



## Adhesive, Two-Part, MMA, Mix

### 1 Scope

**1.1 Material Description.** This mixed adhesive is comprised of an adhesive resin component, 9986440, and an adhesive activator component, 9986441. The mixture of 9986440 and 9986441 is identified as 9986442, Adhesive, Two-Part, Methyl Methacrylate (MMA) Mix. The system components must be capable of being metered, mixed, and dispensed with current production equipment. This adhesive system shall also be made available in cartridges to support laboratory testing and special production build events. It shall be compatible with production assembly systems with which it is interfaced. It shall be compatible with production paint systems and cannot be adversely affected by paint oven temperatures reaching 130 °C.

**1.2 Symbols.** Not applicable.

**1.3 Applicability.** This specification covers the mixture of a two-part adhesive for structural bonding of composites, including carbon fiber reinforced nylon panels, to themselves and to primed metallic substrates.

### 2 References

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

#### 2.1 External Standards/Specifications.

|           |            |               |                  |
|-----------|------------|---------------|------------------|
| ASTM D570 | ASTM D1144 | ASTM D3418    | SAE J243, ADS-10 |
| ASTM D638 | ASTM D1338 | ASTM E831     | SAE J1756        |
| ASTM D792 | ASTM D2240 | EPA Method 24 |                  |

#### 2.2 GM Standards/Specifications.

|         |         |         |          |
|---------|---------|---------|----------|
| 9986440 | 9986441 | GMW3059 | GMW15921 |
|---------|---------|---------|----------|

### 3 Requirements

**3.1 Toxicity.** This mixed adhesive must not have any adverse effects on personnel handling it. In addition, the material must have full approval of the appropriate medical department prior to production use.

**3.2 Mix Ratio.** The mix ratio of 9986440 Resin to 9986441 Activator is 1:1 by volume (1:1 by weight) and shall be capable of being varied  $\pm 5\%$ , and meet all the requirements of this specification.

**3.3 Color.** The two (2) adhesive components shall be in contrasting colors. The colors shall be so picked, that, in instances of improper mixing, color striations shall be visible in the dispensed bead.

**3.4 Paint Compatibility.** The mixed adhesive shall be compatible with production pre-treat, and paint systems.

**3.5 Material Properties – Uncured Adhesive.** See Table 1.

**3.6 Material Properties – Cured Adhesive.** See Table 2.

**3.7 Adhesive Properties.** Test specimens prepared as specified in the designated procedures, must meet the requirements of the specifications of GMW15921, Adhesion Requirements for Bonding Exterior Fiber Reinforced and Non-Fiber Reinforced Thermoset Plastics.

Table 1: Material Properties – Uncured Adhesives

| Properties                      | Values                                                                                                    | Test Methods                                                        |
|---------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Odor                            | The mixed adhesive shall not have a noxious odor in either cured or uncured condition.                    | ASTM D4339                                                          |
| Homogeneity                     | The mixed material must be homogeneous and free of lumps or air bubbles.                                  | Visual                                                              |
| Sag Resistance                  | < 5 mm                                                                                                    | SAE J243, ADS-10, °C                                                |
| Working Life                    | The mixed adhesive shall have an "open time" (working life) of 30 minutes minimum at 23 °C.               | ASTM D1338, Method A, 23 °C, dew point > 10 °C, 10 mm diameter bead |
| Time to Handling Strength       | 90 minutes to 160 minutes - dependent upon bond gap, and ambient temperature, without external influence. | ASTM D1144, 23 °C                                                   |
| Time to Peak Exothermal         | Peak exothermal occurs at approximately 75 minutes for a 30 g mass.                                       | ASTM D3418, 23 °C                                                   |
| Full Cure Time, 23 °C           | Approximately 24 h at 23 °C.                                                                              | ASTM D1144, 23 °C                                                   |
| Volatile Organic Compound (VOC) | < 1%                                                                                                      | Environmental Protection Agency (EPA) Method 24                     |

Table 2: Material Properties – Cured Adhesives

| Properties                       | Values                                | Test Methods                                                                      |
|----------------------------------|---------------------------------------|-----------------------------------------------------------------------------------|
| Density (Mixed)                  | 0.95 g/cc                             | ASTM D792                                                                         |
| Hardness                         | Shore D: 64 to 68                     | ASTM D2240, Method A                                                              |
| Glass Transition                 | 66.5 °C ± 1.5 °C                      | ASTM D3418                                                                        |
| Coefficient of Thermal Expansion | 121.3 µm/m/°C                         | ASTM E831                                                                         |
| Moisture Absorption              | < 1%                                  | ASTM D570                                                                         |
| Elongation                       | 90% to 160%                           | ASTM D638                                                                         |
| Tensile Strength                 | 17 MPa to 24 MPa Nominal              | ASTM D638                                                                         |
| Young's Modulus                  | 600 MPa (Nominal)                     | ASTM D638                                                                         |
| Bondline Read-through            | No unacceptable Bondline Read-through | -                                                                                 |
| Shrinkage                        | 13%                                   | -                                                                                 |
| Fogging                          | None                                  | SAE J1756 Photometric Method, bath temperature 85 °C (cooling temperature, 38 °C) |