



## Polycarbonate – UV Stabilized

### 1 Scope

**1.1 Material Description.** This specification describes material types of unfilled polycarbonate, ultraviolet (UV) stabilized applications. This specification is based on GMW3013 per ISO 7391-1/2 recommendations.

**1.1.1 Paintability.** Plastics used for painted applications are required to meet Paint Performance Requirements for New Plastic Materials per GMW16172. Additionally, painted plastic parts are required to meet Painted Plastic Parts Performance Requirements per GMW14797.

**1.1.2 Types.** The classification into type codes is according to the different properties as described in Table 1 and Table 2.

**1.2 Symbols.** The material abbreviation according to ISO 11469 is >PC<.

**1.3 Applicability.** Typical applications include interior UV stabilized and exterior applications that are not exposed to sunlight or have a UV protective coating. Not for use in optical lens applications. For optical lens applications refer to GMW16729. For non-UV stable grades refer to GMW16727.

### 2 References

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

#### 2.1 External Standards/Specifications.

|            |           |            |             |
|------------|-----------|------------|-------------|
| ASTM D100  | ISO 179   | ISO 527-2  | ISO 7391-2  |
| ASTM D955  | ISO 294-1 | ISO 1133   | ISO 7724-1  |
| ASTM D1003 | ISO 294-3 | ISO 1183   | ISO 11359-2 |
| ASTM D3763 | ISO 294-4 | ISO 3795   | ISO 11469   |
| ASTM E831  | ISO 306   | ISO 6603-1 | SAE J1545   |
| ISO 75-1   | ISO 527   | ISO 6603-2 |             |
| ISO 75-2   | ISO 527-1 | ISO 7391-1 |             |

#### 2.2 GM Standards/Specifications.

|         |          |          |          |
|---------|----------|----------|----------|
| GMW3013 | GMW3235  | GMW14650 | GMW16729 |
| GMW3059 | GMW3417  | GMW14797 | GMW16853 |
| GMW3205 | GMW14162 | GMW15634 |          |
| GMW3221 | GMW14270 | GMW16172 |          |
| GMW3232 | GMW14444 | GMW16727 |          |

#### 2.3 Additional References.

Certification Template, available from GM SupplyPower <https://gmsupplypower.covisint.com>

### 3 Requirements

**3.1 Requirements on Test Specimens.** Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294-1 with the conditions for injection molding from ISO 7391-2. Test methods and specimen dimensions are also to be in accordance with ISO 7391-2.

All tests shall be performed on specimens 40 h minimum after molding and immediately following a conditioning period of 24 h minimum in a controlled atmosphere per GMW3221, Code A unless otherwise specified. All tests shall be performed on un-annealed specimens unless otherwise noted.

**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 Material Requirements.** Materials approved to this specification shall meet the requirements of GMW3013, General Requirements for Handling of Technical Terms of Delivery for Plastics.

**3.4 Requirements on Delivery.** Important physical, mechanical and thermal properties that characterize the material are summarized in Table 1 and Table 2.

**Note:** For each product, the requirements shall be documented using the latest Certification Template and Certification Statement according to GMW3013.

**3.5 Chemical Requirements.** All parts manufactured from molding compounds shall be resistant to the media they contact at their place of use.

**3.6 Compound Properties.** For compound property requirements, see Table 1 and Table 2. Table 1 defines the properties by code numbers which will be used within the specification. Full specification approval also requires general material properties per 3.6.1. The values listed in the compound property tables shall represent the minimum three sigma calculated values unless otherwise specified.

**3.6.1 Other Data.** The minimum number of lots per test required is one (1) in natural/crystal for:

- Poisson's Ratio
- Stress Strain Curve at -30 °C, +23 °C, +85 °C, +120 °C
- Differential Scanning Calorimeter (DSC) Curve
- Dynamic Mechanical Analysis (DMA) Curve
- Multiaxial Impact Curves

**3.7 Performance Requirements.**

All finished parts for Interior applications shall meet the requirements according to GMW14444.

All finished parts for Exterior applications shall meet the requirements according to GMW14650.

**3.8 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 Property Requirements - Type Code (Natural or Black)**

| Type                                                       |                                |                             | T1             | T2               | T3                   | T4            | T5                 |
|------------------------------------------------------------|--------------------------------|-----------------------------|----------------|------------------|----------------------|---------------|--------------------|
| Type Description                                           |                                |                             | High Viscosity | Medium Viscosity | Low/Medium Viscosity | Low Viscosity | Very Low Viscosity |
| Property                                                   | Standard <sup>Note 1</sup>     | Units                       |                |                  |                      |               |                    |
| Melt Flow Rate (MFR) <sup>Note 2</sup><br>+300 °C/1.2 kg   | ISO 1133                       | g/10 minutes                | < 8.0          | 10 ± 2           | 14 ± 2               | 18 ± 3        | > 25               |
| Melt Volume Rate (MVR) <sup>Note 2</sup><br>+300 °C/1.2 kg | ISO 1133                       | cm <sup>3</sup> /10 minutes | Report         | Report           | Report               | Report        | Report             |
| Charpy Notched Impact<br>at +23 °C                         | ISO 179/1eA<br>ISO 7391-2 3 mm | kJ/m <sup>2</sup>           | Report         | Report           | Report               | Report        | Report             |

|                                                                                                               |                                                                    |                              |                                |        |        |        |        |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------|--------------------------------|--------|--------|--------|--------|
| Charpy Notched Impact at -30 °C                                                                               | ISO 179/1eA<br>ISO 7391-2 3 mm                                     | kJ/m <sup>2</sup>            | Report                         | Report | Report | Report | Report |
| Multiaxial Impact at +23 °C, total energy, Speed = 6.6 m/s                                                    | ASTM D3763, Specimen C<br>100 mm × 100 mm ×3.2 mm                  | J                            | > 50                           | > 50   | > 40   | > 40   | > 30   |
| Multiaxial Impact at +23 °C, total energy, Speed = 4.4 m/s                                                    | ISO 6603-1<br>ISO 6603-2<br>Ø 60 x 2 mm or<br>60 mm × 60 mm × 2 mm | J                            | Report                         | Report | Report | Report | Report |
| Density                                                                                                       | ISO 1183                                                           | g/cm <sup>3</sup>            | 1.18 to 1.22 <sup>Note 3</sup> |        |        |        |        |
| Tensile Modulus                                                                                               | ISO 527-1, ISO 527-2                                               | MPa                          | > 1950                         |        |        |        |        |
| Tensile Stress at Yield                                                                                       | ISO 527                                                            | MPa                          | > 54                           |        |        |        |        |
| Vicat Softening Temperature, Heating rate +50 °C/h, Load 50 N                                                 | ISO 306                                                            | °C                           | > 135                          |        |        |        |        |
| Deflection Temperature Under Load (DTUL)<br>0.45 MPa                                                          | ISO 75-1<br>ISO 75-2                                               | °C                           | Report                         |        |        |        |        |
| DTUL<br>1.8 MPa                                                                                               | ISO 75-1<br>ISO 75-2                                               | °C                           | > 114                          |        |        |        |        |
| Mold Shrink <sup>Note 4</sup>                                                                                 | ISO 294-3, ISO 294-4 or<br>ASTM D955                               | %                            | 0.50 to 0.80 <sup>Note 3</sup> |        |        |        |        |
| Coefficient of Linear Thermal Expansion (CLTE) - Flow Direction <sup>Note 4</sup>                             | ASTM E831 or<br>ISO 11359-2                                        | 10 <sup>-6</sup><br>mm/mm/°C | 50 to 80                       |        |        |        |        |
| Luminous Transmittance <sup>Note 5</sup>                                                                      | ASTM D1003<br>Procedure B<br>3.2 mm thick plaque                   | %                            | > 84                           |        |        |        |        |
| Haze <sup>Note 5</sup>                                                                                        | ASTM D1003<br>Procedure B<br>3.2 mm thick plaque                   | %<br>maximum                 | < 2                            |        |        |        |        |
| For initial approval only, the following tests are required for one lot of a black, gray and neutral (brown). |                                                                    |                              |                                |        |        |        |        |
| Flammability                                                                                                  | GMW3232 or ISO 3795 (report values according to GMW3232)           | mm/min                       | ≤ 100                          |        |        |        |        |
| Emissions Testing of Interior Materials                                                                       | GMW16853                                                           |                              | See below                      |        |        |        |        |
| Odor                                                                                                          | GMW3205                                                            | Rating                       | See requirements of GMW16853   |        |        |        |        |