



Adhesion Requirements for Bonding Exterior Fiber Reinforced and Non-Fiber Reinforced Thermoset Plastics

1 Scope

1.1 Material Description. This specification covers the performance requirements for an adhesive or adhesive system suitable for bonding thermoset fiber reinforced plastics (FRP) such as Sheet Molding Compound (SMC) and Structural Reaction Injection Molded (SRIM), and non-fiber reinforced plastics in exterior applications.

1.2 Symbols. Not applicable.

1.3 Applicability. Exterior applications of all vehicles.

1.4 Remarks. Supplier is responsible for evaluating both in-house approved adhesives (production intent) as well as any GM assembly plant adhesives that will be bonded to the substrate.

2 References

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

2.1 External Standards/Specifications.

ASTM D3163	ASTM D5041	ISO 4587
ASTM D3807	ASTM D5573	

2.2 GM Standards/Specifications.

GM9751P	GMW3221	GMW14729
GMW3059	GMW14124	GMW15288

2.3 Additional References.

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

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221. All samples are to be conditioned prior to each requirement test to GMW3221, Code A.

3.2 Materials and Equipment Required.

3.2.1 Substrate coupons, 25 mm × 101 mm × 2.5 mm and 101 mm × 152 mm × 2.5 mm.

3.2.2 Suitable bonding fixture.

3.2.3 Water soak chamber capable of maintaining 54 °C ± 2 °C.

3.2.4 Universal tensile test machine capable of measuring loads at an accuracy of 1%.

3.2.5 Side impact machine as described in GM9751P.

3.2.6 Heated chamber capable of maintaining 82 °C ± 2 °C.

3.2.7 Oven capable of maintaining 70 °C ± 2 °C.

3.2.8 Freezer capable of maintaining -30 °C ± 2 °C.

3.2.9 Sixty degree (60°) wedge as described in ASTM D5041.

3.3 Physical Properties (Uncured Adhesive System). The adhesive and bonding method must be compatible with production systems.

3.4 Physical Properties/Requirements (Cured Adhesive System).

3.4.1 Paint Compatibility. The adhesive system must be compatible with the proposed paint systems and processes.

3.4.2 Process Compatibility. The cured adhesive system must meet all performance criteria specified in this standard after going through the production process for the intended application.

3.5 Requirements and Procedure for FRP and Non FRP Samples.

3.5.1 Lap Shear and Side Impact Samples.

3.5.1.1 Specimens shall be prepared according to the procedure outlined in ASTM D3163.

Caution: Cure must be compatible with the intended plant cure schedule. This includes initial cure and oven exposures at the sub assembler as well as the GM assembly plant.

3.5.1.2 A sample set shall consist of a minimum of five (5) specimens.

3.5.1.3 Lap shear specimens shall be tested according to the procedure outlined in ISO 4587.

3.5.1.4 Side impact specimens shall be tested according to the procedures outlined in GM9751P.

3.5.1.5 All samples must demonstrate cohesive failure within the adhesive or fiber tear of the substrate in all test conditions. Adhesive failure is not acceptable unless otherwise stated.

3.5.1.6 Substrate fracture, below minimum performance requirements, is to be considered a no-test condition, and the test repeated or sample rejected.

3.5.2 Environmental Conditioning.

3.5.2.1 Two (2) sample sets shall be maintained at room conditions; $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ Relative Humidity (RH) and will be referred to as initial.

3.5.2.2 Two (2) sample sets will be equilibrated to $-30\text{ }^{\circ}\text{C}$.

3.5.2.3 Four (4) sample sets shall be exposed to water soak at $54\text{ }^{\circ}\text{C}$ for a period of seven (7) days. For sets tested wet, test within 15 minutes of removal from water.

3.5.2.4 Two (2) sample sets shall be exposed to the cycle as described in GMW14124, (Cycle G, 30 cycles, 6 weeks).

3.5.2.5 Two (2) sample sets shall be exposed to the cycle described in GMW15288 (20 cycles; four (4) weeks).

3.5.2.6 Two (2) sample sets shall be exposed to condensing humidity at $38\text{ }^{\circ}\text{C}$ for eight (8) weeks (GMW14729).

3.5.2.7 Two (2) sample sets shall be aged at $70\text{ }^{\circ}\text{C}$ for eight (8) weeks.

3.5.2.8 One (1) sample set shall be equilibrated at $82\text{ }^{\circ}\text{C}$.

3.5.3 Performance Requirements.

3.5.3.1 Lap Shear Requirements. See Table 1 for non FRP samples. All samples shall maintain at least 75% of the initial strength regardless of the magnitude or failure mode with the exception of the $82\text{ }^{\circ}\text{C}$ test which must maintain a minimum of 1.4 MPa.

3.5.3.2 Side Impact Requirements. See Table 2.

3.6 Requirements and Procedure for FRP Samples Only.

3.6.1 Wedge Samples.

3.6.1.1 Specimens shall be prepared according to the procedure outlined in ASTM D5041, Section 7. Plaques shall be $101\text{ mm} \times 152\text{ mm} \times 2.5\text{ mm}$. Bond area shall be $101\text{ mm} \times 51\text{ mm}$. Bond gap shall be $0.8\text{ mm} \pm 0.25\text{ mm}$.

Caution: Cure must be compatible with the intended plant cure schedule. This includes initial cure and oven exposures at the sub assembler as well as the GM assembly plant.

3.6.1.2 A sample set shall consist of a minimum of five (5) specimens.

3.6.1.3 Wedge specimens shall be tested according to the procedure outlined in ASTM D5041, except use a 60 degree wedge.

3.6.2 Environmental Conditioning.

3.6.2.1 One (1) sample set shall be maintained at room conditions $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and will be referred to as initial.

3.6.2.2 One (1) sample set shall be equilibrated at $82\text{ }^{\circ}\text{C}$.