



## Structural Low-Density, Liquid Molded Composite

### 1 Scope

**1.1 Material Description.** This specification covers the properties of compression molded, hand poured polyester incorporating nano-type fillers, and using a directed fiberglass preform. The cured material shall have a density of 1.2 g/cm<sup>3</sup> maximum, and 48% random oriented chopped glass fibers 25 mm long.

**1.2 Symbols.** The material abbreviation according to ISO 11469 is > UP-GF48 <.

**1.3 Applicability.** Typical applications include structural body panels.

**1.4 Remarks.** The material must meet the bondability requirements of GMW15921.

### 2 References

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

#### 2.1 External Standards/Specifications.

|         |             |             |           |
|---------|-------------|-------------|-----------|
| ISO 62  | ISO 527-1/2 | ISO 2577    | ISO 11469 |
| ISO 178 | ISO 1172    | ISO 6603-2  |           |
| ISO 180 | ISO 1183    | ISO 11359-2 |           |

#### 2.2 GM Standards/Specifications.

|         |         |          |          |
|---------|---------|----------|----------|
| GMW3059 | GMW3221 | GMW14270 | GMW15921 |
|---------|---------|----------|----------|

### 3 Requirements

**3.1 Requirements on Test Specimens.** Reference GMW3221.

**3.2 Test Procedures.** Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes, and/or handling the materials required by this specification.

**3.2.1** Properties shall be determined using test specimens router cut from compression molded, Liquid Molded Composite (LMC) test plaques. Plaques shall be molded using the mold temperatures, mold pressure, and cure cycle that will be used to mold production parts. Each material vendor shall define these molding conditions in this certifiable data package. The length and width of the test mold, as well as the gate configuration, shall be included in the certification package. Plaques shall be 2.5 mm ± 0.1 mm thick. Weight variation between plaques shall not exceed ± 3.0%.

**3.2.2** Raw materials used for compounding shall be within their vendor defined shelf life. Plaques shall be uniform in appearance and free from blisters, pregels, knit lines, cracks, and surface contamination. Porosity shall be one (1) pit maximum per 625 mm<sup>2</sup>. Surfaces shall also be free of external mold release. (Mold and scrap a minimum of three (3) plaques after using external mold release.)

**3.2.3** An equal number of specimens shall be cut from both the longitudinal and transverse plaque directions for each mechanical property. The specimens shall be tested, and the results averaged. The average value is the material property value. This value is compared to the required value in Table 1.

**3.2.4** Tests shall be conducted 40 h minimum after molding, and immediately following a conditioning period of 24 h minimum at 22 °C ± 3 °C and 50% ± 5% Relative Humidity (RH), unless otherwise specified. All testing shall be done on unannealed samples.

### 3.3 Compound Properties.

#### 3.3.1 Compound Properties (Natural, Gray and Black). See Table 1.

**Table 1: Compound Properties**

| Properties                                                                                                                         | Test Values                                                     | Test Methods                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Glass Fiber Reinforcement                                                                                                          | 44% to 52%                                                      | ISO 1172                                                                                                                                                                          |
| Moisture Absorption                                                                                                                | 1.0% maximum                                                    | ISO 62 Method 1                                                                                                                                                                   |
| Density                                                                                                                            | 1.20 g/cm <sup>3</sup> maximum                                  | ISO 1183 Method A                                                                                                                                                                 |
| Flexural Modulus<br>At +22 °C<br>0.5 mm deflection<br>2.5 mm deflection<br><br>At 150 °C<br>0.5 mm deflection<br>2.5 mm deflection | 8400 MPa minimum<br>9000 MPa minimum<br><br>Report<br>Report    | ISO 178 Method 1. Three point loading.<br>1.3 mm/minute, 70 mm length<br>10 mm wide, thickness 2.5 mm to 3.0 mm, 60 mm span, secant calculations at 0.5 mm and 2.5 mm deflection. |
| Flexural Strength                                                                                                                  | 195 MPa minimum                                                 | ISO 178 Method 1                                                                                                                                                                  |
| Tensile Strength at Break                                                                                                          | 108 MPa minimum                                                 | ISO 527-1/2                                                                                                                                                                       |
| Tensile Modulus                                                                                                                    | 9600 MPa minimum                                                | ISO 527-1/2                                                                                                                                                                       |
| Multi Axial Instrumented Impact<br><br>Maximum Load<br>Deflection to Maximum Load<br>Energy to Maximum Load<br>Total Energy        | 680 N minimum<br>6 mm maximum<br>1.8 J minimum<br>2.3 J minimum | ISO 6603-2 Speed of testing, 2.2 m/s                                                                                                                                              |
| Poisson's Ratio                                                                                                                    | Report                                                          | ISO 527-1/2                                                                                                                                                                       |
| Coefficient of Linear Thermal Expansion (CLTE)                                                                                     | Report                                                          | ISO 11359-2, Mean secant value over the temperature range -30 °C to 150 °C                                                                                                        |
| Unnotched Izod Impact                                                                                                              | 1110 kJ/m <sup>2</sup> minimum                                  | ISO 180                                                                                                                                                                           |
| Mold Shrinkage <sup>Note 1</sup>                                                                                                   | +0.0003 ± 0.013% maximum                                        | ISO 2577                                                                                                                                                                          |

**Note 1:** This property assures reproducible mold shrinkage, but does not indicate the shrinkage used to cut tools for production parts.

**3.3.2 Constituent Materials.** Individual specifications for the materials which constitute the molding compound shall be established by the molder. Incoming materials shall be approved to those specifications by the molder's laboratory before release for production. Test results shall be maintained by the molder and be available for GM review.

**3.4 Suggested Compound Verification.** Inherent compound properties and test procedures that may be used to identify the material are noted within this list:

- Filler Content
- Glass Fiber Content