GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16556

Polyamide 6 – Glass Fiber Reinforced, Heat Stabilized, Weatherable

1 Scope

1.1 Material Description. This specification describes 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.

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 294	ISO 1874-2	ISO 11460
ASTM E831	ISO 294-3	ISO 3146	ISO 11469
ISO 75-2	ISO 294-4	ISO 3451	ISO 15512
ISO 179/1eA	ISO 527	ISO 11357-3	SAE J1545
ISO 188	ISO 1183	ISO 11359-2	SAE J1976

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14335	GMW14650
GMW3059			

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 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. 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.

3.2.1 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, per ISO 1874-2, specimens shall be sealed in moisture-proof containers and stored at 23 °C ± 2 °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 below or above 23 °C ± 2 °C, shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

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3.2.2 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 a typical exterior color for approval to the specification and/or by test specimens in specific colors as required during color development.

3.3 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 for the following properties is one (1) 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, +140 °C).

See GMW3013 for all test procedures and parameters.

3.4 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 Method 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.

3.5 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)

			Nominal Glass Content
Property Note 1	**Standard**	**Unit**	**30%**
			Value
ISO Symbol	ISO 11460		>PA6-GF30<
Ash	ISO 3451	% by mass	27 to 33
Density	ISO 1183	g/cm^3	Target Range 1.32 to 1.40
Moisture Content	ISO 15512 Method A or Method B or GMW14335	%	≤ 0.2
Tensile Modulus	ISO 527	MPa	8500 to 11 000
Tensile Stress at Break	ISO 527	MPa	≥ 130
Tensile Stress at Break After Heat Aging, 1000 h at +140 °C	ISO 527 ISO 188	% Retention	≥ 75
Strain at Break	ISO 527	%	≥ 15
Notched Charpy Impact Strength At +22 °C At -30 °C	ISO 179/1eA	kJm^2	≥ 4 ≥ 2.5
Notched Charpy Impact Strength after heat aging, 1000 h at +140 °C, Notch specimens prior to aging	ISO 179/1eA ISO 188	% Retention	≥ 75

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