GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW17967

Polyamide 6, Glass Fiber Reinforced, Heat Stabilized, Non-Conductive for Electrical Components

1 Scope

1.1 Material Description. This specification describes glass fiber reinforced, heat stabilized, non-conductive, injection moldable polyamide 6 (nylon 6). This material is used for electrical components. Copper heat stabilizers are not allowed in this resin.

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

1.3 Applicability. Electrical components, transmission components, any component requiring non-metallic heat stabilizers.

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 1183	ISO 11359-2
ASTM E831	ISO 294	ISO 1874-2	ISO 11469
IEC 60243-1	ISO 294-3	ISO 3146	ISO 15512
ISO 75-2	ISO 294-4	ISO 3451	
ISO 179/1eA	ISO 527	ISO 11357-3	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14335
GMW3059	GMW14270	

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 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.

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.

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

3.3 Compound Properties. See Table 1. 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, +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.

3.6 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

Table 1: Compound Properties (Natural and Black)

			Nominal Glass Content
Property	**Standard**	**Unit**	**30%**
			Value
ISO Symbol	ISO 11469		>PA6-GF30<
Ash	ISO 3451	% by mass	27 to 33
Density	ISO 1183	g/cm^3	Target Range 1.33 to 1.39
Moisture Content	ISO 15512, Method A, Method B or GMW14335	%	≤ 0.2
Tensile Modulus	ISO 527	MPa	9000 to 11 100
Tensile Stress at Break	ISO 527	MPa	≥ 160
Tensile Strain at Break	ISO 527	MPa	≥ 2.5
Tensile Stress at Break after Heat Aging, 1000 h at +140 °C	ISO 527 ISO 188	% Retention	≥ 75
Notched Charpy Impact Strength at +22 °C at -30 °C	ISO 179/1eA	kJ/m^2	≥ 7.0 ≥ 5.0

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