GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16797

Polyphthalamide – 25% Glass Fiber/Carbon Fiber Reinforced, Impact Modified, Fuel Compatible, Electrostatically Dissipative, Heat Stabilized, Hot Oil Moldable

1 Scope

1.1 Material Description. This standard covers the properties of a 25% glass fiber/carbon fiber reinforced, impact modified, fuel compatible, electrostatically dissipative, heat stabilized polyphthalamide, injection moldable, hot oil moldable.

1.2 Symbols. The material abbreviation according to SAE J1344 is >PPA-(GF13+CF12)<.

1.3 Applicability. Typical applications include the following: fuel components where electrostatic dissipation is required.

2 References

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

2.1 External Standards/Specifications.

ASTM D6869	ISO 527-1	ISO 3146	SAE J1344
ISO 75	ISO 1183	ISO 3451	SAE J1645
ISO 179	ISO 1817	ISO 3795	SAE J1681
ISO 188	ISO 1874-1	ISO 11357-3	
ISO 294	ISO 1874-2	ISO 15512	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14270	GMW14335
GMW3059	GMW3232		

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

3.1.1 Unless otherwise specified, injection molding of test specimens shall be accomplished per ISO 294 with the conditions for injection molding from ISO 1874-1.

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 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.

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3.3 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.

3.4 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, electronic Stress/Strain Curve at multiple temperatures (for example -30 °C, +23 °C, +150 °C), Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage and Fogging. See GMW3013 for all test procedures and parameters.

3.5 Swell After Fuel Soak. On a standard tensile bar or flexural modulus bar, measure length, width, and thickness prior to start of test. Measure length, width, and thickness again after 1000 h fuel soak. Calculate percent change in each direction:

$$\frac{d_2 - d_1}{d_1}$$

Where:

- $\mathbf{d_1}$ is the original measurement.
- $\mathbf{d_2}$ is the measurement after fuel soak.

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

Table 1: Compound Properties (Natural and Black)

			Glass Fiber/Carbon Fiber Percentage
			25% (13% Glass/12% Carbon)
Property	**Standard**	**Units**	**Range**
SAE Symbol	SAE J1344		>PPA-(GF13+CF12)<
Ash (Glass Only)	ISO 3451	%	11 to 15
Density	ISO 1183	g/cm^3	Target Range 1.25 to 1.40
Tensile Modulus	ISO 527	MPa	11 000 to 16 000
Tensile Stress at Break	ISO 527	MPa	≥ 165
Stress at Break (at +23 °C) after Heat Aging [Note 1]	ISO 188 ISO 527 1000 h at 170 °C	% Retention	≥ 75
Moisture Content	ISO 15512 Method A or B or GMW14335	%	≤ 0.2
Notched Charpy Impact Strength at +23 °C at -30 °C	ISO 179/1eA	kJ/m^2	≥ 5.4 ≥ 3.0

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