



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 Typical Applications. 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
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2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

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 $\pm$ 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 22 °C $\pm$ 3 °C shall be conducted at the specified temperature using specimens conditioned at the specified temperature for 4 h minimum.

3.2.3 The minimum values specified in the property tables must be met by test specimens in natural, black, or in a specification 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 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):

- 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
Specific Gravity	ISO 1183		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	ISO 527, 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
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.

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	8.0 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									
Tensile Stress		%	-80 max.	-65 max.	± 60 max.	-55 max.	-50 max.	-45 max.	-40 max.	-50 max.	-40 max.
Elongation		%	-85 max.	-75 max.	± 80 max.	-75 max.	-65 max.	-60 max.	-55 max.	-50 max.	-60 max.

Property	Test Method	Unit	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10
Tensile Stress at 100% Elongation		%	N/A	-35 max.	± 35 max.	-20 max.	-20 max.	-20 max.	-25 max.	-15 max.	N/A
Volume Change		%	+150 max.	+120 max.	± 120 max.	+110 max.	+95 max.	+80 max.	+65 max.	+55 max.	+50 max.
Tear Strength		%	-90 max.	N/A	± 80 max.	-65 max.	-65 max.	-65 max.	-60 max.	-50 max.	-50 max.

Min. = minimum

Max. = maximum

N/A = not applicable

3.4 Performance Requirements. Performance requirements e.g., flammability, resistance to odor, etc., shall be specified on part drawings or in component specifications.

4 Manufacturing Process

Not applicable.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. Samples of components or materials released to a GM material specification shall be tested for conformity with the requirements of this material specification and approved by the responsible Engineering department prior to commencement of delivery of bulk supplies.

A new approval must be received for any changes, e.g., properties, manufacturing process, location of manufacture, etc. If not otherwise agreed, all testing and documentation normally required for initial release must be completed.

It is the responsibility of the supplier to inform the customer in a timely manner, without solicitation, and to include documentation of all modifications of materials and/or processes and to apply for a new release.

If not otherwise agreed, all release tests shall be repeated and documented by the supplier prior to commencement of delivery of non-conforming bulk supplies. In individual cases, a shorter test can be agreed to between the responsible Engineering department and the supplier.

5.4 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.

5.5 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements. In addition, product MSDS/SDS submissions must be in compliance with specific country General Motors TMC003 Material Safety Data Sheet/Safety Data Sheet guidance documents where available.

5.6 All materials supplied to this standard must comply with the requirements of GMW3059, Restricted and Reportable Substances for Parts.

6 Approved Sources

Engineering qualifications of an approved source are required for this standard. Only sources listed in the GM Materials File, MATSPC, under this standard number have been qualified by Engineering as meeting the requirements of this standard.

7 Notes

7.1 Glossary.

MATSPC: Global repository of GM approved materials for corresponding GM Engineering Standards.

7.2 Acronyms, Abbreviations, and Symbols.

CLTE	Coefficient of Linear Thermal Expansion
CVJ	Constant Velocity Joint
EPDM	Ethylene-Propylene-Diene Monomer
GHS	Globally Harmonized System of Classification and Labeling of Chemicals
IRM	Industry Reference Material
MSDS	Material Safety Data Sheet
N/A	Not applicable
PP	Polypropylene
SDS	Safety Data Sheet
TPV	Thermoplastic Vulcanizate

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Material per GMW15813P-TPV(EPDM+PP)-Type X

Where:

GMW	=	GM Worldwide Specification
15813	=	Sequential Number
P	=	Plastic
TPV	=	Thermoplastic Vulcanizate
(EPDM+PP)	=	Ethylene-Propylene-Diene Monomer plus Polypropylene
Type X	=	Type 1 to 10 as defined in Table 1

9 Release and Revisions

This standard was originated in February 2008. It was first approved by the Global Plastics Team in September 2008. It was first published in September 2008.

Issue	Publication Date	Description (Organization)
1	SEP 2008	Initial publication.
2	JUN 2012	Revised Table 1. (Plastics GSSLT)

Cross Reference of Replaced Material Coding

GMW15813P-TPV(EPDM+PP) Material Codes	Formerly Identified As
Type 1	N/A
Type 2	GMN3927 (GMNA) HN 2355 Type 41 (Holden)
Type 3	GMP.E/P.137 (GMNA) QK 003511, QK 001071 (GME) HN 2355 Type 11 (Holden)
Type 4	GMP.E/P.001 (GMNA) QK 003513 (GME) HN 2355 Type 12 (Holden)
Type 5	GMP.E/P.002 (GMNA) QK 003521, QK 000589 (GME) HN 2355 Type 21 (Holden)
Type 6	GMP.E/P.003 (GMNA) QK 003532, QK 000582 (GME) HN 2355 Type 22 (Holden)
Type 7	GMP.E/P.004 (GMNA) QK 003524, QK 000583 (GME) HN 2355 Type 23 (Holden)
Type 8	GMP.E/P.005 (GMNA) QK 003526, QK 000570 (GME) HN 2355 Type 24 (Holden) EDS-M-4615 (GMK)
Type 9	GMP.E/P.006 (GMNA) QK 003531, QK 000598 (GME) HN 2355 Type 31 (Holden)
Type 10	GMP.E/P.007 (GMNA) QK 003533, QK 000584 (GME) HN 2355 Type 32 (Holden) EDS-M-4617 (GMK)

N/A = Not applicable

Appendix A

Table A1: Type Definition

Type	Hardness Range
1	25 ± 5 Shore A
2	35 ± 5 Shore A
3	45 ± 5 Shore A
4	55 ± 5 Shore A
5	65 ± 5 Shore A
6	73 ± 5 Shore A
7	80 ± 5 Shore A
8	87 ± 5 Shore A
9	40 ± 5 Shore D
10	50 ± 5 Shore D