



Polypropylene Copolymer – Unfilled Ultraviolet Stable, Heat Stabilized

1 Scope

1.1 Material Description. This specification covers the properties of unfilled polypropylene copolymer, ultraviolet (UV) stable, heat stabilized pellet form, injection molding compounds.

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

1.2 Symbols. The material abbreviation according to ISO 11469 is >PP/PE<

1.3 Typical Applications. Typical applications include the following: interior trim.

2 References

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

2.1 External Standards/Specifications.

AATCC 23	ISO 105-G02	ISO 527-1	ISO 3167
ASTM D3012	ISO 178	ISO 527-2	ISO 4577
ASTM D3763	ISO 179/1eA	ISO 1133	ISO 6603-1/2
ASTM E831	ISO 188	ISO 1183	ISO 11359-2
ISO 75-1/2	ISO 294	ISO 1873-2	ISO 11469

2.2 GM Standards/Specifications.

GM9302P	GMW3221	GMW14162
GMW3013	GMW3232	GMW14334
GMW3059	GMW3235	GMW14444
GMW3205	GMW3417	GMW14688

2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

3 Requirements

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

3.2 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 to Table 1 and Table 2 shall be documented by Certification Statement according to GMW3013. The color shall be specified on drawings, in material specifications and otherwise.

3.3 Requirements on Test Specimens. Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294, using the injection molding conditions specified in 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 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 unannealed specimens.
- The values specified in Table 1 shall be met by test specimens in natural or black color, the values specified in Table 2 shall be met by integrally colored test specimens. For integrally colored grades where other additive systems (e.g., stabilizer) are used, the impact values shall not decrease more than 10% from specified minimum value.

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

3.4 Compound Properties. See Table 1 and Table 2. The following are also required for full specification approval. The minimum number of lots per test required is one in natural:

- Tensile Modulus.
- Poisson's Ratio.
- Stress Strain Curve at multiple temperatures e.g., +23 °C, +85 °C, -30 °C.
- Differential Scanning Calorimetry (DSC) Curve and Multiaxial Impact Curve. See the polypropylene certification template for the test procedures.

3.5 Performance Requirements. Performance requirements shall be specified on part drawings or in component specifications.

All finished parts for Interior applications shall meet the requirements specified in GMW14444.

Table 1: Compound Properties (Black or Natural)

Property	Standard	Units	T1 Requirement	T2 Requirement	T3 Requirement	T4 Requirement	T5 Requirement
Density	ISO 1183/A	g/cm ³	Target Range 0.90 ± 0.02	Target Range 0.90 ± 0.02	Target Range 0.90 ± 0.02	Target Range 0.90 ± 0.02	Target Range 0.9 ± 0.03
Melt Flow Rate MFR 230 °C/Load 2.16 kg	ISO 1133	g/10 minute	Target Range 30 to 45	Target Range 30 to 40	Target Range 30 to 40	Target Range 12 to 25	Target Range 15 to 30
Flexural Modulus	ISO 178, 2 mm/minute test speed	MPa	900 to 1300	1250 to 1650	650 to 1100	900 to 1250	750 to 1100
Tensile Modulus	ISO 527-1 ISO 527-2 Specimen 1A, 1 mm/minute test speed	MPa	850 to 1350	1200 to 1700	650 to 1050	800 to 1150	750 to 1000
Tensile Stress at Yield	ISO 527-1 ISO 527-2 Specimen 1A, 50 mm/minute test speed	MPa	≥ 18	≥ 24	≥ 14	≥ 16	≥ 15
Flexural Modulus at 85 °C	ISO 178, 2 mm/minute test speed	MPa	Report	Report	Report	Report	Report

Property	Standard	Units	T1 Requirement	T2 Requirement	T3 Requirement	T4 Requirement	T5 Requirement
Tensile Modulus at 85 °C	ISO 527-1 ISO 527-2 Specimen 1A, 1 mm/minute test speed	MPa	Report	Report	Report	Report	Report
Tensile Stress at Yield after Heat Aging 1000 ± 5 h at 105 °C ± 3 °C Note 1	ISO 527-1 ISO 527-2 50 mm/minute test speed	% Retention	≥ 85	≥ 85	≥ 85	≥ 85	≥ 85
Multiaxial Impact at 23 °C	ASTM D3763 6.6 m/s speed	J at maximum Load	≥ 15	≥ 15	≥ 15	≥ 15 All Ductile	≥ 15 All Ductile
Multiaxial Impact at -30 °C	ASTM D3763 6.6m/s speed	J at maximum Load	N/A	N/A	N/A	≥ 15 All Ductile	≥ 20 All Ductile
Multiaxial Impact at 23 °C	ISO 6603-1/2 Specimen 60 mm diameter × 3.2 mm, or 60 × 60 × 3.2 mm plaque 4.4 m/s speed	J at maximum Load	Report	Report	Report	≥ 10 All Ductile	≥ 5 All Ductile
Multiaxial Impact at -30 °C	ISO 6603-1/2 Specimen 60 mm diameter × 3.2 mm, or 60 × 60 × 3.2 mm plaque 4.4 m/s speed	J at maximum Load	N/A	N/A	N/A	≥ 20 All Ductile	≥ 15 All Ductile
Notched Charpy Impact at 23 °C	ISO 179/1eA	kJ/m ²	≥ 5	≥ 5	≥ 5	≥ 30	≥ 10
Notched Charpy Impact at -30 °C	ISO 179/1eA	kJ/m ²	≥ 2	≥ 2	≥ 1.5	≥ 5	≥ 5
Mold Shrink, 48 h after molding longitudinal	ISO 294, plaque size 101.6 × 152 × 3.2 mm	%	Target Range 1.2 to 1.8	Target Range 1.2 to 1.8	Target Range 1.0 to 1.8	Target Range 0.8 to 1.5	Target Range 0.9 to 1.6
Mold Shrink, 48 h after molding transverse	ISO 294, plaque size 101.6 × 152 × 3.2 mm	%	Target Range 1.4 to 2.0	Target Range 1.2 to 1.8	Target Range 1.0 to .8	Target Range 1.0 to 1.6	Target Range 1.0 to 1.6
Mold Shrink, 48 h at 80 °C after molding longitudinal	ISO 294, plaque size 101.6 × 152 × 3.2 mm	%	Target Range 1.4 to 2.0	Target Range 1.4 to 2.0	Target Range 1.2 to 2.0	Target Range 1.2 to 1.8	Target Range 1.1 to 1.8
Mold Shrink, 48 h at 80 °C after molding transverse	ISO 294, plaque size 101.6 × 152 × 3.2 mm	%	Target Range 1.4 to 2.0	Target Range 1.4 to 2.0	Target Range 1.3 to 2.0	Target Range 1.2 to 1.8	Target Range 1.1 to 1.8
HDT Method A, 0.45 MPa, flatwise	ISO 75-1/2, specimen 80 × 10 × 4 mm, flatwise, unannealed	°C	≥ 70	≥ 80	≥ 65	≥ 70	≥ 65