GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16280

Polyamide 6 - Mineral Filled/Glass Fiber Reinforced, Heat Stabilized, Weatherable

1 Scope

1.1 Material Description. This specification describes mineral filled/glass fiber reinforced, heat stabilized, weatherable 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. Exterior door handles, roof rack components.

1.4 Remarks. The classification into groups is according to the different ranges of mineral/glass fiber content.

2 References

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

2.1 External Standards/Specifications.

ASTM D6869	ISO 294-3/4	ISO 3146	ISO 11469
ASTM E831	ISO 527	ISO 3167	ISO 15512
ISO 75-2	ISO 960	ISO 3451	SAE J1545
ISO 179/1eA	ISO 1183	ISO 11357-3	SAE J1976
ISO 188	ISO 1874-2	ISO 11359-2	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14650
GMW3059	GMW14335	

3 Requirements

3.1 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.

3.2 Requirements on Test Specimens. Reference GMW3221. Materials approved to this specification shall meet the requirements of GMW3013, General Requirements for Handling of Technical Terms for Delivery for Plastics. Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294-3/4 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 with the following additions:

- Use ISO 3167, Type A, thickness 4 mm for tensile and flexural properties.
- 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 Method B, or GMW14335). Immediately after molding, as per ISO 1874-2, specimens shall be sealed in moisture-proof containers and stored at 22 °C ± 3 °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.
- The values specified in Table 1 and Table 2 shall be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available. 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.

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3.3 Requirements on Parts. Parts of this material type shall have a water content at delivery, when tested per GMW14335 or ISO 960, Method A 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.

3.3.1 Chemical Requirements. 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.

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

- Stress/Strain Curve at multiple temperatures (-30 °C, +23 °C, +140 °C).
- Poisson's Ratio.

See GMW3013 for all test procedures and parameters.

3.4 Process Requirements. Not applicable.

3.5 Performance Requirements. Performance requirements shall be specified on part drawings or in component specifications. All finished parts for exterior applications shall meet the requirements of GMW14650.

Table 1: Compound Properties (Natural and Black)

Property [Note 1]	Standard	Unit	M20-GF10	M25-GF15
			Value	Value
ISO Symbol	ISO 11469		>PA6-(M20+GF10)<	>PA6-(M25 + GF15)<
Ash	ISO 3451	% by mass	27 to 33	37 to 43
Density	ISO 1183	g/cm^3	Target Range 1.31 to 1.39	Target Range 1.43 to 1.50
Moisture Content	ISO 15512 Method A or Method B or GMW14335	%	≤ 0.2	
Tensile Modulus	ISO 527	MPa	7000 to 10 000	7500 to 12 000
Tensile Stress at Break	ISO 527	MPa	≥ 100	≥ 95
Tensile Stress at Break after Heat Aging, 100 h at + 140 °C	ISO 527 ISO 188	% Retention	≥ 75	
Strain at Break	ISO 527	%	≥ 2	≥ 2
Notched Charpy Impact Strength at +22 °C at -30 °C	ISO 179/1eA	kJ/m^2	 ≥ 2 ≥ 2	 ≥ 3 ≥ 2

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