GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16359

Polyphthalamide - Glass Fiber Reinforced, Impact Modified, Heat Stabilized, Hot Oil Moldable

1 Scope

1.1 Material Description. This standard covers properties of various types of glass fiber reinforced, impact modified, heat stabilized Polyphthalamide (PPA), injection moldable, hot oil moldable.

1.2 Symbols. The material abbreviations according to SAE J1344 are shown in Table 1.

1.3 Applicability. Typical applications include the following: Quick connectors, electric motor components.

1.4 Remarks. The classification into groups is according to the different ranges of glass fiber content. Additional glass ranges will be added as necessary.

2 References

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

2.1 External Standards/Specifications.

ISO 75	ISO 527	ISO 3795	SAE J1344
ISO 179-1/1eA	ISO 1183	ISO 11357-3	
ISO 188	ISO 3146	ISO 15512	
ISO 294	ISO 3451	ISO 16396-2	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14270	GMW14444
GMW3059	GMW3232	GMW14335	GMW16853

3 Requirements

3.1 Requirements on Test Specimens. Materials approved to this specification shall meet the requirements of GMW3013.

Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 16396-2.

All values indicated herein are based on material considered to be in the dry-as-molded state with moisture content of 0.2% maximum, ISO 15512 Method A or Method 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 16396-2. 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 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. See the Polyamide tab on the Plastics Submission Template and GMW3013 for test details and parameters.

3.2 Emissions Testing of Interior Materials and Parts. For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

3.3 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.

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3.4 Compound Properties (Natural and Black). See Table 1. The following are also required for full approval. The minimum number of lots per test required is one unless otherwise specified. See the Polyamide tab on the Plastics Submission Template and GMW3013 for test details and parameters.

- Poisson's Ratio
- Stress/strain data points and curves at the following temperatures: -30 °C, +23 °C, +85 °C, +110 °C, +125 °C, +150 °C, +170 °C

Note: See GMMPD tab on Plastics Submission Template (located in GM SupplyPower) for test details.

- Coefficient of Linear Thermal Expansion (CLTE) data

Note: See GMMPD tab on Plastics Submission Template (located in GM SupplyPower) for test details.

- Differential Scanning Calorimetry (DSC) curve
- Fourier Transform Infrared (FTIR) spectroscopy curve
- Mold shrinkage

Note: See the Polyamide tab on the Plastics Submission Template and GMW3013 for test details.

3.5 Initial Source Approval. No shipments shall be made by any supplier until representative initial production samples have been approved by the appropriate Materials Engineering department(s) as meeting the requirements of this specification.

3.6 Performance Requirements. Performance requirements shall be specified on part drawings or in component specifications. All parts manufactured from these materials shall be resistant to the media contacted, such as aliphatic and aromatic hydrocarbons, fuels, lubricants, oils, greases and alcohols, at the places of use.

3.7 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.

Table 1: Compound Properties (Natural and Black)

			Nominal Glass Fiber Reinforcement Percentage
			15%
Property	**Standard**	**Units**	**Range**
SAE International Symbol	SAE J1344	-	> PPA-I-GF15 <
Ash	ISO 3451	%	12 to 20
Density	ISO 1183	g/cm^3	Target Range 1.24 to 1.30
Tensile Modulus	ISO 527	MPa	5500 to 7500
Tensile Stress at Break	ISO 527	MPa	≥ 130
Stress at Break after Heat Aging [Note 1]	ISO 188, ISO 527 1000 h at 160 °C	% Retention	≥ 60
Moisture Content	ISO 15512 Method A or Method B or GMW14335	%	≤ 0.2

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