



Polyolefin Alloy - Talc Filled, Heat Stabilized, High Stiffness, High Impact, Interior Thermoplastic Olefin

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 grades of talc filled, heat stabilized polyolefin alloy, pellet form, injection molding compounds. This material may be molded in color or painted.

For the purpose of this specification, polyolefin alloy is defined as an alloy of Polypropylene (PP) plastic and Ethylene Propylene (EP) or Ethylene Propylene Diene Monomer (EPDM) rubber.

The classification into groups is according to the different properties as described in Table 1.

1.2 Symbols. The material abbreviations according to ISO 11469 are listed in Table 1.

1.3 Applicability. Typical applications include the following: Interior trim, instrument panel top pad.

2 References

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

2.1 External Standards/Specifications.

AATCC TM23	ISO 75-2	ISO 294	ISO 3451-1
ASTM D3012	ISO 75-3	ISO 527-1	ISO 6603-1/2
ASTM D3763	ISO 105-G02	ISO 527-2	ISO 11359-2
ASTM E831	ISO 179-1/1eA	ISO 1133	ISO 11469
ISO 75-1	ISO 188	ISO 1183-1	ISO 19069-2

2.2 GM Standards/Specifications.

GMW3013	GMW3235	GMW14444	GMW15634
GMW3059	GMW3417	GMW14650	GMW16172
GMW3205	GMW14162	GMW14688	GMW16853
GMW3221	GMW14270	GMW14797	
GMW3232	GMW14334	GMW15520	

2.3 Additional References.

- American Association of Textile Chemists and Colorists (AATCC) Test Method for Colorfastness to Burnt Gas Fumes TM23 available from <https://www.aatcc.org>.
- General Motors North American Appearance Engineering (NAAE) Interior WPEPGLD Plastic Color Submission Plaque or, for other regions, the Master Plaques with the Grains, Colors and Gloss Levels defined in the CTDAR Sheet of the corresponding GM Program.
- Plastic Submission Template.

3 Requirements

3.1 Requirements on Test Specimens. Materials approved to this specification shall meet the requirements of GMW3013.

Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 19069-2. Test methods and specimen dimensions are also to be in accordance with ISO 19069-2.

All tests shall be performed on unannealed specimens immediately after their removal from the containers in a controlled atmosphere per GMW3221, Code A, unless otherwise specified. In addition, tests specified at temperatures below or above $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

The values specified in Table 1 shall be met by test specimens in natural, black or in a standard sampled color if natural or black are not available. The values specified in Table 2 shall be met by four typical interior colors (black, gray, tan/neutral, and either red or blue) for approval to the specification and by test specimens in specific colors as required during color development. These test specimens may be produced using generic colorants in the four colors or by specific colors required by a GM program. See the TPO tab on the Plastic Submission Template (contact specification owning group named in Section 6 for access) and GMW3013 for test details and parameters.

3.1.1 Chemical Requirements. All parts manufactured from molding compounds shall be resistant to the media contacted at the place of use.

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 Requirements on Delivery. Important physical, mechanical and thermal properties that characterize the material are summarized in Table 1 and Table 2. The color shall be specified on drawings, in material specifications and otherwise.

3.4 Compound Properties (Natural, Black and Integrally Colored). See Table 1 and Table 2. The following are also required for full approval. The minimum number of lots per test required is one unless otherwise specified. See the TPO tab on the Plastic Submission Template (contact specification owning group named in Section 6 for access) and GMW3013 for test details and parameters.

- Poisson's Ratio.
- Stress/strain data points and curves at the following temperatures: $-30\text{ }^{\circ}\text{C}$, $+23\text{ }^{\circ}\text{C}$, $+85\text{ }^{\circ}\text{C}$, $+100\text{ }^{\circ}\text{C}$. **Note:** See GMMPD tab on Plastic Submission Template for test details (contact specification owning group named in Section 6 for access).
- Coefficient of Linear Thermal Expansion (CLTE) data. **Note:** See GMMPD tab on Plastic Submission Template for test details (contact specification owning group named in Section 6 for access).
- Differential Scanning Calorimetry (DSC) curve.
- Fourier Transform Infrared (FTIR) spectroscopy curve.
- Mold shrinkage.

3.5 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.

3.6 Performance Requirements. Performance requirements, e.g., flammability, fogging or resistance to odor shall be specified on part drawings or in component specifications. All parts manufactured from these materials shall be resistant to the media contacted, such as aliphatic and aromatic hydrocarbons, fuels, lubricants, oils, greases and alcohols, at the places of use.

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.

3.7 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.

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.

Table 1: Compound Properties (Black or Natural)

Property	Standard	Units	T1		T2		T3		T4
			Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}
International Organization for Standardization (ISO) Symbol	-	-	>PP+EP(D)M-M20<		>PP+EP(D)M-M18<		>PP+EP(D)M-M15<		>PP+EP(D)M-M16<
Filler Content	ISO 3451-1 Method A	%	18 to 22	18 to 22	16 to 19	16 to 19	13 to 17	13 to 17	14 to 18
Density	ISO 1183-1	g/cm ³	1.01 to 1.05	1.01 to 1.05	1.01 to 1.03	1.01 to 1.03	0.95 to 1.01	0.95 to 1.01	0.98 to 1.02
Melt Flow Rate (MFR) 230/2.16	ISO 1133	g/10 minutes	19 to 23	19 to 23	9 to 13.5	9 to 13.5	19 to 23	19 to 23	27 to 33
Melt Volume Flow Rate (MVR) 230/2.16	ISO 1133	g ³ /10 minutes	22.1 to 26.7	22.1 to 26.7	11 to 15	11 to 15	Report	Report	34 to 40
Tensile Modulus at 23 °C	ISO 527-1, ISO 527-2	MPa	1600 to 2260	1600 to 2260	Report	Report	1600 to 2260	1600 to 2260	1600 to 2260
Tensile Stress at Yield	ISO 527-1, ISO 527-2	MPa	≥ 17	≥ 17	≥ 17	≥ 17	≥ 17	≥ 17	≥ 17
Tensile Elongation	ISO 527-1, ISO 527-2	%	Report	Report	Report	Report	Report	Report	Report
Tensile Stress at Yield after Heat Aging (1000 h ± 5 h at 105 °C ± 3 °C) ^{Note 2}	ISO 527-1, ISO 527-2	% Retention	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100
Multiaxial Impact Strength at 23 °C	ASTM D3763, Specimen 100 mm diameter × 3.2 mm or 100 mm × 100 mm × 3.2 mm, 6.6 m/s speed	J at maximum load	≥ 18 All failures must be ductile	≥ 18 All failures must be ductile	≥ 18 All failures must be ductile	≥ 18 All failures must be ductile	≥ 18 All failures must be ductile	≥ 18 All failures must be ductile	≥ 17 All failures must be ductile

Property	Standard	Units	T1		T2		T3		T4
			Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}	Class P ^{Note 1}	Class U ^{Note 1}
Multiaxial Impact Strength at Cold Temperature	ASTM D3763, Specimen 100 mm diameter × 3.2 mm or 100 mm × 100 mm × 3.2 mm, 6.6 m/s speed	J at maximum load	≥ 20 at-30 °C All failures must be ductile	≥ 20 at-30 °C All failures must be ductile	≥ 24 at-40 °C All failures must be ductile	≥ 24 at-40 °C All failures must be ductile	≥ 20 at-30 °C All failures must be ductile	≥ 20 at-30 °C All failures must be ductile	≥ 20 at-40 °C All failures must be ductile
Multiaxial Impact Strength at Cold Temperature after Heat Aging (1000 h ± 5 h at 105 °C ± 3 °C) ^{Note 2}	ASTM D3763, Specimen 100 mm diameter × 3.2 mm or 100 mm × 100 mm × 3.2 mm, 6.6 m/s speed	% Retention	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile	≥ 100 All failures must be ductile
Multiaxial Impact Strength at 23 °C	ISO 6603-1/2, Specimen 60 mm diameter × 2 mm or 60 mm × 602 mm × 2 mm plaque, 4.4 m/s speed	J at maximum load	Report	Report	Report	Report	Report	Report	Report
Multiaxial Impact Strength at Cold Temperature	ISO 6603-1/2, Specimen 60 mm diameter × 2 mm or 60 mm × 602 mm × 2 mm plaque, 4.4 m/s speed	J at maximum load	Report	Report	Report	Report	Report	Report	Report
Multiaxial Impact Strength at Cold Temperature after Heat Aging (1000 h ± 5 h at 105 °C ± 3 °C) ^{Note 2}	ISO 6603-1/2, Specimen 60 mm diameter × 2 mm or 60 mm × 602 mm × 2 mm plaque, 4.4 m/s speed	% Retention	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100	≥ 100
Notched Charpy Impact at 23 °C	ISO 179-1/1eA	kJ/m ²	≥ 40	≥ 40	≥ 49	≥ 49	Report	Report	≥ 45