GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16456

Polypropylene Copolymer - Mineral Filled, Heat Stabilized, Injection Molding

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.

This standard covers the properties of mineral filled, heat stabilized, injection molding grade polypropylene copolymer.

1.1 Material Description. Approved paint systems that can be used on this material are listed in the GM Approved Paint on Parts Systems (APOPS) database.

1.2 Symbols. The material abbreviation according to ISO 11469 is >PP/PE-YYXX<. The symbol has to be completed by the supplier according to the mineral type and content.

1.3 Typical Applications. Typical applications include the following: underhood sight shields.

1.4 Remarks. The classification into groups is according to different ranges and types of mineral filler content.

2 References

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

2.1 External Standards/Specifications.

ASTM D3012	ISO 179/1eA	ISO 1133	ISO 3451-1
ASTM E831	ISO 188	ISO 1183	ISO 4577
ISO 75-1/2	ISO 294	ISO 1873-2	ISO 11469
ISO 178	ISO 527-1/2	ISO 3167	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14650
GMW3059	GMW14444	GMW15725

2.3 Additional References.

- TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).
- General Motors Approved Paint on Parts Systems (APOPS) database.

3 Requirements

3.1 Requirements on Test Specimens. Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 1873-2. Test methods and specimen dimensions are also to be in accordance with ISO 1873-2 with the following addition:

- Use ISO 3167; Type A, thickness 4 mm, for tensile and flexural properties.

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

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

Note: The requirements to Table 1 and Table 2 shall be documented for self-certification of the product according to GMW3013. The color shall be specified on drawings, in material specifications, and otherwise.

3.1.3 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.

3.1.4 The values specified in Table 1 and Table 2 shall be met by test specimens in natural or black. For colored grades where other pigment and additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from the specified minimum value.

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

3.3 Requirements on Materials. Refer to Table 1 and Table 2.

3.4 Performance Requirements. Performance requirements, e.g., flammability, fogging, or resistance to odor 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.
- All finished parts for underhood applications shall meet the requirements according to GMW15725.

3.5 Compound Properties. The following are also required for full specification approval:

- The minimum number of lots per test required is one (1) in natural.
- Tensile Modulus, Poissons Ratio, and Stress Strain Curve at +23 °C, +85 °C, -30 °C.
- Differential Scanning Calorimetry (DSC) Curve; Multiaxial Impact Curve, and Infrared Spectroscopy Curve.

Table 1: Compound Properties (Natural and Black)

Property	Standard	Unit	TD20	TD30	TD40	KD15
Mineral Filler	ISO 3451-1, Method A	Percent (%) by mass	18 to 22	28 to 32	38 to 42	13 to 17
Density	ISO 1183, Method A	g/cm^3	Target Range 1.02 to 1.07	Target Range 1.10 to 1.16	Target Range 1.20 to 1.26	Target Range 1.00 to1.05
Tensile Strength at Yield	ISO 527-1/2 Specimen A, Test Speed 50 mm/minute	MPa	≥ 24	≥ 24	≥ 24	≥ 23
Tensile Strength Retention after Heat Aging	ISO 527-1/2 ISO 188 1000 h at 100 °C	% Retention	≥ 75	≥ 75	≥ 75	≥ 75
Flexural Modulus	ISO 178, 80 mm × 10 mm × 4 mm Specimen, Test Speed 2 mm/minute, 64 mm span	MPa	2000 to 2600	2800 to 3600	3500 to 4200	2700 to 3300
Tensile Modulus	ISO 527-1/2, Specimen 1A, 1 mm/minute test speed	MPa	2200 to 2800	2800 to 3700	3600 to 4300	2800 to 3400

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