



Thermoplastic Elastomers – Poly(ether-ester) Block Copolymers – High Performance

1 Scope

1.1 Material Description. This specification covers the properties of high performance, black and natural, polyester thermoplastic elastomers. These materials can be processed by injection molding and extrusion.

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

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

1.3 Applicability. Typical applications include grommets, isolators, hoses, tubing, seals, jacketing for wire and cable, gears, and bearings.

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

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14270	GMW16853
GMW3059	GMW3232	GMW14444	
GMW3205	GMW3235	GMW15634	

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.

Immediately after molding, specimens shall be sealed in a moisture proof container/envelope and aged for a minimum of 21 days at $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. 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** $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, shall be conducted at

the specified temperature using specimens conditioned at the specified temperature for 4 h minimum. Tests specified at temperatures **over** $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ 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 tables 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.

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.

3.2 Emissions Testing of Interior Materials and Parts. For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

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

3.5 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 $+23\text{ }^{\circ}\text{C}$

Table 1: Compound Properties (Black and Natural)

Property	Test Method	Unit	Type 1	Type 2	Type 3M1	Type 3M2	Type 3M2H	Type 4	Type 5	Type 6
Flexural Modulus	ISO 178, 64 mm span, 2 mm/minute test speed, chord modulus using 0.5 mm to 2.5 mm strain	MPa	30 to 60	75 to 100	160 to 225			250 to 320	440 to 610	780 to 1450
Shore D Hardness	ISO 868, 15 s delay	Shore D	33 ± 5	42 ± 5	50 ± 5	54 ± 10	55 ± 6	58 ± 8	68 ± 8	73 ± 8
Density	ISO 1183	g/cm ³	1.09 to 1.13	1.12 to 1.16	1.17 to 1.21			1.20 to 1.24	1.24 to 1.28	1.26 to 1.30
Tensile Stress at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	20 Minimum	25 Minimum	28 Minimum	30 Minimum	10 Minimum	30 Minimum	30 Minimum	25 Minimum
Elongation at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	%	500 Minimum	450 Minimum	440 Minimum	400 Minimum	300 Minimum	300 Minimum	300 Minimum	160 Minimum
Tensile Stress at 10% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	2.0 Minimum	5.0 Minimum	10.0 Minimum	9.5 Minimum	9.0 Minimum	10.0 Minimum	15.0 Minimum	25 Minimum
Tear Strength, Parallel	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	85 Minimum	100 Minimum	115 Minimum	115 Minimum	115 Minimum	135 Minimum	160 Minimum	195 Minimum
Tear Strength, Perpendicular	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	85 Minimum	110 Minimum	105 Minimum	100 Minimum	100 Minimum	120 Minimum	150 Minimum	190 Minimum
Notched Charpy at -40 °C	ISO 179/1eA	kJ/m ²	50 Minimum	90 Minimum	15 Minimum	15 Minimum	8.0 Minimum	5.0 Minimum	3.0 Minimum	4.0 Minimum
Moisture Content	ISO 15512 Method A or Method B	%	0.10 Maximum							
Melt Temperature Range	ISO 11357, 10 °C/minute, report 2 nd melt	°C	188 to 198	187 to 200	199 to 205	196 to 206	195 to 205	205 to 215	212 to 220	215 to 225
Melt Mass Flow Rate	ISO 1133, 220 °C, 2.16 kg load	g/10 Minutes	7.0 to 10.0	7.0 to 10.0	15 to 21	6.5 to 9.0	6.0 to 10.0	Not applicable	Not applicable	Not applicable
	ISO 1133, 230 °C, 2.16 kg load		Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	7.0 to 10.5	Not applicable	Not applicable