



Thermoplastic Elastomer – Poly(ether-ester) Block Copolymers – High Performance, Transmission Applications

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 transmission baffles and other transmission applications.

2 References

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

2.1 External Standards/Specifications.

ASTM D638	ISO 306	ISO 1183	ISO 15512
ISO 34-1	ISO 527	ISO 11357	ISO 18064
ISO 178	ISO 527-2	ISO 11357-2	
ISO 179/1eA	ISO 868	ISO 11359	
ISO 188	ISO 1133	ISO 14910-2	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW16444	GMW16973
GMW3059	GMW14270		

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

3.2 Requirements on Delivery. Important physical, mechanical, and thermal properties that characterize the material are summarized in Table 1 and Table 2.

Note: For each product, the requirements to Table 1 and Table 2 shall be documented by Certification Statement according to GMW3013. A transmission application specific version of this template is available from GM Powertrain Materials Engineering. 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 submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

3.4 Compound Properties. See Table 1. A minimum of six (6) lots shall be tested to Table 1.

Table 1: Compound Properties (Black and Natural)

Property	Test Method	Unit	Type 2
Flexural Modulus	ISO 178, 64 mm span, 2 mm/minute test speed, chord modulus using 0.5 mm to 2.5 mm strain	MPa	440 to 610
Shore D Hardness	ISO 868, 15 s delay	Shore D	60 to 75
Density	ISO 1183	g/cm ³	1.18 to 1.30
Tensile Stress at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	35 minimum
Elongation at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	%	250 minimum
Tensile Stress at 10% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	15 minimum
Tear Strength	ISO 34-1, Method B, angle die, 500 mm/minute, parallel	kN/m	155 minimum
Notched Charpy at -40 °C	ISO 179/1eA	kJ/m ²	2.5 minimum
Moisture Content	ISO 15512 Method A or B	%	0.10 maximum
Melt Temperature Range	ISO 11357, +10 °C/minute, report 2 nd melt	°C	211 to 223
Glass Transition Temperature (1 lot only)	ISO 11357-2, Method A, +10 °C /minute	°C	To be reported
Melt Mass Flow Rate	ISO 1133, +240 °C, 2.16 kg load	g/10 minutes	10.5 to 15
Vicat Softening Temperature	ISO 306, Method A, +50 °C/h, 10 N load	°C	202 to 209

3.5 Requirements for Heat Resistance. The materials approved to this standard shall meet the tensile property retention requirements specified in Table 2, when tested both at room temperature and at aging temperature (+125 °C and +140 °C).

3.6 Requirements for Transmission Fluid Resistance. The tensile properties of the material approved to this standard shall meet transmission fluid resistance requirements specified in Table 2 both at room temperature and at aging temperature (+125 °C and +140 °C). Test fluid shall be Dexron® VI in accordance with GMW16444. Test requirements are as follows: Samples shall be aged in suitable vented vessels. Minimum fluid to sample ratio shall be 150 ml:3 specimens. A minimum of five (5) specimens shall be tested per condition. Samples shall have insignificant contact with the vessel. For tensile test samples, contact or alterations are allowed outside Length (L), as specified in ISO 527-2 (the initial distance between grips). Samples shall be brought to room temperature in the aging fluid, and shall be tested the same day they are pulled from the aging medium. Samples shall be wiped with filter paper or a lint free cloth before testing.

All samples shall be aged at the specified conditions in Table 2. After aging, samples shall be brought to room temperature. Samples to be tested at room temperature shall be tested. The remaining samples to be tested at