM regions, GM North America (GMNA), GM South America (GMSA) and GM International Operations (GMIO).

The material must demonstrate a minimum of fine line cohesion performance after the first primer/anti-chip/sealer bake.

Table 8: Bakes for Adhesion (Nominal Baked e-Coat)

Bake System	9986286	9986287	9986595/9986606 (SGM Region)
	High Bake	Low Bake	High Bake
Minimum Prime/Seal	15 minutes at 158 °C	15 minutes at 125 °C	15 minutes at 158 °C
Nominal Prime/Seal	20 minutes at 165 °C	20 minutes at 130 °C	20 minutes at 165 °C
Maximum Prime/Seal	60 minutes at 180 °C	90 minutes at 158 C	60 minutes at 180 °C
Maximum Powder Prime	60 minutes at 190 °C	Not Applicable	Not Applicable

Table 9: Bakes for Adhesion (Oven Baked e-Coat)

Electrodeposition Paint Operation (ELPO) Bake	Anti-chip/Sealer/Primer Bake
Maximum: 90 minutes at 190 °C	Minimum for High or Low Bake Primer: 15 minutes at 158 °C or 15 minutes at 125 °C

3.2.1.1 The material, when baked as described in Table 8 and Table 9, must not crack or lose adhesion to the substrate during or after exposure to the following conditions (see 3.2.1.1 a thru 3.2.1.1c). In addition, the material must demonstrate cohesive adhesion when peeled from substrate.

- a. **Initial Adhesion:** After cooling to ambient temperatures.
- b. **Exterior Cycle:** (GMW14124, Cycle F) Twelve (12) cycles.
- c. **Mandrel Bend:** (GMW3154) at -30 °C. Samples prepared unpainted.

3.2.2 Elongation, ASTM D412, Method "A" (Using Die "C" Dumbbell). Material baked as described in 3.2.1 must exhibit no < 100% elongation. This applies to all bakes (i.e., minimum, nominal and maximum).

3.2.3 Shrinkage/Expansion (GMW15481). Material baked as described in 3.2.1 (maximum bakes only) must exhibit no (0%) expansion and no shrinkage > 2%.

3.2.4 Porosity. The material must exhibit no signs of trapped air from either an external observation or a cross sectional view after being baked as described in 3.2.1 (maximum bake only).

3.2.5 Degradation Resistance. Apply two (2) beads of anti-chip/sealer, approximately 1 mm thick × 40 mm wide × 200 mm long, to the surface of a phosphated steel panel (inspect panel first to be sure it is free of surface corrosion). Repeat the application over a panel coated with production e-Coat. Bake panel as follows:

- a. For 9986286/9986595/9986606: Bake for 1 h at 200 °C.
- b. For 9986287: Bake for 1 h at 150 °C.

After baking remove panel from oven and allow it to cool to room temperature before proceeding.

3.2.5.1 After Bake. Remove one (1) anti-chip/sealer bead from each panel and inspect the surface of the panel. There must be no corrosion on the surface of the panel where the anti-chip/sealer had been.

3.2.5.2 After Humidity. Expose both panels, with the remaining anti-chip/sealer beads, to 40 °C and > 98% humidity for 240 h.

3.2.5.3 After exposure, remove the remaining anti-chip/sealer from the panels and inspect the surface of the panel. Again, there must be no corrosion on the panel surface where the anti-chip/sealer had been.

3.2.6 Compatibility with Associated Production Materials/Processes. Compatibility with plant specific materials such as wheelhouse deadener, anti-corrosion wax, primer surfacers, and topcoats shall be evaluated prior to introduction to any production facilities.

3.2.6.1 If there are any plant specific material issues that must be addressed, the details are to be discussed and resolved between the responsible engineer and the supplier prior to the initiation of testing.

3.2.7 Topcoat Compatibility (GMW14829) (9986286/9986287/9986606 only). The test panels shall be prepared per the layering combinations listed in 3.2.7.1 primer only, 3.2.7.2 basecoat (BC) only, 3.2.7.3 basecoat/clearcoat (CC) only and 3.2.7.4 full paint system (primer, BC and CC) and baked per the appropriate bake schedule in Table 10 (high or low primer bake). The paint systems tested shall represent at least one (1) production system from each major paint supplier. The systems chosen should also cover the different types of primer, basecoat (BC), and clearcoat (CC) technologies and must also represent paint systems/technologies from each region of GM globally, i.e., GM North America, GM South America, GM International Operations.

Note: For all paintable test panels, the anti-chip material must be spray applied to the test panel with the panel in a vertical orientation. In addition, all subsequent paint layering applications must also be applied and baked with the test panels in a vertical orientation.

3.2.7.1 Primer Only. Primer is applied Wet-on-Wet (WOW) over anti-chip/sealer. Primer is to be applied at 0.8 mil to 1.4 mil film build (wedge).

3.2.7.2 Basecoat Only. Basecoat applied Wet-on-Dry (WOD) over cured anti-chip/sealer. Basecoat to be applied in the following two (2) separate scenarios:

- a. Target film builds for hiding/technology.
- b. Wedge from 0 mils to target film builds.

3.2.7.3 Basecoat/Clearcoat Only. Basecoat/Clearcoat applied Wet-on-Dry over cured anti-chip/sealer in the following three (3) separate layering scenarios:

- a. Basecoat and clearcoat applied at target film builds for hiding/technology.
- b. Wedge panels prepared with basecoat and clearcoat both applied in a wedge from 0 mils up to target film builds.
- c. Wedge panels with clearcoat applied in wedge from 0 mils up to target film builds over basecoat that is applied at target film build.

3.2.7.4 Full Paint System (Primer, BC and CC). Complete the following steps (see 3.2.7.4a and 3.2.7.4b).

- a. Apply primer Wet-on-Wet over anti-chip/sealer at target film build, plus apply basecoat/clearcoat at target film builds over the baked primer/anti-chip/sealer.
- b. Apply primer Wet-on-Wet over anti-chip/sealer at film builds from 0 mils up to target, plus apply basecoat/clearcoat wedge from 0 mils up to target film build over baked primer/anti-chip/sealer wedge.