



Sealer, Preformed, Body Shop, Expandable, Weldable

1 Scope

This specification details the material and performance requirements for weldable, preformed sealers that expand and cure in the Paint Shop Electrocoat (ELPO) oven. These materials are intended to seal body joints from water, dust, and air intrusion. These materials must be capable of being welded through.

1.1 Material Description. Weldable, preformed sealers are intended for use between two pieces of oily metal that will be welded through. After application and welding, the material is processed through pretreatment and ELPO baths, and then baked in the ELPO oven. These materials are typically tacky throughout, and may be referred to as “two-side tacky” or “T2.” A thin, dry film may be applied to one surface of the tacky, preformed sealer to improve the handling or weldability of the part, and the resulting composite sealer may be referred to as “one-side tacky” or “T1”.

1.2 Symbols. Not applicable.

1.3 Typical Applications. These materials are typically applied manually at the Metal Center, Assembly Plant Body Shop, or at an outside source.

1.4 Remarks. These materials are not intended to be fuel resistant and are not intended to be applied in the Paint Shop.

2 References

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

2.1 External Standards/Specifications.

ASTM D2369	ISO 1183
EPA Method 24	ISO/TS 16949

2.2 GM Standards/Specifications.

9986265	GMW3016
9986321	GMW3059
GM9650P	GMW3205
GM9763P	GMW3221
GM9764P	GMW14019
GM9831P	GMW14124

GM9921P	GMW14706
GME 60434	GMW14729
GME L 000 0131	GMW14872
GMW2	GMW15416
GMW8	GMW15477
GMW11	GMW15481
GMW3001	GMW15634
GMW3008	GMW15635
GMW3011	GMW16152

2.3 Additional References.

GWS-5A: Global Welding Standard Test Procedures – Resistance Spot Welding of Steel

3 Requirements

Unless otherwise specified, the following requirements must be met. All testing shall be performed with materials that are representative of production processes.

3.1 Requirements on Test Specimens.

Reference GMW3221.

3.1.1 Test Specimen Conditioning. Test specimens shall be conditioned per GMW3221, Code D.

3.2 Physical Properties. Requirements in this section refer to the uncured material.

3.2.1 Specific Gravity (ISO 1183 (Density), Part 1, Method B). The specific gravity of the uncured material shall be reported. A specific gravity range will be established at the time of approval and become a requirement for the material. A typical specific gravity is 1.2.

3.2.2 Odor. The material shall have a neutral odor that is not unpleasant in the uncured condition.

3.2.3 Flame Resistance (GM9831P). The material shall resist 50 passes with an open flame and be self-extinguishing.

3.2.4 Plant Emissions.

3.2.4.1 Oven Condensing Volatiles Test (GMW3016). Evaluate at Maximum bake per 3.3.2.3, followed by 2 h at $23 \pm 5^\circ\text{C}$. Volatile Organic Compounds (VOC) shall be 2% by mass, maximum. If reported VOC exceeds 2% by mass, the composition of the VOC must be declared.

3.2.4.2 Plant Emissions Volatile Organic Compounds (VOC) Determination (EPA Method 24, section 2.2, using ASTM D2369 Method E). EPA Method 24 is required for US and Canada. For US, Hazardous Air Pollutants (HAP) shall be 1% by mass, maximum, based on Material Safety Data Sheet (MSDS) formula. Evaluate after Minimum and Maximum bake per 3.3.2.3, followed by 2 h at $23 \pm 5^\circ\text{C}$. Local plant review and approval may be required prior to each new plant implementation of this material.

3.3 Performance.

3.3.1 Expansion.

3.3.1.1 General Expansion. Sealer shall display controlled expansion that is smooth and uniform after all bake conditions. Cell structure shall be closed cell, uniform, and free of large voids. Sealer shall show no loss of expansion or detrimental effects from subsequent bakes.

3.3.1.2 Volumetric Expansion.

3.3.1.2.1 Volumetric Expansion (GMW15481). Report the volumetric expansion for the material after each of the bakes per 3.3.2.3. The volumetric expansion at the Target bake shall be used to determine the approval category per Table 1.

Table 1: Volumetric Expansion

Volumetric Expansion Description	Volumetric Expansion Code	Volumetric Expansion at Target Bake
Very Low Expansion	E20	20 to 100%
Low Expansion	E100	>100 to 200%

3.3.1.2.2 Volumetric Expansion Range. The volumetric expansion range shall be calculated using a tolerance of $\pm 25\%$ based on the volumetric expansion at Target bake, and will become a requirement for the material. For example, if a material has an average of 120% volumetric expansion at Target bake, the calculated volumetric expansion range will be 90 to 150%. The volumetric expansion measured for the material shall be contained within the volumetric expansion range after each of the specified bake conditions (Minimum, Target, Maximum and Full System). Furthermore, the volumetric expansion of the material shall be contained within the volumetric expansion range when measured at any point within the bake window defined by the following four points: Minimum time/temperature, Minimum time/Maximum temperature, Maximum

time/Minimum temperature, and Maximum time/temperature per 3.3.2.3.

3.3.1.3 Vertical Expansion/Ramp Expansion (GM9764P). Not required.

3.3.1.4 Horizontal Expansion/Bridging (GM9650P). After baking a set of samples at Minimum and Maximum bakes per 3.3.2.3, horizontal expansion shall be reported. A horizontal expansion range will be established at the time of approval, and become a requirement for the material.

3.3.2 Adhesion and Corrosion. Prepare test pieces per GMW15477. Adhesion and Corrosion testing shall be completed with a minimum of 1 sample per test condition. Allow test pieces to age for a minimum of 24 h at $23 \pm 5^\circ\text{C}$ following any specified bake, prior to exposure to any test environments, unless otherwise specified.

3.3.2.1 Substrates. Testing shall be completed with the substrates in Table 2. For oily metal, use one challenging GMW14019 approved lubricant as specified by the approving material engineer.

Table 2: Substrates

Substrate Description ^{Note 1}
Oily Cold Rolled Steel (CRS) (GMW2)
Oily Hot Dipped Galvanized Steel (HDG) (GMW8), 60 g/m ² galvanized coating weight
Oily Electrogalvanized Steel (EG) (GMW11), 60 g/m ² galvanized coating weight

Note 1: After application of the sealer, the oily metal panels shall be processed through pretreatment and ELPO prior to baking and exposure per 3.3.2.4.2 Thermal Cycle or 3.3.2.4.3 Corrosion. Use any GM approved pretreatment (GMW3011) and ELPO (GMW3008) at target film thickness, as specified by the approving material engineer.

3.3.2.2 Panel Configurations. If there is a conflict between GMW15477 and this standard, the requirements in this standard shall take precedence.

3.3.2.2.1 Weldable Test Panel Configuration. Weldable preformed sealers shall be tested Fully Constrained (all expansions) as defined in GMW15477. For one-side tacky sealers, the sealer shall be applied with the tacky side facing the primary sheet metal, according to the diagrams in GMW15477.

3.3.2.2.2 Constrained Panel Spacing. The Panel Spacing for the constrained panels as defined in GMW15477 shall be as defined in Table 3, unless otherwise agreed to by the approving material engineer.

Table 3: Constrained Panel Spacing

Volumetric Expansion Description	Volumetric Expansion Code	Constrained Panel Spacing (t = initial sealer thickness)
Very Low Expansion	E20	t
Low Expansion	E100	t

3.3.2.3 Bake Conditions. All bakes are specified as times at metal temperature, and defined in Table 4.

Table 4: Bake Conditions

Bake Description	Bake Conditions (Time at Metal Temperature)
Minimum	15 minutes at 160°C
Target	20 minutes at 165°C
Maximum	60 minutes at 190°C
Full System	15 minutes at 160°C, then cool to 23 ± 5°C + 20 minutes at 177°C, then cool to 23 ± 5°C + 20 minutes at 141°C

3.3.2.4 Test Environments.

3.3.2.4.1 Initial. Evaluate all Substrates per 3.3.2.1 and all Bakes per 3.3.2.3. Evaluate for Adhesion and Corrosion.

3.3.2.4.2 Thermal Cycle (GMW14124, Cycle I, 15 cycles). Evaluate all Substrates per 3.3.2.1. Evaluate at Minimum and Maximum bakes per 3.3.2.3. Evaluate sample within 1 h after removal from environment. Evaluate for Adhesion and Corrosion.

Note: All Thermal Cycle testing shall be performed on test specimens that have been "pretreated and ELPO'd" due to the corrosive nature of the test environment.

3.3.2.4.3 Corrosion (GMW14872, Underbody (UB), All, 4 salt sprays (4s), Method Severe-High/Severe-Moderate (SH/SM), Exposure D). Evaluate all Substrates per 3.3.2.1. Evaluate Minimum, Target and Maximum bakes per 3.3.2.3.

Evaluate sample within 1 h after removal from environment. Evaluate for Adhesion and Corrosion.

Note: All Corrosion testing shall be performed on test specimens that have been "pretreated and ELPO'd" due to the corrosive nature of the test environment.

3.3.2.5 Evaluation Criteria. After exposure to the Test Environments per 3.3.2.4, visually inspect the sealer for any unusual effects. Remove the sealer per GMW14706 and evaluate the area beneath the entire expanded footprint of the sealer. If there is a constraining panel, evaluate both sealer-to-substrate interfaces. The evaluation criteria is summarized in Table 5 and detailed in 3.3.2.5.1 and 3.3.2.5.2.

Table 5: Evaluation Criteria

Substrate Note 1	3.3.2.4.1 Initial	3.3.2.4.2 Thermal Cycle	3.3.2.4.3 Corrosion
Oily CRS	>80% cohesive separation No corrosion under sealer No undercutting		
Oily HDG			
Oily EG			

Note 1: After application of the sealer, the oily metal panels shall be processed through pretreatment and ELPO prior to baking and exposure per 3.3.2.4.2 Thermal Cycle or 3.3.2.4.3 Corrosion.

3.3.2.5.1 Adhesion. The sealer shall display no cracking or loss of adhesion to the substrate. The sealer shall demonstrate a minimum of 80% cohesive separation to the substrate. Fine line cohesive separation (surface close separation) is acceptable.

3.3.2.5.2 Corrosion. The metal beneath the sealer shall display no white or red corrosion. Slight discoloration on the surface of the metal under the sealer may be acceptable if the discoloration does not penetrate the metal or contribute to corrosion.

3.3.3 Water Absorption (GMW16152, 2 h and 24 h Immersion). Material cured at the Minimum and Maximum bakes per 3.3.2.3 shall have water absorption as defined in Table 6. No moisture shall penetrate the sealer to reach the substrate.