



Polyamide 6 - Glass Fiber Reinforced, Heat Stabilized, UV Stabilized

1 Scope

1.1 Material Description. This specification describes glass fiber reinforced, heat stabilized, ultraviolet (UV) stabilized polyamide 6 (nylon 6) which is used in injected form for molded components.

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

1.3 Applicability. Interior color matched components, e.g., seat handles, bezels, sunroof components.

1.4 Remarks. The classification into groups is according to the different ranges of glass fiber content. Additional glass ranges will be added as they become necessary.

2 References

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

2.1 External Standards/Specifications.

ASTM D6869	ISO 188	ISO 3146	ISO 11469
ASTM E831	ISO 294	ISO 3451	ISO 15512
ISO 75-2	ISO 527	ISO 3795	SAE J1545
ISO 179/1eA	ISO 1183	ISO 11357-3	SAE J1885
ISO 179/1eU	ISO 1874-2	ISO 11359-2	

2.2 GM Standards/Specifications.

GMW3013	GMW3232	GMW14334	GMW16853
GMW3059	GMW3235	GMW14335	
GMW3205	GMW3417	GMW14444	
GMW3221	GMW14162	GMW15634	

2.3 Additional References.

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

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. Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 1874-2. Test methods and specimen dimensions are also to be in accordance with ISO 1874-2.

All values indicated herein are based on material considered to be in the dry-as-molded state with moisture content of 0.2% maximum (ASTM D6869, ISO 15512 Method A or B, or GMW14335). Immediately after molding, per ISO 1874-2, specimens shall be sealed in moisture-proof containers and stored at $22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ for at least 24 h. 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 $< 22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ or $> 22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ 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 for approval to the specification and by test specimens in specific colors as required during color development.

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. See Tables 1 and 2. The following are also required for full standard approval. The minimum number of lots per test required for the following properties is one in natural: Poisson's Ratio, Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage, Stress Strain Curve at multiple temperatures (for example -30 °C, 23 °C, 85 °C). See GMW3013 for all test procedures and parameters.

3.5 Requirements on Parts. Parts of this material type shall have a water content at delivery, when tested per GMW14335 or ISO 15512, Method A or B, of at least:

- 1.5% by mass for material types reinforced up to 20% by mass.
- 1.0% by mass for material types reinforced over 20% by mass.

Deviations from this shall be specifically indicated on the part drawings.

3.6 Performance Requirements. Performance requirements shall be specified on part drawings or in component specifications. All parts manufactured from molding compounds shall be resistant to the media they contact, such as aliphatic and aromatic hydrocarbons, fuels, lubricants, oils, greases and alcohols, at their places of use.

Table 1: Compound Properties (Natural and Black)

Property ^{Note 1}	Standard	Unit	Nominal Glass Content				
			15%	25%	30%	35%	50%
			Value	Value	Value	Value	Value
ISO Symbol	ISO 11469		>PA6-GF15<	>PA6-GF25<	>PA6-GF30<	>PA6-GF35<	>PA6-GF50<
Ash	ISO 3451	% by mass	13 to 17	22 to 28	27 to 33	32 to 38	47 to 53
Density	ISO 1183	g/cm ³	Target Range 1.20 to 1.26	Target Range 1.28 to 1.34	Target Range 1.32 to 1.38	Target Range 1.37 to 1.43	Target Range 1.53 to 1.59
Moisture Content	ISO 15512 Method A or B or GMW14335	%	≤ 0.2				
Tensile Modulus	ISO 527	MPa	5000 to 6750	7250 to 8750	8500 to 11 000	9500 to 12 500	14 000 to 17 000
Tensile Stress at Break	ISO 527	MPa	≥ 110	≥ 150	≥ 150	≥ 175	≥ 200
Tensile Stress at Break after Heat Aging, 1000 h at 140 °C	ISO 527 ISO 188	% Retention	≥ 75				
Strain at Break	ISO 527	%	≥ 2.5	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0
Unnotched Charpy Impact Strength at +22 °C at -30 °C	ISO 179/1eU	kJ/m ²	≥ 35 ≥ 30	≥ 45 ≥ 40	≥ 55 ≥ 50	≥ 65 ≥ 60	≥ 95 ≥ 90
Notched Charpy Impact Strength at +22 °C at -30 °C	ISO 179/1eA	kJ/m ²	≥ 4 ≥ 3	≥ 5 ≥ 4	≥ 6 ≥ 5	≥ 7 ≥ 6	≥ 12 ≥ 9