



## **Polyurethane Reinforced Reaction Injection Molded, Weatherable, 20 MPa, 30 MPa, 85 MPa or 270 MPa Flexural Modulus**

### **1 Scope**

**Note:** Nothing in this standard supercedes applicable laws and regulations.

**Note:** In the event of conflict between the English and domestic language, the English language shall take precedence.

**1.1 Purpose/Material Description.** This specification covers the properties of a molded in color, weatherable, reaction injection molded polyurethane compound having either a 20 MPa, 30 MPa, 85 MPa, or 270 MPa flexural modulus.

**1.2 Symbols.** Not applicable.

**1.3 Applicability.** Typical applications include encapsulated modular window assemblies.

**1.4 Remarks.** None.

### **2 References**

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

#### **2.1 External Standards/Specifications.**

|             |            |             |           |
|-------------|------------|-------------|-----------|
| ISO 34      | ISO 1183   | ISO 11359-2 | SAE J1976 |
| ISO 178     | ISO 6603-2 | SAE J1545   | SAE J2527 |
| ISO 527-1/2 |            |             |           |

#### **2.2 GM Standards/Specifications.**

|         |          |          |
|---------|----------|----------|
| GMW3059 | GMW14270 | GMW16853 |
| GMW3221 | GMW14444 |          |

#### **2.3 Additional References.**

- Armor All/STP Products Company, Danbury, Connecticut ([www.armorall.com](http://www.armorall.com))

### **3 Requirements**

**3.1 Requirements on Test Specimens.** Reference GMW3221, Code A.

**3.2 Emissions Testing of Interior Materials and Parts.** For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

**3.3 Test Procedures.** Tests shall be conducted using the latest issue of the test method 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.

**3.3.1** Properties shall be determined using test specimens die cut from edge gated reaction injection molded test plaques that have been post cured by baking for 60 minutes at 121 °C within 8 h of molding. The plaques shall be (250 mm ± 0.2 mm) × (300 mm ± 0.2 mm) (minimum) × (3.8 mm ± 0.2 mm).

**3.3.2** Tests shall be conducted 40 h minimum after post cure and immediately following a conditioning period of 24 h minimum at 22 °C ± 3 °C and 50% Relative Humidity (RH) ± 5% RH unless otherwise specified.

**3.3.3** 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 shown in the Compound Properties table(s).

**3.3.4 Colorfastness Evaluation Procedure.** The color of each test specimen shall be measured per SAE J1545, Commission Internationale de l'Eclairage (International Commission on Illumination) (CIELAB), ten (10) degree observer, illuminant D65, specular included, sphere geometry, before and after exposure.

**3.3.4.1** Prior to making measurements and observations on weathered specimens, wash the specimens with a solution consisting of 2 g Number 7 Car Wash Concentrate (distributed by Armor All Products) and 1 L deionized water at  $22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ . Use a soft sponge saturated with the solution and scrub the samples with a firm action.

**3.4 Compound Properties (Natural and Black).** See Table 1. Material types are defined according to the flexural modulus as follows:

- **T1:** 20 MPa Flexural Modulus
- **T2:** 30 MPa Flexural Modulus
- **T3:** 85 MPa Flexural Modulus
- **T4:** 270 MPa Flexural Modulus

**3.5 Suggested Compound Verification.** Inherent compound properties and test procedures that may be used to identify this material are listed as follows. The test value and test procedure requirements are identical to those listed in 3.3 and 3.4.

- Infrared Characterization Scan
- Density

**Table 1: Compound Properties (Natural and Black)**

| Properties                                           | T1 (20 MPa Flexural Modulus) Test Values            | T2 (30 MPa Flexural Modulus) Test Values             | T3 (85 MPa Flexural Modulus) Test Values              | T4 (270 MPa Flexural Modulus) Test Values               | Test Methods                                                                                                                                                  |
|------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Density                                              | 1.067 to 1.107 g/cm <sup>3</sup>                    | 1.039 to 1.099 g/cm <sup>3</sup>                     | 1.033 to 1.111 g/cm <sup>3</sup>                      | 1.033 to 1.145 g/cm <sup>3</sup>                        | ISO 1183 Method A                                                                                                                                             |
| Flexural Modulus at -30 °C<br>at +22 °C<br>at +70 °C | 250 MPa maximum<br>8 MPa to 35 MPa<br>0 MPa minimum | 350 MPa maximum<br>22 MPa to 52 MPa<br>5 MPa minimum | 615 MPa maximum<br>49 MPa to 132 MPa<br>7 MPa minimum | 880 MPa maximum<br>195 MPa to 355 MPa<br>22 MPa minimum | ISO 178,<br>10 mm/minute,<br>50 mm span,<br>80 mm × 25 mm<br>× 3.5 mm<br>specimen, chord<br>modulus<br>calculation using<br>0.5 mm to<br>2.5 mm<br>deflection |
| Tensile Strength at Break                            | 6 MPa minimum                                       | 8 MPa minimum                                        | 9 MPa minimum                                         | 15 MPa minimum                                          | ISO 527-1/2<br>Type 1B<br>specimen<br>50 mm/minute                                                                                                            |
| Elongation at Break                                  | 122% minimum                                        | 125% minimum                                         | 118% minimum                                          | 140% minimum                                            | ISO 527-1/2<br>Type 1B<br>specimen<br>50 mm/minute                                                                                                            |
| Tear Resistance                                      | 18 kN/m minimum                                     | 18 kN/m minimum                                      | 23 kN/m minimum                                       | 50 kN/m minimum                                         | ISO 34 Angle<br>Test Piece, No<br>Notch,<br>500 mm/minute<br>speed                                                                                            |