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| GM | WORLDWIDE ENGINEERING STANDARDS | Material Specification | GMW16362 |

# Polyphthalamide – 35% Glass Fiber Reinforced, Non-Lubricated, Heat Stabilized, Hot Water Moldable

## 1 Scope

**1.1 Material Description.** This standard covers the properties of a 35% by mass glass fiber reinforced, non-lubricated, heat stabilized polyphthalamide (PPA), injection moldable, hot water moldable. This resin is non-lubricated to improve adhesion in cure-in-place gaskets (CIPG).

**1.2 Symbols.** The material abbreviations according to SAE J1344 is >PPA-GF35<.

**1.3 Applicability.** Typical applications include chassis control modules.

## 2 References

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

**2.1 External Standards/Specifications.**

| | | | |
|---|---|---|---|
| ASTM D6869 | ISO 294 | ISO 1874-2 | ISO 11357-3 |
| ISO 75 | ISO 527 | ISO 3146 | ISO 15512 |
| ISO 179/1eA | ISO 1183 | ISO 3451 | SAE J1344 |
| ISO 188 | ISO 1874-1 | ISO 3795 | |

**2.2 GM Standards/Specifications.**

| | | | |
|---|---|---|---|
| GMW3013 | GMW3221 | GMW14270 | GMW14335 |
| GMW3059 | GMW3232 | | |

## 3 Requirements

**3.1 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 +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 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.

**3.3 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, +155 °C), Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage.

See GMW3013 for all test procedures and parameters.

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

**Table 1: Compound Properties (Natural and Black)**

| | | | Nominal Glass Fiber Reinforcement Percentage |
|---|---|---|---|
| | | | **35%** |
| **Property** | **Standard** | **Units** | **Range** |
| SAE Symbol | SAE J1344 | | >PPA-GF35< |
| Ash | ISO 3451 | % | 32 to 38 |
| Density | ISO 1183 | $g/cm^3$ | Target Range<br>1.44 to 1.50 |
| Tensile Modulus | ISO 527 | MPa | 10 500 to 14 500 |
| Tensile Stress at Break | ISO 527 | MPa | ≥ 185 |
| Stress at Break after Heat Aging Note 1 | ISO 188<br>ISO 527<br>1000 h at 155 °C | % Retention | ≥ 80 |
| Moisture Content | ISO 15512 Method A, Method B, or GMW14335 | % | ≤ 0.2 |
| Notched Charpy Impact Strength<br>at +23 °C<br>at -30 °C | ISO 179/1eA | $kJ/m^2$ | ≥ 5<br>≥ 5 |
| Notched Charpy Impact Strength after Heat Aging Note 1 | ISO 188<br>ISO 179/1eA<br>1000 h at 155 °C | % Retention | ≥ 80 |
| Melting Temperature | ISO 3146 or<br>ISO 11357-3 | °C | Target Range<br>300 to 320 |
| Heat Deflection Temperature under Load, 1.8 MPa | ISO 75 | °C | ≥ 280 |
| Flammability | GMW3232 or ISO 3795<br>All reporting must be in accordance with GMW3232 | mm/minute | Self-Extinguishing (SE) or ≤ 100 |

**Note 1:** Specimens tested for Stress at Break to ISO 527 and Notched Charpy Impact Strength to ISO 179 at +23 °C ± 2 °C after heat aging 1000 h ± 5 h at +155 °C ± 5 °C according to ISO 188 Method A (air oven method) shall have a minimum of 80% retention relative to unaged specimens tested concurrently.\

## 4 Manufacturing Process

Not applicable.

## 5 Rules and Regulations

**5.1 Legal Regulations.** All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

**5.2 Language.** In the event of conflict between the English and domestic language, the English language shall take precedence.

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