GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16428

Polyamide 66 - 15% Glass Fiber Reinforced, Heat Stabilized, Flame Retardant for Underhood Applications

1 Scope

1.1 Material Description. This standard covers the properties of a 15% by mass glass fiber reinforced, heat stabilized, flame retardant, polyamide 66 (nylon 66), which is used in injected form for molded components. This material can be colorable or paintable to meet underhood requirements. Types are defined in Table 4.

1.2 Symbols. The material abbreviation according to ISO 11469 is >PA66-(GF15+Mxx)<.

1.3 Applicability. Typical applications include engine covers.

2 References

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

2.1 External Standards/Specifications.

ASTM D3801	ISO 188	ISO 527-2	ISO 11469
ASTM D6869	ISO 294	ISO 1183	ISO 15512
ISO 75	ISO 527	ISO 1874-2	UL 94
ISO 179/1eA	ISO 527-1	ISO 3451	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14335	GMW16172
GMW3059	GMW14270		

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 charts. The color shall be specified on drawings, in material specifications, and otherwise.

Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from 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, specimens shall be sealed in moisture proof containers and stored at +22 °C ± 3 °C for at least 24 h prior to test as specified in ISO 1874-2. 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 +22 °C ± 3 °C shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available.

3.2.1 Compound Properties (Natural, Black and Integrally Colored). See Table 1, Table 2 and Table 3. The following are also required for full standard approval:

- 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).
- Shear Modulus Curve; Differential Scanning Calorimetry (DSC) Curve.
- Infrared Spectroscopy Curve.

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See GMW3013 for the test procedures.

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

3.4 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) – Must be met by Type 1 and Type 2

Property	Standard	Units	Value
Ash Note 1	ISO 3451	%	Target Range 13 to 35
Density Note 2	ISO 1183	g/cm^3	Target Range 1.25 to 1.55
Moisture Content	ISO 15512 Method A or Method B, or GMW14335	%	≤ 0.2
Tensile Modulus	ISO 527-1, ISO 527-2	MPa	5000 to 7000
Tensile Stress at Break	ISO 527-1, ISO 527-2	MPa	≥ 90
Tensile Stress at Break after Heat Aging Note 3	ISO 188 ISO 527	% Retention	≥ 65
Tensile Strain at Break	ISO 527-1, ISO 527-2	%	≥ 2.0
Notched Charpy Impact Strength At +23 °C At -30 °C	ISO 179/1eA	kJ/m^2	≥ 3.0 ≥ 3.0
Notched Charpy Impact after Heat Aging Note 4	ISO 188 ISO 179/1eA	% Retention	≥ 75
Heat Deflection Temperature under Load 1.8 Mpa	ISO 75	°C	≥ 170
Flammability Rating at 0.8 mm	UL 94 ASTM D3801	Rating	V0
Flammability Rating at 0.8 mm after Heat Aging A Note 5 Heat Aging B Note 5	UL 94 ASTM D3801	Rating	V0 V0

Note 1: Wide ash content range due to differences in flame retardant additives. Material is to be 15% glass fiber with the remainder of ash being flame retardant additive remnants.
Note 2: Wide density range and wide ash range due to differences in flame retardant additives.
Note 3: Specimens tested for Tensile Stress at Break to ISO 527 after heat aging 1000 h ± 5 h at +140 °C ± 5 °C according to ISO 188 Method A (air oven method) shall have a minimum of 65% retention relative to unaged specimens tested concurrently.
Note 4: Specimens tested for Notched Charpy Impact per ISO 179/1eA after heat aging 1000 h ± 5 h at +140 °C ± 5 °C according to ISO 188 Method A (air oven method) shall have a minimum of 75% retention relative to unaged specimens tested concurrently. Charpy impact specimens shall be notched prior to aging.
Note 5: Specimens tested for flammability to UL 94 after heat aging (A-1000 h ± 5 h at +140 °C ± 5 °C, B-3000 h ± 5 h at +140 °C ± 5 °C) according to ISO 188/A shall have a V0 rating.

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