



Polycarbonate Copolymer - Weather Resistant

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 describes material types of Polycarbonate (PC) copolymer that offer the attributes of standard polycarbonate resin with enhanced weather resistance without the aid of a protective coating. Type numbers distinguish between different levels of weatherability based on color formulation and the applications requirements. Two resin melt flow rates are available. For high flow grades, a suffix indicating low molecular weight shall be added, see Table 3. This specification is based on GMW3013 per ISO 21305-1/2 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 standard properties are described in Table 1, the different levels of weather resistance properties are described in Table 2, and resin melt flow suffix codes are listed in Table 3. If no type designation is defined, Type 1 (T1), of highest level of weatherability, and standard resin melt flow apply as the default standard.

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

1.3 Applicability. Typical applications include interior and exterior applications that are exposed to sunlight without an Ultraviolet (UV) protective coating. Not intended for use in optical lens applications for regulated exterior lighting, refer to GMW16729.

2 References

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

2.1 External Standards/Specifications.

ASTM D523	ISO 188	ISO 1133	ISO 21305-2
ASTM D955	ISO 294-1	ISO 1183	ISO 21305-1/2
ASTM D1003	ISO 294-3	ISO 3795	SAE J1545
ASTM D3763	ISO 294-4	ISO 4892-1/2	SAE J1976
ASTM E831	ISO 306	ISO 6603-1	SAE J2527
ISO 75-1	ISO 527	ISO 6603-2	
ISO 75-2	ISO 527-1	ISO 11359-2	
ISO 179-1/1eA	ISO 527-2	ISO 11469	

2.2 GM Standards/Specifications.

GMW3013	GMW3232	GMW14650	GMW16172
GMW3059	GMW3235	GMW14797	GMW16729
GMW3205	GMW14270	GMW15634	GMW16853
GMW3221	GMW14444	GMW15635	

2.3 Additional References.

Plastic Submission Template

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 21305-2. Test methods and specimen dimensions are also to be in accordance with ISO 21305-2 with the following additions:

- All tests shall be performed on specimens for 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 unannealed specimens, unless otherwise noted.
- The values specified in Table 1, Table 2 and Table 3 shall be met by test specimens in natural and black. Integrally colored grades shall be tested to T1 requirements listed in Table 2, weatherability requirements, regardless of final approval type. Where other additive systems, e.g., stabilizers, are used; the impact values and impact after heat aging shall not decrease more than 10% from the specified minimum value.
- All types may be formulated with internal mold release, provided the physical properties of the compound remain within the specified limits and the mold release does not interfere with the appearance or function of the part to be molded, including any post-molding decorative process.

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,

3.4 Requirements on Delivery. Important physical, mechanical and thermal properties that characterize the material are summarized in Table 1, Table 2 and Table 3.

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 contacted at the place of use.

3.6 Compound Properties. Full specification approval requires the properties defined in Table 1, Table 2, Table 3 and 3.6.1. The values listed in the compound property tables in Table 1, Table 2, and Table 3, shall represent the minimum three (3) sigma calculated values.

3.6.1 Other Data. The minimum number of lots per test required for the following properties is one in natural:

- Poisson's Ratio.
- Stress strain curve at multiple temperatures: -30 °C, +23 °C, +85 °C and 120 °C. See the GMMPD tab on Plastic Submission Template for test parameters (contact specification owning group named in Section 6 for access).
- Coefficient of Thermal Expansion (CTE) data, See GMMPD tab on Plastic Submission Template for test parameters (contact specification owning group named in Section 6 for access).
- Differential Scanning Calorimetry (DSC) curve.
- Dynamic Mechanical Analysis (DMA) curve.
- Fourier Transform Infrared (FTIR) spectroscopy transmission and absorbance curve.

See the Polycarbonate tab on the Plastic Submission Template for the test procedures (contact specification owning group named in Section 6 for access).

Reference GMW3013 for all test procedures and parameters.

3.7 Performance Requirements. Additional Performance requirements shall be specified on part drawings or in component specifications.

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 obtain a GM-approved International Material Data System (IMDS) submission.

3.9 Initial Source Approval. No shipments shall be made by any supplier until representative initial production samples have been approved by the appropriate Materials Engineering department(s) as meeting the requirements of this specification.

Table 1: Standard Compound Property Requirements (Natural or Black)

Property	Standard ^{Note 1}	Unit	T1 and T2
Density (information only) ^{Note 2}	ISO 1183	g/cm ³	1.19 to 1.24
Tensile Modulus	ISO 527-1, ISO 527-2	MPa	≥ 2000
Tensile Stress at Yield	ISO 527	MPa	≥ 60
Tensile Properties after Heat Aging for 1000 h (90 °C) ^{Note 2}	ISO 188	% Retention of initial properties	≥ 90
Charpy Notched Impact Strength at +23 °C	ISO 179-1/1eA	kJ/m ²	≥ 5
Charpy Notched Impact Strength at -30 °C	ISO 179-1/1eA	kJ/m ²	≥ 5
Charpy Notched Impact Strength at +23 °C after Heat Aging for 1000 h (90 °C)	ISO 188	% Retention of initial properties	≥ 80
Multiaxial Impact at 23 °C, total energy	ASTM D3763, Speed = 6.6 m/s, Specimen C 100 mm × 100 mm × 3.2 mm or ISO 6603-1, ISO 6603-2, Speed = 4.4 m/s 60 mm diameter × 2 mm or 60 mm × 60 mm × 2 mm	J	≥ 50
Vicat Softening Temperature Heating rate 50 °C/h, Load 50 N	ISO 306	°C	≥ 130
Heat Deflection Temperature Under Load/Method B (HDT/B) 0.45 MPa	ISO 75-1, ISO 75-2	°C	≥ 123
Heat Deflection Temperature Under Load/Method A (HDT/A) 1.8 MPa	ISO 75-1, ISO 75-2	°C	≥ 110
Mold Shrink (information only) ^{Note 3}	ISO 294-3, ISO 294-4, or ASTM D955 Required plaque size ^{Note 4} 101.6 mm × 152.0 mm × 3.2 mm (4 in × 6 in × 0.125 in)	%	Report ^{Note 5}
Coefficient of Linear Thermal Expansion (CLTE): Flow Direction (information only) ^{Note 3}	ASTM E831 or ISO 11359-2	10 ⁻⁶ mm/mm/°C	50 to 80
Luminous Transmittance ^{Note 6}	ASTM D1003 Procedure B 3.2 mm thick sheet	%	> 84