GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW17479

Thermoplastic Elastomers – Poly(ether-ester) Block Copolymers, Heat Stabilized – Blow Moldable, Boots

1 Scope

1.1 Material Description. This specification covers the properties of blow moldable, black, polyester thermoplastic elastomers. These materials can be processed by blow molding. These resins are not for use in interior applications.

Material types are delineated by Flexural Modulus. The types and corresponding modulus ranges are identified in Appendix A, Table A1. Further delineation is identified by Melt Flow.

Type 1 and Type 2 materials are typically used for compact constant velocity joint (CVJ) boots; Type 3 and Type 4 materials are typically used for rack and pinion boots, and propeller shaft boots, and applications where increased stiffness is required.

1.2 Symbols. The material abbreviation according to ISO 18064 is >TPC-ET<.

1.3 Applicability. Typical applications include constant velocity joint (CVJ) boots, rack and pinion boots, and propeller shaft boots.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ISO 34-1	ISO 306	ISO 1183	ISO 14910-2
ISO 178	ISO 527	ISO 3795	ISO 15512
ISO 179/1eA	ISO 868	ISO 11357	ISO 18064
ISO 188	ISO 1133		

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14270
GMW3059	GMW3232	

2.3 Additional References.

Safety and Industrial Hygiene (S&IH) Technical Standard (TS), S&IH TS 3.4-160-02

3 Requirements

Materials approved to this specification shall meet the requirements of GMW3013, General Requirements for Handling of Technical Terms of Delivery for Plastics.

3.1 Requirements on Test Specimens. Tests shall be conducted using the latest issue of the test methods indicated. Suitable precautions should be taken to ensure that applicable safe limits are not exceeded when conducting test procedures, processes, and/or handling the materials required by this specification.

Unless otherwise specified, preparation of specimens and standard test methods shall be in accordance with ISO 14910-2.

All test values herein are based on material with a moisture content of 0.1% maximum at the time of molding.

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Immediately after molding, specimens shall be sealed in a moisture-proof container/envelope and aged for a minimum of 21 days at +23 °C ± 3 °C. Samples shall then be removed from the moisture-proof container/envelope and conditioned for a period of 24 h minimum per GMW3221 Code B.

Test immediately following this conditioning period, unless otherwise specified. All tests shall be performed on unannealed specimens. In addition, test specified at temperatures **under** +23 °C ± 3 °C, shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum. Tests specified at temperatures **over** +23 °C ± 3 °C shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 20 minutes minimum.

The minimum values specified in the property table must be met by test specimens in black, natural, or in a standard sampled color, if natural or black are not available. For colored grades, where other pigment and additive systems (e.g., stabilizers) are used, the impact values shall not decrease by more than 10% from the specified minimum value.

3.2 Requirements on Delivery. Important physical, mechanical, and thermal properties that characterize the material are summarized in Table 1.

Note: For each product, the requirements to Table 1 shall be documented by Certification Statement according to GMW3013. The color shall be specified on drawings, in material specifications, and otherwise.

3.3 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.

3.4 Compound Properties. See Table 1. The minimum of number of lots required to be tested shall be according to the GMW3013 template. For most properties, the minimum number of lots is six (6). The following are also required for full specification approval. The minimum number of lots per test required is one (1):

- Young's Modulus
- Poisson's Ratio
- Coefficient of Linear Thermal Expansion (CLTE)
- Stress Strain Curve at +23 °C

Table 1: Compound Properties (Black)

Property	Test Method	Unit	Type 1		Type 2	Type 3	Type 4
			A	B			
Flexural Modulus	ISO 178, 64 mm span, 2 mm/minute test speed, chord modulus using 0.5 mm to 2.5 mm strain	MPa	65 to 100		75 to 100	70 to 130	90 to 170
Shore D Hardness	ISO 868, 15 s delay	Shore D	32 to 42		35 to 50	40 to 53	40 to 55
Density	ISO 1183	g/cm^3	1.11 to 1.15		1.13 to 1.17	1.14 to 1.18	1.15 to 1.19
Tensile Stress at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	20 Minimum		18 Minimum	25 Minimum	20 Minimum
Elongation at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	%	200 Minimum		230 Minimum	250 Minimum	350 Minimum
Tensile Stress at 10% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	4.0 Minimum		5.4 Minimum	6.0 Minimum	6.5 Minimum
Tear Strength, Parallel	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	75 Minimum		100 Minimum	105 Minimum	90 Minimum
Tear Strength, Perpendicular	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	75 Minimum		110 Minimum	90 Minimum	80 Minimum

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