GM ENGINEERING STANDARDS	Material Specification	9984537

Sealer - Pumpable, High Bake, Paintable, Ultralight

1 Scope

This specification details the requirements of a **high** bake, paintable ultralight sealer. The material is applied in the paint shop after Electrocoat (e-coat) bake and before the application of primer surfacer. This material must be capable of being either flow- brushed or robotically applied and is intended to seal interior and exterior body joints against water, dust, air intrusion and corrosion. The material must be compatible with primer surfacer and topcoat systems and bakes with resulting high appearance requirements.

1.1 Material Description. The material must be a smooth and homogeneous mixture that is free of air, lumps, unmixed particles or foreign materials. It must be capable of being dispensed with approved and validated standard production displacement pumping and application equipment. It must not have a noxious or toxic odor in either the uncured or cured state. In addition, the material must not adversely affect the personnel handling it.

1.1.1 The material must adhere to all approved production e-coat substrates. It must have good durability and not accelerate the rusting of steel over which it is applied.

1.2 Symbols. Not applicable.

1.3 Typical Applications. Sealing of interior and exterior e-coated body joints in the paint shop after the e-coat oven but before primer surface 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 D412	ASTM D2369	EPA Method 24	SAE J1524
ASTM D1475	EN ISO 1524	ISO 3219	SAE J1864
ASTM D2196			

2.2 GM Standards/Specifications.

GMW3016	GMW3059	GMW14829	GMW17405
GMW3019	GMW14124	GMW15481	
GMW3022	GMW14270	GMW16695	
GMW3025	GMW14729	GMW16701	

2.3 Additional References.

Production Part Approval Process (PPAP) Requirements

3 Requirements

Specific material requirements and appropriate test methods are listed under the individual properties and summarized in Table 1.

All bake schedules are specified in time at substrate temperature.

3.1 Requirements on Delivery.

3.1.1 Specific Gravity (ASTM D1475). Maximum is 0.85G.

3.1.2 Volatile Organic Compound (VOC) Determination (EPA Method 24 Section 2.2 using ASTM D2369, Procedure B). Report the final VOC as well as all weights and calculations as data.

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3.1.2.1 Condensing Volatiles Test (GMW3016). Four percent (4%) maximum allowed when baked at 20 minutes at 130 °C ± 5 °C and tested according to GMW3016.

3.1.3 Viscosity. The viscosity shall be determined and reported using the methods in 3.1.3.1 thru 3.1.3.3.

3.1.3.1 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

3.1.3.1.1 Viscosity Requirements. Key Product Characteristic (KPC) requirement: 72 h from batch manufacture, the viscosity shall be 60 s ± 5 s.

In addition, when stored in proper conditions, the rate at which the viscosity increases with age shall not exceed the guidelines in 3.1.3.1.1 a thru 3.1.3.1.1 c.

a. Viscosity at 30 days: ≤ 72 h value + 20%

b. Viscosity at 60 days: ≤ 72 h value + 40%

c. Viscosity at 90 days: ≤ 72 h value + 60%

In no case should the material viscosity exceed 100 s at the end of the 90 day shelf life of the material.

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

3.1.3.2 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

3.1.3.2.1 Viscosity Requirements. KPC requirement: 72 h from batch manufacture, the viscosity shall not be less than 100 000 cps.

In addition, when stored in proper conditions, the viscosity increase with age shall not exceed 150 000 cps by the end of the 90 day shelf life of the material.

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

3.1.3.3 Determination of the Viscosity Using a Rotational Viscometer (ISO 3219, Z4 DIN). (See Table 1).

a. Rotation Speed: 0 1/s to 130 1/s

b. Sample Test Temperature: 25 °C ± 0.5 °C

Table 1: Test Cycle for Viscosity Using a Rotational Viscometer

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

3.1.3.3.1 The viscosity and yield point must be calculated according to the descending cycle as Bingham Viscosity and shall be reported as data in the submission for this material. All numerical data, charts and calculations shall be included as well.

3.1.4 Particle Size (EN ISO 1524). Maximum of 200 µm.

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3.1.4.1 Glass Sphere Size. Ninety percent (90%) of the population is to be ≤ 90 µm. In addition, only glass microspheres are to be used. Plastic or polymeric bubbles are not allowed.

3.2 Performance Requirements.

3.2.1 Adhesion (GMW3019). One full set of test panels must be prepared using a major production technology from each approved source of e-coat.

3.2.1.1 The material must be capable of demonstrating a minimum of fine line cohesion performance after the first primer/sealer bake. See Table 2.

Table 2: Bake Cycle for Adhesion Testing

Bake System	9984537
	High Bake
Minimum Prime/Seal	20 minutes at 158 °C
Nominal Prime/Seal	25 minutes at 165 °C
Maximum Prime/Seal	90 minutes at 180 °C
Maximum Powder Prime	60 minutes at 190 °C

3.2.1.2 The material, when baked per Table 2, must not crack or lose adhesion to the substrate during or after exposure to the following conditions.

a. Initial Adhesion: After cooling to ambient temperatures.

b. Exterior Cycle: (GMW14124, Cycle F) 12 cycles.

3.2.1.3 In addition, the material must demonstrate cohesive adhesion when peeled from the substrate.

3.2.2 Elongation (ASTM D412, Method A, Using Die C Dumbbell). Material baked as described in Table 2 must exhibit no less than 100% elongation. This applies to all bakes (Minimum, Nominal and Maximum).

3.2.3 Shrinkage/Expansion (GMW15481). Material baked as described in Table 2 (Maximum bakes only) must exhibit zero percent (0%) expansion and no shrinkage greater than 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 Table 2 (Maximum bake only).

3.2.5 Degradation Resistance.

a. Apply two (2) beads of sealer, 3 mm thick x 40 mm wide x 200 mm long, to the surface of a phosphated steel panel (inspect panel first to be sure it is free of surface corrosion).

b. Repeat the application over a panel coated with production e-coat. Bake panel for 1 h at 150 °C.

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) sealer bead from each panel and inspect the surface of the panel. There must not be any corrosion on the surface of the panel where the sealer had been.

3.2.5.2 After Humidity (GMW14729). Expose both panels, with the remaining sealer beads, to 40 °C at > 98% humidity for 240 h. After exposure, remove the remaining sealer from the panels and inspect the surface of the panel. Again there must be no corrosion on the panel surface where the sealer had been.

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

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 Method B). The test panels shall be prepared per 3.2.7 a thru 3.2.7 f and baked per Table 3.

a. **Layering Combinations.**

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