



Polycarbonate - Optical Lens

1 Scope

1.1 Material Description. This specification describes materials types of unfilled polycarbonate for optical lens applications. Code numbers that apply to this specification are listed in Table 1. This specification is based on GMW3013 per ISO 7391-1/2 recommendations.

1.1.1 Paintability. Approved paint systems that can be used on this material are listed, e.g., in the General Motors Approved Paint on Parts Systems (GM APOPS) database.

1.1.2 Types. The classification into type codes is according to the different properties as described in Table 1. Standard Properties are listed in Table 2.

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

1.3 Typical Applications. Typical applications include exterior optical lens substrates.

2 References

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

2.1 External Standards/Specifications.

ASTM D1003	ISO 179/1eA	ISO 527-1	ISO 6603-2
ASTM D3763	ISO 294-1	ISO 527-2	ISO 7391-1
ASTM E831	ISO 294-3	ISO 1133	ISO 7391-2
CMVSS 108	ISO 294-4	ISO 1183	ISO 11359-2
FMVSS 108	ISO 306	ISO 3167	ISO 11469
ISO 75-1	ISO 527	ISO 6603-1	SAE J576
ISO 75-2			

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14650
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2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.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 with the following additions: use ISO 3167, Type 1A, thickness 4 mm for tensile and flexural properties.

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.

The values specified in Tables 1 and 2 shall be met by test specimens in natural/crystal. For crystal lens grades used in forward lighting, color review and approval by GM Materials Engineering is required. Integrally colored transparent grades used in exterior lighting shall meet 3-year weathering resistance as specified in Table 2.

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

3.3 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. The color shall be specified on drawings, in material specifications and/or otherwise.

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

3.5 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 listed in Table 2 and in 3.5.1. The values listed in the compound property tables shall represent the minimum three sigma calculated values.

3.5.1 Other Data. The minimum number of lots per test required is one in natural for: Poisson's Ratio, Stress Strain Curve at +23 °C, +120 °C, -30 °C; Differential Scanning Calorimeter (DSC) Curve; Multiaxial Impact Curve, and Infrared Spectroscopy Curve. It is preferred to include Dynamic Mechanical Analysis (DMA) Curves.

3.6 Performance Requirements. All finished lens components for exterior lighting require the use of a hardcoat unless not used for optical devices and are not visible when in vehicle position.

Optical device requirements shall be met as a requirement for approval to this specification. For example, all finished lens components for exterior lighting shall meet the necessary legal requirements, such as the Federal Motor Vehicle Safety Standards (FMVSS) and the Economic Commission for Europe (ECE), Regulatory Requirements for Lighting and Light Signaling Devices.

All finished parts for exterior applications shall meet the requirements according to GMW14650 and will require the use of an ultraviolet (UV) protecting coating such as a clearcoat or a hardcoat.

Additional performance requirements, e.g., flammability, fogging or resistance to odor, shall be specified on part drawings or in component specifications.

Table 1: Compound Property Requirements - Type Code (Natural/Crystal)

Property	Standard ^{Note 1}	Units	T1	T2
Melt Flow Rate ^{Note 2} (MFR) 300 °C/1.2 kg	ISO 1133	g/10 minutes	12 ± 3	18 ± 3
Melt Volume Flow Rate ^{Note 2} (MVR) 300 °C/1.2 kg	ISO 1133	cm ³ /10 minutes	Report	Report

Note 1: Standard test specimen and test setup should follow GMW3013.

Note 2: Preferred method is to test per MVR and calculate back to MFR, note if value is calculated or tested.