GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW17723

Thermoplastic Elastomer – Poly(ether-ester) Block Copolymers –Blow Moldable, High Temperature Hot Side Charged Air Cooler Ducts

1 Scope

1.1 Material Description. This specification covers the properties of black, heat stabilized, polyester thermoplastic elastomers. These materials can be processed by blow molding.

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

1.3 Applicability. Typical applications include high temperature hot side charger air cooler ducts.

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 11357	ISO 15512
ISO 179/1eA	ISO 868	ISO 11357-2	ISO 18064
ISO 188	ISO 1133	ISO 11359	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	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 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.

3.2 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, processed, and/or handling the materials required by this specification.

3.2.1 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. Test specimens shall be die cut, perpendicular to flow, from molded plaques. (If specimens are not die cut immediately after molding, the plaques shall be sealed in a moisture-proof container/envelope until die cutting of specimens.)

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3.2.2 Immediately after die-cutting, specimens shall be sealed in a moisture proof container/envelope and aged for a minimum of 21 days at +23 °C ± 2 °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 °C ± 2 °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 °C ± 2 °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.

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

Table 1: Compound Properties (Black)

Property	Test Method	Unit	Value
Flexural Modulus	ISO 178, 64 mm span, 2 mm/minute test speed, chord modulus using 0.5 mm to 2.5 mm strain	MPa	250 to 350
Tensile Modulus	ISO 527, Type 1BA dumbbell, 1 mm/minute, perpendicular	MPa	260 minimum
Shore D Hardness	ISO 868, 15 s delay	Shore D	60 to 65
Density	ISO 1183	g/cm^3	1.25 to 1.27
Tensile Stress at 10% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute, perpendicular	MPa	16 minimum
Tensile Stress at 100% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute, perpendicular	MPa	18.8 minimum
Tensile Stress at 200% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute, perpendicular	MPa	23.3 minimum
Tear Strength -parallel -perpendicular	ISO 34-1, Method B, angle die, 500 mm/minute	 kN/m kN/m	 169 minimum 139 minimum
Notched Charpy at -40 °C	ISO 179/1eA	kJ/m^2	3.6 minimum
Moisture Content	ISO 15512 Method A or Method B	%	0.10 maximum
Melt Temperature Range	ISO 11357,10 °C/minute, report 2nd melt	°C	198 to 212
Glass Transition Temperature –one (1) lot only	ISO 11357-2, Method A, 10 °C /minute	°C	-10
Melt Mass Flow Rate	ISO 1133, 230 °C, 10 kg load	g/10 minutes	13 to 39
Melt Volume Flow Rate	ISO 1133, 230 °C, 10 kg load	cm^3/10 minutes	Report
Vicat Softening Temperature	ISO 306, Method A, 50 °C/h, 10 N load	°C	183 minimum

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