



Polyamide - High Heat Resistant, Glass Fiber Reinforced, Heat Stabilized

1 Scope

1.1 Material Description. This standard covers the properties of glass fiber reinforced, heat stabilized, high temperature capable polyamides which are used in injected molded components.

1.2 Symbols. The material abbreviations according to ISO 11469 are shown in Table 1 through Table 3.

1.3 Applicability. Typical applications include the following: Engine covers, turbo system components, and other applications where temperature resistance is desired.

1.4 Remarks. The classification into types is according to the different ranges of glass fiber content within different temperature usage ranges. Additional glass and temperature ranges will be added as necessary.

1.4.1 T1: Continuous use temperature, +180 °C

1.4.2 T2: Continuous use temperature, +200 °C

1.4.3 T3: Continuous use temperature, +220 °C

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 11469
ISO 75	ISO 294	ISO 1874-2	ISO 15512
ISO 179	ISO 527	ISO 3451	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14335
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 B, or GMW14335). Immediately after molding, specimens shall be sealed in moisture-proof containers and stored at +23 °C ± 2 °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 +23 °C ± 2 °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. The following are also required for full standard approval. The minimum number of lots per test required is one in natural: Poisson's Ratio, Coefficient of Linear Thermal Expansion (CLTE), Thermal Expansion Curve, Mold Shrinkage, Stress

Strain Curve at multiple temperatures including those on the GMW3013 GMMPD tab plus 180 °C^{Type1,2,3}, +200 °C^{Type2,3}, +220 °C^{Type3} Shear Modulus Curve. See GMW3013 for details and test procedures.

3.3 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 for Type 1 Materials (Natural and Black)

			Glass Fiber Reinforcement Percentage		
			30%	35%	50%
Property	Standard	Units	Value	Value	Value
ISO Symbol	ISO 11469		>PA-GF30<	>PA-GF35<	>PA-GF50<
Ash	ISO 3451	%	27 to 33	33 to 38	48 to 52
Density	ISO 1183	g/cm ³	Target Range 1.30 to 1.50	Target Range 1.35 to 1.50	Target Range 1.57 to 1.61
Moisture Content	ISO 15512, Method A or B or GMW14335	%	≤ 0.2	≤ 0.2	≤ 0.2
Tensile Modulus	ISO 527-1/2	MPa	9000 to 11400	9500 to 13000	14 500 to 18700
Tensile Stress at Break	ISO 527-1/2	MPa	≥ 150	≥ 150	≥ 206
Tensile Stress at Break at +180 °C	ISO 527-1/2	MPa	Target ≥ 70	Target ≥ 70	Target ≥ 80
Tensile Stress at Break after Heat Aging 1000 h at +180 °C	ISO 188 ISO 527	% Retention	≥ 80	≥ 80	≥ 80
Tensile Stress at Break after Heat Aging 2500 h at +180 °C	ISO 188 ISO 527	% Retention	≥ 65	≥ 65	≥ 65
Tensile Strain at Break	ISO 527-1/2	%	≥ 2.5	≥ 2.0	≥ 2.0
Notched Charpy Impact Strength At +23 °C At -30 °C	ISO 179/1eA	kJ/m ²	≥ 8.0 ≥ 6.5	≥ 9.0 ≥ 7.0	≥ 11.0 ≥ 8.5
Notched Charpy Impact after Heat Aging 1000 h at +180 °C	ISO 188 ISO 179/1eA	% Retention	≥ 90	≥ 90	≥ 90
Notched Charpy Impact after Heat Aging 2500 h at +180 °C	ISO 188 ISO 179/1eA	% Retention	≥ 75	≥ 75	≥ 75
Heat Deflection Temperature under Load 1.8 MPa	ISO 75	°C	≥ 230	≥ 230	≥ 246