GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW8693

Polyamide 66 - Mineral Filled, Heat Stabilized

1 Scope

1.1 Material Description. This standard describes material types of mineral filled, heat stabilized polyamide 66 (nylon 66), which are used in injected or extruded form for molded components. Additional characteristics will be indicated by code letters according to the respective specification number. Code letters that may apply to this specification are in GMW3013.

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

1.3 Applicability. Cover cylinder head, shift cable components.

1.4 Remarks. The classification into groups is according to the different ranges of mineral content. Additional mineral 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 11357-3
ISO 75-2	ISO 527-1	ISO 3146	ISO 11469
ISO 179/1eA	ISO 527-2	ISO 3167	ISO 15512
ISO 188	ISO 1183	ISO 3451	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	GMW14335

2.3 Additional References.

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

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

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.

3.2.1 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 shall also be in accordance with ISO 1874-2 with the clarification to 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, ISO 15512 Method A or 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 of +22 °C ± 3 °C and 50% ± 5% relative humidity unless otherwise specified.

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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3.2.2 Requirements on Parts. Parts of this material type shall have a water content 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 (test to ASTM D6869, ISO 15512 Method A or B, or GMW14335.)

3.2.3 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.

3.2.4 Performance Requirements. Performance Requirements, e.g., flammability, fogging or resistance to odor, shall be specified on part drawings or in component specifications.

3.3 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, +120 °C), Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage. See GMW3013 for all test procedures and parameters.

Table 1: Mechanical Requirements

Property [Note 1]	Standard	Unit	M35	M40
			Range	Range
ISO Symbol	ISO 11469		>PA66-MD35<	>PA66-MD40<
Ash	ISO 3451 (+950 °C)	% by mass	33 to 38	36 to 44
Density	ISO 1183	g/cm^3	Target Range 1.38 to 1.44	Target Range 1.45 to 1.53
Tensile Modulus	ISO 527-1 ISO 527-2	MPa	4300 to 5700	6900 to 11 600
Tensile Stress at Break	ISO 527-1 ISO 527-2	MPa	≥ 70	≥ 65
Tensile Stress at Break after Heat Aging [Note 2]	ISO 527-1 ISO 527-2	% retention	≥ 75	≥ 75
Tensile Strain at Break	ISO 527-1 ISO 527-2	%	≥ 7	≥ 1
Charpy Notched Impact Strength at +22 °C at -30 °C	ISO 179/1eA	kJ/m^2	≥ 3.5 Report	≥ 2 ≥ 1
Charpy Notched Impact Strength at +22 °C after Heat Aging [Note 2]	ISO 179/1eA ISO 188	% retention	≥ 75	≥ 75
Melting Temperature	ISO 3146 Method C or A (10 K/minute) or ISO 11357-3	°C	Target Range 245 to 265	Target Range 250 to 270

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