



Polyamide 66 - Mineral/Glass Fiber Reinforced, Heat Stabilized

1 Scope

1.1 Material Description. This standard describes material types of mineral/glass fiber reinforced, heat stabilized polyamide 66 (nylon 66) which are 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. Cover cylinder head, engine covers.

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	ISO 1874-2	ISO 11469
ISO 75-2	ISO 527-1	ISO 3146	ISO 15512
ISO 179	ISO 527-2	ISO 3167	
ISO 188	ISO 1183	ISO 3451	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14335
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2.3 Additional References.

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

3 Requirements

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

3.1 Requirements on Test Specimens. Reference GMW3221. 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 with the following additions: Use ISO 3167, Type A, thickness 4 mm, for tensile and flexural properties.

Test values indicated in Table 1 are based on material with moisture content of 0.2% maximum (dry as molded) as tested per ASTM D6869, GMW14335, or ISO 15512, Method A or B. Immediately after molding, as 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 24 h minimum. 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.

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 Requirements on Parts. Parts of this material type shall have a water content, when tested per GMW14335, at delivery 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.

3.4 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.

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

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

Table 1: Compound Properties (Natural and Black)

Property ^{Note 1}	Standard	Unit	M15-GF15	M15-GF25	M20-GF10	M25-GF15	M30-GF10
			Range	Range	Range	Range	Range
ISO Symbol	Not applicable	Not applicable	>PA66-(MD15+GF15)<	>PA66-(GF25+MD15)<	>PA66-(MD20+GF10)<	>PA66-(MD25+GF15)<	>PA66-(MD30+GF10)<
Ash	ISO 3451 +950 °C	% by mass	27 to 33	37 to 43	27 to 33	36 to 44	36 to 44
Density	ISO 1183	g/cm ³	Target Range 1.25 to 1.40	Target Range 1.43 to 1.51	Target Range 1.33 to 1.39	Target Range 1.45 to 1.55	Target Range 1.4 to 1.5
Tensile Modulus	ISO 527-1 ISO 527-2	MPa	5000 to 7000	9100 to 12 700	6000 to 6800	8000 to 10 500	7200 to 8600
Stress at Break	ISO 527-1 ISO 527-2	MPa	≥ 90	≥ 145	≥ 115	≥ 105	≥ 105
Stress at Break at +22 °C after Heat Aging ^{Note 2}	ISO 527-1 ISO 527-2	% Retention	≥ 75				
Strain at Break	ISO 527-1 ISO 527-2	%	≥ 2	≥ 1.9	≥ 3	≥ 3	≥ 2
Charpy Impact Strength	ISO 179/1eU						
At +22 °C		kJ/m ²	≥ 45	≥ 34	≥ 40	≥ 35	≥ 25
At -30 °C		kJ/m ²	≥ 35	≥ 30	≥ 35	≥ 30	≥ 20
Charpy Notched Impact Strength	ISO 179/1eA						
At +22 °C		kJ/m ²	≥ 3	≥ 3	≥ 4	≥ 3	≥ 2
At -30 °C		kJ/m ²	≥ 3	≥ 2	≥ 3	≥ 1	≥ 1
Charpy Notched Impact Strength at +22 °C after Heat Aging ^{Note 2}	ISO 179/1eA	% Retention	≥ 75				
Melting Temperature	ISO 3146 Method C or A (10 K/minute)	°C	Target Range +250 to +270				