



Poly-N-methylmethacrylimide

1 Scope

1.1 Material Description. This specification describes material types of a transparent or pigmented Poly-N-methylmethacrylimide (PMMI) which are used in injection molded components.

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

1.1.2 Types. The classification into groups is according to the different properties as described in Table 1 and Table 2. Table 3 contains a brief description of the differentiation between the types.

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

1.3 Applicability. Typical applications include transparent exterior lighting lenses, light guides, light pipe, etc., that require higher heat resistance than acrylic/Polymethyl Methacrylate (PMMA).

2 References

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

2.1 External Standards/Specifications.

ASTM D955	ISO 294-4	ISO 11469	UN R 31.03
ASTM D1003	ISO 306	UN R 01.02	UN R 38.00
FMVSS 108	ISO 527	UN R 03.02	UN R 48.06
ISO 75-1	ISO 1133	UN R 04.00	UN R 77.00
ISO 75-2	ISO 1183	UN R 06.01	UN R 87.00
ISO 179/1eU	ISO 3167	UN R 07.02	UN R 91.00
ISO 294-1	ISO 8257-2	UN R 19.04	
ISO 294-3	ISO 11359-2	UN R 23.00	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14650
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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 as recommended by the resin supplier. Test methods and specimen dimensions are also to be in accordance with ISO 8257-2 with the following additions:

- Use ISO 3167, Type 1A, thickness 4 mm, for tensile and flexural properties, and thermal loads adjusted to reflect PMMI technology.
- 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 annealed specimens per ISO 8257-2, unless otherwise specified.
- The values specified in Table 1 and Table 2 shall be met by test specimens in natural/crystal. For integrally colored grades where other additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from the specified minimum value.

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 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, natural/crystal and integrally colored, see Table 1 and Table 2. The property values listed in Table 1 are minimum values unless otherwise specified. The property values listed in Table 2 are a general range for each group listed and shall be considered as information only since the actual property values are resin grade specific. Recommended tolerances from the resin grade specific mean values are given for each property. Full specification approval also requires general material properties as listed in 3.5.1.

3.5.1 Other Data. The minimum number of lots per test required is one (1) in natural:

- Poisson's Ratio
- Stress Strain Curve at +23 °C, +85 °C, -30 °C
- Differential Scanning Calorimeter (DSC) Curve
- Infrared Spectroscopy Curve

3.6 Performance Requirements. Performance requirements, e.g., flammability, fogging, resistance to odor, and any other applicable component performance requirements shall be specified on part drawings or in component specifications.

All finished parts for exterior applications shall meet the requirements according to GMW14650. All finished lenses/parts for Exterior Lighting must meet the legal requirements of FMVSS 108, and the Economic Commission for Europe (ECE) Regulatory Requirements - Lighting and Light Signaling Devices: UN R 01.02, UN R 03.02, UN R 04.00, UN R 06.01, UN R 07.02, UN R 19.04, UN R 23.00, UN R 31.03, UN R 38.00, UN R 48.06, UN R 77.00, UN R 87.00, and UN R 91.00.

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

Property	Standard ^{Note 1}	Unit	T1	T2	T3
Density	ISO 1183	g/cm ³	1.21 ± 0.02		
Tensile Modulus	ISO 527	MPa	≥ 4000		
Tensile Stress at Break	ISO 527	MPa	≥ 80		
Charpy Unnotched Impact Strength at +23 °C	ISO 179/1eU	kJ/m ²	≥ 20		
Luminous Transmittance	ASTM D1003 Procedure B 3.2 mm thick sheet	%	> 91		
Haze		%	< 1		
Melt Volume Flow Rate (MVR) 260 °C/10 kg	ISO 1133	cm ³ /10 minutes	1.7 (260 °C/10 kg)	5 (260 °C/10 kg)	13 (260 °C/3.8 kg)
Vicat Softening Temperature Heating Rate 50 °C/h Load 50 N	ISO 306	°C	≥ 170	≥ 150	≥ 126
Heat Deflection Temperature (HDT) 0.45 MPa	ISO 75-1, ISO 75-2	°C	≥ 158	≥ 140	≥ 124
HDT 1.8 MPa	ISO 75-1, ISO 75-2	°C	≥ 149	≥ 132	≥ 122

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