GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16799

Polyphthalamide – Impact Modified, Fuel Compatible, Heat Stabilized, Hot Water Moldable

1 Scope

1.1 Material Description. This standard covers the properties of impact modified, fuel compatible, heat stabilized polyphthalamide, injection moldable, hot water moldable.

1.2 Symbols. The material abbreviation according to SAE J1344 is >PPA-I<.

1.3 Applicability. Typical applications include fuel pump module and components.

1.4 Remarks. The specification is classified by level of impact modifiers:

- **T1:** Impact modified.
- **T2:** High impact modified.

2 References

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

2.1 External Standards/Specifications.

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

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW3232	GMW14335
GMW3059			

3 Requirements

3.1 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.

3.2 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 1874-1.

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 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.

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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 (1) in natural:
- Poisson's Ratio, electronic Stress/Strain Curve at multiple temperatures (for example -30 °C, 23 °C, 130 °C).
- Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage.

See GMW3013 for all test procedures and parameters.

3.4 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.

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

Table 1: Compound Properties (Natural and Black)

Property	Standard	Units	T1 Values	T2 Values
SAE International (SAE) Symbol	SAE J1344		>PPA-I<	>PPA-I<
Density	ISO 1183	g/cm^3	Target Range 1.11 to 1.17	Target Range 1.09 to 1.17
Tensile Modulus	ISO 527	MPa	2000 to 3500	1900 to 2600
Tensile Stress at Yield	ISO 527	MPa	≥ 55	≥ 60
Tensile Stress at Yield (at +23 °C) after Heat Aging Note 1	ISO 188 ISO 527 1000 h at 130 °C	% Retention	≥ 75	≥ 75
Moisture Content	ISO 15512 Method A or Method B or GMW14335	%	≤ 0.2	≤ 0.2
Notched Charpy Impact Strength at +23 °C at -30 °C	ISO 179/1eA	kJ/m^2	≥ 6 ≥ 1	≥ 55 ≥ 9
Notched Charpy Impact Strength (at +23 °C) after Heat Aging Note 1	ISO 188 ISO 179/1eA 1000 h at 130 °C	% Retention	≥ 75	≥ 75
Melting Temperature	ISO 3146 or ISO 11357-3	°C	Target Range 305 to 320	Target Range 295 to 320
Heat Deflection Temperature under Load, 1.8 MPa	ISO 75	°C	≥ 95	≥ 115

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