



## **Polybutylene Terephthalate (PBT) – Glass Fiber Reinforced, Impact Modified**

### **1 Scope**

**1.1 Material Description.** This specification covers the properties of glass fiber reinforced, impact modified, pellet form, injection moldable, polybutylene terephthalate compound.

**1.2 Symbols.** The material abbreviations according to ISO 11469 are shown in Table 1.

**1.3 Applicability.** Typical applications include the following: Fuel system components, gas-oil ratio (GOR) systems, underhood connectors, and ignition system.

**1.4 Remarks.** The classification into groups is according to the different ranges of glass fiber content. Additional glass fiber percentages will be added as required.

### **2 References**

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

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

|             |            |             |           |
|-------------|------------|-------------|-----------|
| ASTM E831   | ISO 527-1  | ISO 3795    | ISO 11469 |
| ISO 75      | ISO 527-2  | ISO 7792    |           |
| ISO 179/1eA | ISO 1183-1 | ISO 11357-3 |           |
| ISO 294     | ISO 3451-1 | ISO 11359-2 |           |

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

|         |         |          |          |
|---------|---------|----------|----------|
| GMW3013 | GMW3221 | GMW14270 | GMW16853 |
| GMW3059 | GMW3232 | GMW14444 |          |
| GMW3205 | GMW3235 | GMW15634 |          |

### **3 Requirements**

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

**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 Requirements on Delivery.** Important physical, mechanical and thermal properties that characterize the material are summarized in charts. The color shall be specified on drawings, in material specifications and otherwise.

**3.3.1** Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 7792. Before processing, the moisture content of the sample shall not exceed 0.02%. Test specimens shall be conditioned in a controlled atmosphere of  $+23\text{ °C} \pm 2\text{ °C}$  and  $50\% \pm 6\%$  Relative Humidity (RH) for at least 24 h prior to test. All tests shall be performed on unannealed specimens in a controlled atmosphere of  $+23\text{ °C} \pm 2\text{ °C}$  and  $50\% \pm 5\%$  RH unless otherwise specified. In addition, tests specified at temperatures below or above  $+23\text{ °C} \pm 2\text{ °C}$  shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum. The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available.

**3.3.2 Compound Properties (Natural and Black).** The following are also required for full standard approval. The minimum number of lots per test required is one (1) in natural:

- Poisson's Ratio
- Coefficient of Linear Thermal Expansion (CLTE)
- Mold Shrinkage
- Stress Strain Curve at multiple temperatures. For example:  $-30\text{ °C}$ ,  $+23\text{ °C}$ ,  $+85\text{ °C}$ ,  $+140\text{ °C}$ .

See GMW3013 for the test procedures.

**3.3.3 Chemical Requirements.** All parts manufactured from molding compounds shall be resistant to the media they contact, such as aliphatic and aromatic hydrocarbons, fuels, lubricants, oils, greases and alcohols, at their places of use.

**3.4 Properties Requirements.** See Table 1.

**3.5** All materials supplied to this standard must comply with GMW3059, Restricted and Reportable Substances, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

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

|                                                                 |                      | Glass Fiber Reinforcement Percentage |                              |
|-----------------------------------------------------------------|----------------------|--------------------------------------|------------------------------|
|                                                                 |                      |                                      | 35%                          |
| Property                                                        | Standard             | Unit                                 | Value                        |
| ISO Symbol                                                      | ISO 11469            | -                                    | >PBT-I-GF35<                 |
| Density                                                         | ISO 1183-1           | g/cm <sup>3</sup>                    | Target Range<br>1.48 to 1.54 |
| Ash                                                             | ISO 3451-1           | %                                    | 30 to 36                     |
| Melting Temperature                                             | ISO 11357-3          | °C                                   | ≥ 218                        |
| Tensile Modulus                                                 | ISO 527-1, ISO 527-2 | MPa                                  | 7500 to 13000                |
| Tensile Stress at Yield                                         | ISO 527-1, ISO 527-2 | MPa                                  | ≥ 85                         |
| Tensile Strength After Heat Aging 1000 h at + 120 °C            | ISO 527-1, ISO 527-2 | % retention                          | ≥ 100                        |
| Notched Charpy Impact Strength<br>At + 23 °C<br>At -30 °C       | ISO 179/1eA          | kJ/m <sup>2</sup>                    | ≥ 7.0<br>≥ 4.0               |
| Notched Charpy Impact after Heat Aging after 1000 h at + 120 °C | ISO 179/1eA          | % retention                          | ≥ 75                         |
| Heat Deflection Temperature Under Load, 0.45 MPa                | ISO 75               | °C                                   | ≥ 200                        |