GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16070

Sealer, Global, Pumpable, Paintable, Ultralight – Generic Qualification

1 Scope

This specification details the requirements of a paintable, pumpable, ultralight sealer. The material is applied in the Paint Shop after the E-coat bake, before primer surfacer, and must be capable of being either manually or robotically applied. The material 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.

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-coats. It must not have corrosion-causing ingredients.

1.2 Symbols. Not applicable.

1.3 Typical Applications. Sealing of interior and exterior (non-Class A) E-coated body joints in the Paint Shop after the E-coat oven but before primer surfacer 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	ISO 2813	SAE J1524
ASTM D1475	EN ISO 1524	ISO 3219	SAE J1864
ASTM D2196	EPA Method 24	ISO/TS 16949	

2.2 GM Standards/Specifications.

9986307	GMW3019	GMW3205	GMW15481
9986308	GMW3022	GMW3235	GMW15634
9986309	GMW3025	GMW14124	GMW16695
GMW3016	GMW3059	GMW14829	GMW16701

2.3 Additional References.

- TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

Specific material requirements and appropriate test methods are listed under the individual properties and summarized in Table 4. All bake schedules are specified in time at substrate temperature.

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3.1 Requirements on Delivery.

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

3.1.2 Odor (GMW3205 Codings A and 1). Prepare a cured film of sealer that is 3 mm ± 0.5 mm thick baked at the appropriate nominal bake conditions in Table 4. Cut test specimens from this cured film of material, and condition for seven days at 23 °C ± 5 °C before initiating the test procedure. Evaluate using the Wet Condition – Coding A and volume ratio Coding 5 from Table 1 in GMW3205. The material shall have a tolerable or better odor and a minimum rating of 6.

3.1.3 Fogging (GMW3235-A-Y3-T2-90% Minimum). Prepare a cured film of sealer (3 mm ± 0.5 mm thick) baked at the appropriate nominal bake conditions in Table 4. Cut test specimens from this cured film of material, and condition for seven days at 23 °C ± 5 °C before initiating the test procedure. Evaluate using GMW3235 Method A - Photometric Method. Report results.

3.1.4 Volatile and Semi-Volatile Organic Compounds (SVOC) from Interior Materials (GMW15634). Prepare a cured film of sealer (3 mm ± 0.5 mm thick) baked at the appropriate nominal bake conditions in Table 4. Cut test specimens from this cured film of material, and condition for seven days at 23 °C ± 5 °C before initiating the test procedure. After this conditioning, packaging is done as described in this specification for other test materials. Evaluate SVOC using 60 minutes at 120 °C per GMW15634.

3.1.5 Volatile Organic Compound (VOC) Determination (EPA Method 24, Using ASTM D2369). Target material performance should be 35.9 kg/m^3 (0.3 lb/gal) or less. The final VOC of the product, including all weights, calculations, and runs, are to be identified and reported as data in the submission book.

3.1.5.1 Condensing Volatiles Test (GMW3016). Three percent (3%) maximum allowed when baked as follows and tested according to GMW3016:

- 9986307/9986309: 20 minutes at 165 °C ± 5 °C
- 9986308: 20 minutes at 130 °C ± 5 °C

3.1.6 Viscosity. The viscosity shall be determined and reported using the following three methods.

3.1.6.1 Press Flow Viscosity (SAE J1524).

- Orifice: 1.32 mm
- Pressure: 414 kPa
- Sample weight: 20 g
- Sample test temperature: 25 °C ± 0.5 °C

The Key Product Characteristic (KPC) requirement is at 72 h from batch manufacture. The KPC viscosity requirement 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 following guidelines:

- Viscosity at 30 days: ≤ 72 h value +20%
- Viscosity at 60 days: ≤ 72 h value +40%
- Viscosity at 90 days: ≤ 72 h value +60%

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

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

3.1.6.2 Brookfield Viscosity (ASTM D2196).

- Spindle size: No. 7
- Rotational speed: 20 rpm
- Rotation time to reading: 1 minute
- Sample test temperature: 25 °C ± 0.5 °C

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The viscosity requirements are as follows:

The KPC requirement is at 72 h from batch manufacture. The KPC viscosity requirement shall be ≥ 100 000 cP and ≤ 115 000 cP.

3.1.6.2.1 When stored in proper conditions, the viscosity increase with age shall be ≤ 140 000 cP by the end of the 90-day shelf life of the material.

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

3.1.6.3 Rotational Viscometer. Determine the viscosity using a rotational viscometer (ISO 3219 and Z4 DIN cup and spindle).

- Rotation speed: 0 s^{-1} to 130 s^{-1}
- Sample test temperature: 25 °C ± 0.5 °C

Table 1: Viscometer Program

Test	Time (s)	Start Speed (s^{-1})	End Speed (s^{-1})
Wait Period	300	0	0
Ascending	120	0	130
Hold Cycle	180	130	130
Descending	120	130	0

3.1.6.3.1 The relative viscosity, descending Bingham Viscosity, and Yield Point (all KPC requirements) at 72 h after batch manufacture shall be as follows:

- Relative Viscosity: 10.0 Pa·s ± 2.0 Pa·s
- Descending Bingham: 7.0 Pa·s ± 1.0 Pa·s
- Yield Point: 400 Pa·s ± 100 Pa·s

3.1.6.3.2 When stored in proper conditions, the viscosity increase with age **shall not exceed** the following values:

3.1.6.3.2.1 Relative Viscosity at 90 Days: Variation shall not exceed 20% of 72 h data.

3.1.6.3.2.2 Descending Bingham at 90 Days: Variation must not exceed 10% of 72 h data.

3.1.6.3.2.3 Yield Point at 90 Days: Variation must not exceed 20% of 72 h data.

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

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

3.1.7.1 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 (baked according to Tables 2 and 3) must be prepared using a major production technology from each GM approved source of electrocoat. This must also include technologies from all GM regions globally. The electrocoat panels for this testing must be prepared and processed in an actual assembly plant.

The material must be capable of demonstrating at least a minimum of fine line cohesion performance after the first primer/sealer bake.

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Table 2: Bakes for Adhesion (Nominal Baked E-coat)

Bake System	High Bake (9986307/9986309)	Low Bake (9986308)
Minimum Prime/Seal	15 minutes at 158 °C	15 minutes at 125 °C
Nominal Prime/Seal	20 minutes at 165 °C	20 minutes at 130 °C
Maximum Prime/Seal	60 minutes at 180 °C	90 minutes at 158 °C
Maximum Powder Prime (9986309 only)	60 minutes at 190 °C	Not applicable

Table 3: Bakes for Adhesion (Overbaked E-coat)

Electrocoat (ELPO) Bake	Sealer/Primer Bake
Maximum: 60 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 When baked as described in Tables 2 and 3, the material must not crack or lose adhesion to the substrate during or after exposure to the following conditions. In addition, the material must demonstrate at least a minimum of fine line cohesive adhesion when peeled from the substrate.

- Initial adhesion: After cooling to ambient temperatures
- Exterior cycle (GMW14124, Cycle F): 12 cycles

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 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 according to Table 2 (maximum bakes only).

3.2.5 Degradation Resistance. Apply two 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 ensure it is free of surface corrosion). Bake panel as follows:

- For 9986307/9986309: Bake 1 h at 200 °C.
- For 9986308: Bake 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 sealer bead from the 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. Expose the panel with the remaining sealer bead to 40 °C at ≥ 98% humidity for 240 h.

3.2.5.3 After exposure, remove the remaining sealer from the panel and inspect the surface of the panel. 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, antichip 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). The test panels shall be prepared according to combinations 3.2.7.1, 3.2.7.2, 3.2.7.3, and 3.2.7.4 and baked according to the appropriate bake schedule in Table 4 (high or low primer bake). The paint systems tested shall represent at least one production system from each major paint supplier. The systems chosen should also cover the different types of primer, basecoat, and clearcoat technologies and must also represent paint systems/technologies from each region of GM globally.

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