GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW15816

Thermoplastic Elastomers - Polyolefinic, Fully Crosslinked, Interior, UV Stabilized

1 Scope

1.1 Material Description. This specification covers the properties of natural, Ultraviolet (UV) and 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: seal belt sleeves, knobs, key pads, mats, seals, trays, liners, trim lips, overmolds, and 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.

AATCC 23	ISO 105-G02	ISO 815	SAE J1545
ISO 34-1	ISO 188	ISO 868	
ISO 37	ISO 527	ISO 1183	
ISO 105-B06	ISO 812	ISO 18064	

2.2 GM Standards/Specifications.

GMW3013	GMW3221	GMW3417	GMW16853
GMW3059	GMW3232	GMW14444	
GMW3205	GMW3235	GMW15634	

3 Requirements

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 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.

3.4 Compound Properties. See Table 1 and Table 2. 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

Suppliers **must** demonstrate ability to meet integrally colored compound requirements (Table 2) with an appropriate palette of GM visually approved colors (i.e., red, tan, blue, gray) prior to approval of either base compound or colored compounds.

Table 1: Compound Properties (Natural) [Note 1]

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	40 ± 5	55 ± 5	65 ± 5	75 ± 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	0.89 to 0.95	0.90 to 0.96	0.91 to 0.99	0.85 to 0.98	0.91 to 0.99	0.91 to 0.98	0.92 to 0.98	90 to 98	0.91 to 0.97
Tensile Stress at Break	ISO 37, Type 1 dumbbell, 500 mm/minute	MPa	1.9 min	2.8 min	2.4 min	3.1 min	4.9 min	6.6 min	6.7 min	N/A	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	10 min	9.6 min
Elongation at Break	ISO 37, Type 1 dumbbell, 500 mm/minute	%	200 min	500 min	250 min	300 min	350 min	370 min	350 min	N/A	N/A
Elongation at Yield	ISO 527, Type 1BA dumbbell, 50 mm/minute	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25 min	20 min
Tensile Stress at 100% Elongation	ISO 37, Type 1 dumbbell, 500 mm/minute	MPa	0.7 min	0.5 min	1.4 min	1.5 min	2.3 min	3.4 min	4.3 min	N/A	N/A
Compression Set	ISO 815, Type A, 22 h at +70 °C 70 h at +100 °C	%	50 max	45 max N/A	40 max N/A	45 max N/A	50 max N/A	55 max. 65 max	75 max N/A	45 max	75 max 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
Tear Strength	ISO 34-1, Method B, angle die, 500 mm/minute	kN/m	8 min	11 min	14 min	16 min	18 min	23 min	30 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	68 min	80 min
Low Temperature Brittleness	ISO 812, Type B	°C	-56 max	-75 max	-56 max	-54 max	-53 max	-54 max	-51 max	-43 max	-30 max
Properties After Long Term Heat Aging	ISO 188, 1000 h at +110 °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		%		75 retention min							
Elongation		%		70 retention min							
Emission Testing of Interior Materials - For initial approval, test one (1) lot in natural	GMW16853										
Odor	GMW3205-B3	Rating	≥ 6								
Fogging	GMW3235-B-Y1-T2	mg	Requirements, refer to GMW16853								
Emissions Note 2	GMW15634 VOC Value SVOC Value	 µg/g µg/g	 Requirements, refer to GMW16853 Requirements, refer to GMW16853								

Note 1: max = maximum, **min** = minimum, **N/A** = Not applicable
Note 2: SVOC = Semi-Volatile Organic Compound; **VOC** = Volatile Organic Compound

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