



Thermoplastic Elastomers – Poly(ether-ester) Block Copolymers – Extrusion Grade

1 Scope

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose/Material Description. This specification covers the properties of black and natural, high viscosity, heat stabilized, polyester thermoplastic elastomers. These materials can be processed by 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 hoses, hose liners, and tubing.

2 References

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

2.1 External Standards/Specifications.

ISO 34-1	ISO 306	ISO 1183-1	ISO 18064
ISO 178	ISO 527-1/2	ISO 3795	ISO 20029-2
ISO 179-1/1eA	ISO 868	ISO 11357-3	
ISO 188	ISO 1133-1	ISO 15512	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW14270	GMW16853
GMW3059	GMW3232	GMW14444	

3 Requirements

3.1 Requirements on Test Specimens. Materials approved to this specification shall meet the requirements of GMW3013.

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 20029-2.

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 $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$. 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 **less than** $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$, shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum. Tests specified at temperatures **greater than** $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 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.

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. 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 and data points at -30 °C, +23 °C, +85 °C
- Differential Scanning Calorimetry (DSC) curve
- Fourier Transform Infrared (FTIR) spectroscopy curve

3.4 Initial Source Approval. No shipments shall be made by any supplier until representative initial production samples have been approved by the appropriate Materials Engineering department(s) as meeting the requirements of this specification.

3.5 Performance Requirements. Performance requirements shall be specified on part drawings or in component specifications. All parts manufactured from these materials shall be resistant to the media contacted at the place of use, such as aliphatic and aromatic hydrocarbons, fuels, lubricants, oils, greases and alcohols.

3.6 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.

3.7 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.

Table 1: Compound Properties (Black and Natural)

Property	Test Method	Unit	Type 1	Type 2	Type 3
Flexural Modulus	ISO 178, 64 mm span, 2 mm/minute test speed, chord modulus using 0.5 mm to 2.5 mm strain	MPa	170 to 340	280 to 420	100 to 150
Shore D Hardness	ISO 868, 15 s delay	Shore D	53 to 63	55 to 69	38 to 53
Density	ISO 1183-1	g/cm ³	1.17 to 1.23	1.21 – 1.25	1.14 to 1.18
Tensile Stress at Break	ISO 527-1/2, Type 1BA dumbbell, 50 mm/minute	MPa	30 minimum	35 minimum	20 minimum
Elongation at Break	ISO 527-1/2, Type 1BA dumbbell, 50 mm/minute	%	514 minimum	300 minimum	200 minimum
Tensile Stress at 10% Elongation	ISO 527-1/2, Type 1BA dumbbell, 50 mm/minute	MPa	13 minimum	15 minimum	5 minimum
Tear Strength, Parallel	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	150 minimum	100 minimum	80 minimum
Tear Strength, Perpendicular	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	105 minimum	100 minimum	75 minimum
Notched Charpy at -40 °C	ISO 179-1/1eA	kJ/m ²	3.6 minimum	5.0 minimum	100 minimum
Moisture Content	ISO 15512 Method A or Method B	%	0.10 maximum	0.10 maximum	0.10 maximum