



Sealers, Paint Shop, Pumpable, for Waterborne/2K, 3-Wet, Non-Compressed, Compact Painting Process, Generic Qualification

1 Scope

This specification details the performance requirements of a family of sealers designed to be compatible with the three (3) wet compact painting process which uses waterborne basecoat plus Two (2) Component (2K) clearcoat topcoat systems. The materials are, applied in the paint shop after the Electrocoat (E-Coat) bake. They must be capable of being either manually or robotically applied. The materials are intended to seal interior and exterior body joints against water, dust, air intrusion and corrosion. The family of materials include: High Appearance Paintable, Ultralight and Abrasion Resistant Rocker Antichip/Under Body Sealer/Under Body Coating Sealers.

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

1.1.1 The materials must be capable of being dispensed with approved and validated; production displacement pumping and application equipment including (depending upon material type and application): single/multipoint streaming, flat stream, automated hem sealing and airless fan spray and airless spray with rotary masking. Dispense testing shall be conducted through production Manufacturing Systems Qualification (MSQ) validated application equipment appropriate for the type of sealer material and application process.

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

1.1.3 In addition, the materials must not adversely affect those personnel handling them.

1.1.4 The materials must adhere to all approved production E-Coats. They must not have corrosion causing ingredients.

1.2 Symbols. Not applicable.

1.3 Applicability. The materials validated and approved under this specification are formulated to be compatible with the three (3) wet non-compressed sealer and topcoat bakes, painting process and topcoat materials. The placement of application on the vehicle is determined by the type of material. The abrasion resistant materials are typically used as rocker anti-chip and/or underbody coating. The ultralight material is typically used for all interior and underbody seam sealing. In addition, the high appearance paintable material is typically used to seal "appearance" joints that receive subsequent finessing/skiving.

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 J1960
ASTM D634	ASTM E1428	ISO 3219	Z4 DIN
ASTM D1475	ASTM G21	SAE J1524	
ASTM D2196	DIN 53203	SAE J1864	

2.2 GM Standards/Specifications.

9984515	GMW3016	GMW14124	GMW15634
9986329	GMW3019	GMW14270	GMW16124
9986347	GMW3022	GMW14729	GMW16695
9986348	GMW3025	GMW14829	GMW16701
9986351	GMW3059	GMW14873	GMW17468
9986369	GMW3205	GMW15481	
GMW3005	GMW3235	GMW15487	

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2.3 Additional References.

Packaging as Described for Other Test Materials

Photometric Method; Method A

3 Requirements

3.1 Requirements on Delivery.

3.1.1 Specific Gravity (ASTM D1475).

- 9986347 (Abrasion Resistant Material): Typically 1.4 g/cc $\pm$ 0.2 g/cc
- 9986351 (Ultralight Material): 0.85 g/cc maximum
- 9986348 (High Appearance Paintable Material): Typically 1.4 g/cc $\pm$ 0.2 g/cc
- 9986369 (Exposed Roof Ditch Sealer): Typically 1.4 g/cc $\pm$ 0.2 g/cc

3.1.2 Interior Odor (GMW3205-A-1) for 9986351 and 9986348. Prepare a cured film of sealer that is 3 mm $\pm$ 0.5 mm thick baked at the appropriate nominal bake conditions in Table 4. Cut test specimens from this cured film of material, then condition for seven (7) days at 23 °C $\pm$ 5 °C before initiating test procedure. Evaluate using the Wet Condition; Coding A and Volume Ratio Coding Five (5) from Table 1 found in the GMW3205 test procedure. The material shall have a tolerable or better odor; minimum rating of six (6).

3.1.3 Fogging (GMW3235, A Y3 T2, 90% Minimum) for 9986348 and 9986351 Only. Prepare a cured film of sealer that is 3 mm $\pm$ 0.5 mm thick baked at the appropriate nominal bake conditions in Table 2. Cut test specimens from this cured film of material, then condition for seven (7) days at 23 °C $\pm$ 5 °C before initiating test procedure. Evaluate using Photometric Method; Method A.

3.1.4 Volatile and Semi-Volatile Organic Compounds (SVOC) from Interior Materials (GMW15634) for 9986348 and 9986351 Only. Prepare a cured film of sealer that is 3 mm $\pm$ 0.5 mm thick baked at the appropriate nominal bake conditions in Table 2 below. Cut test specimens from this cured film of material, then condition for seven (7) days at 23 °C $\pm$ 5 °C before initiating test procedure. After this conditioning, packaging is done as described for other test materials. Evaluate SVOC using 60 minutes at 120 °C per 4.2.2.1 of GMW15634.

3.1.5 Volatile Organic Compounds (VOC) Determination, (Environmental Protection Agency (EPA) EPA Method 24 Section 2.2 Using ASTM D2369 Procedure B), All Four (4) Materials. 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 shall be, identified and reported as data in the submission book.

3.1.5.1 Condensing Volatiles Test (GMW3016), All 4 Materials. Maximum 3% allowed when baked as follows and tested according to GMW3016:

- High bake materials 20 minutes at 165 °C $\pm$ 5 °C
- Low bake materials 20 minutes at 130 °C $\pm$ 5 °C

3.1.6 Viscosity. The viscosity shall be determined using the Pressflow (see 3.1.6.1), Brookfield (see 3.1.6.2) and Rheometric (see 3.1.6.3) methods.

3.1.6.1 Pressflow Viscosity (SAE J1524).

- Orifice: 1.32 mm (0.052 in)
- Pressure: 414 kPa (60 psi)
- Sample Weight: 20 g
- Test temperature is 25 °K $\pm$ 0.5 °K

3.1.6.1.1 Viscosity Batch Requirements. Key Product Characteristic (KPC) the viscosity requirement, at 72 h from date of batch manufacture, shall be:

- 9986348: 60 s $\pm$ 5 s
- 9986351: 60 s $\pm$ 5 s
- 9986347: 6.5 s $\pm$ 3.5 s
- 9986369: 40 s $\pm$ 5 s

3.1.6.1.2 Viscosity Age Requirements. When product is stored in proper conditions, the rate at which the viscosity increases with age **should not** exceed the following guidelines (see 3.1.6.1.2.1 thru 3.1.6.1.2.3).

3.1.6.1.2.1 Guidelines for 9986348 and 9986351.

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- Viscosity at 30 days $\leq$ 72 h value + 20%
- Viscosity at 60 days $\leq$ 72 h value + 40%
- Viscosity at 90 days $\leq$ 72 h value + 60%
- **Note:** In no case should the material viscosity exceed 100 s at the end of the 90 day shelf life of the material.

3.1.6.1.2.2 Guidelines for 9986347.

- Viscosity at 90 days $\leq$ 72 h value +20%
- **Note:** In no case should the material viscosity exceed 13 s at the end of the 90 day shelf life of the material

3.1.6.1.2.3 Guidelines for 9986369.

- Viscosity at 90 days shall be $\leq$ 72 h data +35%
- **Note:** In no case should the material viscosity exceed 60 s at the end of the 90 day shelf life of the material

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

3.1.6.2 Brookfield Viscosity (ASTM D2196).

- Spindle: Number Seven (7)
- Rotational Speed 20 rpm
- Take viscosity reading after one (1) minute
- Test temperature is $25\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$

3.1.6.2.1 Viscosity Batch Requirements. Key Product Characteristic (KPC) requirement at 72 h from batch manufacture, the viscosity shall be:

- 9986348: 150 000 cps to 165 000 cps (centipoise)
- 9986351: 100 000 cps to 115 000 cps
- 9986347: 55 000 cps to 70 000 cps
- 9986369: 25 000 cps to 40 000 cps

3.1.6.2.2 Viscosity Age Requirements. When stored in proper conditions, the viscosity increase with age should not exceed:

- 9986348: 190 000 cps at 90 days
- 9986351: 140 000 cps at 90 days
- 9986347: 90 000 cps at 90 days
- 9986369: 50 000 cps at 90 days

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

3.1.6.3 Rheometric Determination of Viscosity; Using a Rotational Viscometer (see ISO 3219 using Z4 DIN Cup and Spindle).

- Rotation Speed 0 1/s to 130 1/s sample test temperature $23\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{K}$

Table 1: Viscometer Program

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

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

- 9986348: Descending Bingham ($13 \text{ Pa s} \pm 2 \text{ Pa s}$), Bingham Yield Stress ($575 \text{ Pa} \pm 125 \text{ Pa}$)
- 9986351: Descending Bingham ($7.0 \text{ Pa s} \pm 1.0 \text{ Pa s}$), Bingham Yield Stress ($400 \text{ Pa} \pm 100 \text{ Pa}$)
- 9986347: Descending Bingham ($1.75 \text{ Pa s} \pm 0.8 \text{ Pa s}$), Bingham Yield Stress ($380 \text{ Pa} \pm 120 \text{ Pa}$)
- 9986369: Descending Bingham ($6.7 \text{ Pa s} \pm 0.2 \text{ Pa s}$), Bingham Yield Stress ($117.5 \text{ Pa} \pm 7.5 \text{ Pa}$)

3.1.6.3.2 Viscosity Age Requirements. When stored in proper conditions, the viscosity increase with age shall not exceed the following values:

- Descending Bingham (at 90 days): Variation should not exceed 10% of 72 h data
- Yield Stress (at 90 days): Variation should not exceed 20% of 72 h data

3.1.6.3.3 Viscosity Data. The measured and calculated data, along with the curves generated, shall be included as data in the material submission book.

3.1.7 Particle Size (DIN 53203): 200 μm maximum.

3.1.8 Color. White or light gray.

3.2 Performance Requirements.

3.2.1 Adhesion (GMW3019), All Materials. One (1) full set of test panels (bake according to Table 2 and Table 3) must be prepared using a major production technology from each GM approved source of electrocoat. This must also include electrocoat technologies from all GM regions globally. The electrocoat panels for this testing must be prepared and processed in an actual assembly plant unless otherwise agreed to by the approving GM engineer.

The materials must be capable of demonstrating at least a minimum of fine line cohesion performance after the sealer bake oven.

Table 2: Bakes for Adhesion (Manufacturing Plant Prepared E-Coat Panels)

Sealer Bake Oven	9986347, 9986348, 9986351, 9986369
Minimum Sealer Bake	6 minutes at 130 °C
Low Limit Sealer Bake	10 minutes at 140 °C
Target Sealer Bake	10 minutes at 149 °C
Upper Limit Sealer Bake	20 minutes at 163 °C

**Table 3: Bakes for Adhesion Over Baked E-Coat Panels;
Applied Coating Technology (ACT) Laboratory or Equivalent**

Electrodeposition Paint Operations (ELPO) Bake	Sealer Bake
60 minutes at 190 °C	All bakes in Table 2

3.2.1.1 The materials, when baked as described in Table 2 and Table 3, must not crack or lose adhesion to the substrate during or after exposure to the following conditions (see 3.2.1.1a thru 3.2.1.1b). In addition, the material must demonstrate cohesive adhesion when peeled from substrate.

- Initial Adhesion; after cooling to ambient temperatures.
- Exterior Cycle; (GMW14124, Cycle F), 12 cycles.

3.2.2 Shrinkage/Expansion GMW15481, All Four (4) Materials. Material baked as described in 3.2.1, Table 2 (maximum bakes only) must exhibit no zero (0%) expansion and no shrinkage greater than 2%.

3.2.3 Elongation (9986347, 9986351, 9986348) ASTM D412, Method "A", Using Die "C" Dumbbell. Material baked as described in 3.2.1, Table 2, must not exhibit less than 100% elongation. This applied to all sealer bakes (minimum, lower limit, target, and upper limit).

3.2.3.1 Elongation (for 9986369 only) ASTM D412, Method "A", Using Die "C" Dumbbell and Crosshead Speed of 300 mm/minute.