GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW15813

Thermoplastic Elastomers – Polyolefinic, Fully Crosslinked, General Purpose, Underhood

1 Scope

1.1 Material Description. This specification covers the properties of black and natural, general purpose, heat stabilized, thermoplastic vulcanizates (TPV) containing fully crosslinked Ethylene-Propylene-Diene Monomer (EPDM) elastomer particles dispersed in a continuous Polypropylene (PP) matrix. These materials can be processed by extrusion, injection, and blow molding.

Material Types are delineated by hardness values. The types and corresponding hardnesses available are identified in Appendix A, Table A1.

1.2 Symbols. The material abbreviation according to ISO 18064 is >TPV-(EPDM+PP)<.

1.3 Applicability. Typical applications include the following: mats, seals, gaskets, air ducts, Constant Velocity Joint (CVJ) boots, covers, grommets, and other parts where softness and conformity are needed.

2 References

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

2.1 External Standards/Specifications.

ISO 34-1	ISO 527	ISO 868	ISO 18064
ISO 37	ISO 812	ISO 1183	
ISO 188	ISO 815	ISO 1817	

2.2 GM Standards/Specifications.

GMW3013	GMW3059	GMW3221	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.

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 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.

3.2.1 Tests specimens shall be die cut from fan gated injection molded plaques having a nominal thickness of 2.0 mm ± 0.2 mm. Die cut specimens are to be tested with the long axis of the test specimen perpendicular to the direction of flow. Plaque dimensions must be sufficient to permit this.

3.2.2 Tests shall be conducted 40 h minimum after molding and immediately following a conditioning period of 24 h minimum per GMW3221 Code A unless otherwise specified. All tests shall be performed on unannealed specimens. In addition, tests specified at temperatures below or above +23 °C ± 2 °C shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

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3.2.3 The minimum values specified in the property tables must be met by test specimens in natural, black, or in a standard sampled color if natural or black are not available. For colored grades where other pigment and additive systems (e.g., stabilizer) are used, the impact values shall not decrease 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. 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 (Natural/Black)

Property	Test Method	Unit	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10
Shore A Hardness	ISO 868, 15 s delay	Shore A	35 ± 5	45 ± 5	55 ± 5	65 ± 5	73 ± 5	80 ± 5	87 ± 5	N/A	N/A
Shore D Hardness	ISO 868, 15 s delay	Shore D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	40 ± 5	50 ± 5
Density	ISO 1183	g/cm^3	0.90 to 0.97	0.92 to 0.97	0.90 to 0.97	0.94 to 1.00	0.94 to 1.00	0.93 to 1.00	0.93 to 0.99	0.92 to 0.98	0.91 to 0.96
Tensile Stress at Break	ISO 37, Type 1 dumbbell, 500 mm/minute	MPa	1.6 min.	2.8 min.	4.1 min.	5.1 min.	6.7 min.	8.9 min.	11 min.	N/A	N/A
Tensile Stress at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.7 min.	N/A
Tensile Stress at Yield	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.1 min.
Elongation at Break	ISO 37, Type 1 dumbbell, 500 mm/minute	%	160 min.	265 min.	310 min.	340 min.	370 min.	400 min.	485 min.	N/A	N/A
Elongation at Break	ISO 527, Type 1BA dumbbell, 50 mm/minute	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	520 min.	N/A
Elongation at Yield	ISO527, Type 1BA dumbbell, 50 mm/minute	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15 min.
Tensile Stress at 100% Elongation	ISO 37, Type 1 dumbbell, 500 mm/minute	MPa	0.6 min.	0.8 min.	1.7 min.	1.9 min.	2.8 min.	3.8 min.	5.6 min.	N/A	N/A
Tensile Stress at 100% Elongation	ISO 527, Type 1BA dumbbell, 50 mm/minute	MPa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.4 min.	N/A

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Property	Test Method	Unit	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10
Compression Set	ISO 815, Type A, 70 h at +125 °C	%	55 max.	55 max.	50 max.	50 max.	60 max.	65 max.	80 max.	90 max.	95 max.
Tear Strength	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	8.0 min.	11 min.	15 min.	20 min.	25 min.	30 min.	45 min.	N/A	N/A
Tear Strength	ISO 34-1, Method B, angle die, 50 mm/minute	kN/m	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60 min.	95 min.
Low Temperature Brittleness	ISO 812, Type B	°C	-56 max.	-56 max.	-56 max.	-52 max.	-54 max.	-53 max.	-52 max.	-47 max.	-21 max.
Properties After Short Term Heat Aging	ISO 188, 168 h at +150 °C in an air-circulating oven followed by the indicated property testing at +23 °C. Test methods are the same as for original mechanical property testing.	Change in Property									
Tensile Stress		%	-35 max.	-25 max.	± 35 max.	-35 max.	-35 max.	-35 max.	-35 max.	-35 max.	-35 max.
Elongation		%	-20 max.	-30 max.	± 20 max.	-40 max.	-35 max.	-35 max.	-35 max.	-40 max.	-40 max.
Tensile Stress at 100% Elongation		%	+20 max.	+20 max.	-50 max.	-20 max.	-10 max.	+25 max.	+30 max.	+30 max.	N/A
Properties After Long Term Heat Aging	ISO 188, 1000 h at +135 °C in an air-circulating oven followed by indicated property testing at +23 °C. Test methods are the same as for original mechanical property testing.	Change in Property	No objectionable color change or tackiness								
Tensile Stress		%	60 retention min.								
Elongation		%	60 retention min.								
Properties After Long Term Fluid Aging	ISO 1817, immersion in IRM 903, 70 h at +125 °C followed by indicated property testing at +23 °C. Test methods are the same as for original mechanical property testing.	Change in Property									

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