GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16783

Polypropylene – Deca-BDE Free Flame Retardant

1 Scope

1.1 Material Description. This specification covers the properties of flame retardant, Decabromodiphenyl Ether (Deca-BDE) free polypropylene. This resin may or may not contain talc filler (see specific types for filler level).

1.2 Symbols. The material abbreviation according to ISO 11469 is shown in Table 1.

1.3 Applicability. Typical applications include battery covers.

1.4 Remarks. The classification into groups is according to the density and different ranges of talc content.

2 References

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

2.1 External Standards/Specifications.

ISO 75-1	ISO 188	ISO 1210	ISO 11359-2
ISO 75-2	ISO 294-4	ISO 1873-2	ISO 11469
ISO 75-3	ISO 527-1	ISO 3167	UL 94
ISO 178	ISO 527-2	ISO 3451-1	
ISO 179/1eA	ISO 1133	ISO 4577	
ISO 179/1eU	ISO 1183	ISO 11359-1	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14270

3 Requirements

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

3.1 Requirements on Test Specimens. Reference GMW3221.

3.1.1 Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294-4 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 additions:

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

3.1.2 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 unannealed specimens.

3.1.3 The values specified in Table 1, shall be met by test specimens in natural or black. 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 Requirements on Delivery. Important physical, mechanical, and thermal properties that characterize the material are summarized in Table 1.

Note: For each product, the requirements to Table 1 shall be documented by Certification Statement according to GMW3013. The color shall be specified on drawings, in material specifications and otherwise.

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

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3.4 Compound Properties. See Table 1. The following are also required for full specification approval. The minimum number of lots per test required is one (1) in natural.

Tensile Modulus:

- Poisson's Ratio.
- Stress Strain Curve at +23 °C, +85 °C, and -30 °C.

3.5 Performance Requirements. Performance requirements, e.g., flammability, shall be specified on part drawings or in component specifications.

3.6 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 Properties (Black or Natural)

Property	Test Method	Units	Types and Requirements			
			T1	**T2**	**T3**	**T4**
Nominal Talc Filler Percentage			**0%**	**0%**	**10%**	**20%**
ISO Symbol	ISO 11469	Not applicable	>PP-FR(17)<	>PP-FR(17)<	>PP-TD10-FR(17)<	>PP-TD20-FR(17)<
Ash	ISO 3451-1, Method A, at +600 °C	% by mass	Not applicable	Not applicable	Target Range 9 to 15	Target Range 19 to 25
Density	ISO 1183, Method A	g/cm³	Target Range 0.95 to 1.05	Target Range 1.15 to 1.25	Target Range 1.0 to 1.30	Target Range 1.1 to 1.35
Melt Flow Rate (MFR) 230/2.16	ISO 1133	g/10 minutes	Target Range 2 to 10	Target Range 2 to 10	Target Range 2 to 10	Target Range 2 to 10
Tensile Modulus	ISO 527-1 ISO 527-2, Specimen 1A, 1 mm/minute test speed	MPa	≥ 900	≥ 1000	≥ 1500	≥ 2400
Flexural Modulus	ISO 178, 2 mm/minute test speed	MPa	≥ 800	≥ 1100	≥ 1600	≥ 2500
Tensile Strength at yield	ISO 527-1 ISO 527-2, Specimen 1A, 5 mm/minute test speed	MPa	≥ 18	≥ 18	≥ 20	≥ 20
Tensile Strength at yield after heat aging Note 1	ISO 527-1 ISO 527-2, Specimen 1A, 5 mm/minute test speed	% Retention	≥ 85			

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