GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16357

Polyphthalamide - Glass Fiber Reinforced, Heat Stabilized, Hot Water Moldable

1 Scope

1.1 Material Description. This standard covers properties of various types of glass fiber reinforced, heat stabilized polyphthalamide (PPA), injection moldable, hot water moldable.

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

1.3 Applicability. Typical applications include bulb socket, backplates and charged air cooler ducts.

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

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. 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.

3.1.2 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.

3.1.3 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 Table 1. 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, +170 °C), Coefficient of Linear Thermal Expansion (CLTE), Mold Shrinkage. See GMW3013 for all test procedures and parameters.

© Copyright 2018 General Motors Company All Rights Reserved

Documents
Document Sharing Hub
Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW16357 2018

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%	**45%**
Property	**Standard**	**Units**	**Range**	**Range**
SAE Symbol	SAE J1344		>PPA-GF35<	>PPA-GF45<
Ash	ISO 3451	%	32 to 38	42 to 48
Density	ISO 1183	g/cm^3	Target Range 1.40 to 1.50	Target Range 1.55 to 1.61
Tensile Modulus	ISO 527	MPa	10 000 to 14 000	14300 to 19500
Tensile Stress at Break	ISO 527	MPa	≥ 170	≥ 220
Stress at Break 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 ≥ 5	≥ 9 ≥ 9
Notched Charpy Impact Strength after Heat Aging **Note 1**	ISO 188 ISO 179/1eA 1000 h at +170 °C	% Retention	≥ 75	
Melting Temperature	ISO 3146 or ISO 11357-3	°C	Target Range 300 to 330	Target Range 300 to 310
Heat Deflection Temperature under Load, 1.8 MPa	ISO 75	°C	≥ 280	≥ 285
Flammability	GMW3232 or ISO 3795 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 ± 2 °C after heat aging 1000 h ± 5 h at +170 °C ± 5 °C according to ISO 188, Method A (air oven method) shall have a minimum of 75% retention relative to unaged specimens tested concurrently.

3.5 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.

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.

© Copyright 2018 General Motors Company All Rights Reserved

--`,,```,,,,```-`-`,,`,,`,`,,`---
Documents
Document Sharing Hub
Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW16357 2018