GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification Elastomers	GMW14726

Hoses for Charge - Air Cooler, Turbo Charger

1 Scope

This specification covers the materials and performance of elastomeric turbocharger hoses with 3 layers.

Note: 4-layer hoses for higher service temperatures with FKM lining and VMQ intermediate and cover layer are subject of a separate specification.

1.1 Material Description. Materials covered by this specification are divided into 4 types:

1.1.1 Type A. NBR lining and CR cover for +100°C permanent and +125°C peak temperatures.

1.1.2 Type B. AEM in lining and cover for +160°C permanent and +175°C peak temperatures.

1.1.3 Type C. ACM in lining and cover for +175°C permanent and +185°C peak temperatures.

1.1.4 Type D. Drawing defined (e.g., using SAE J200 or ASTM D2000 line callout).

All hoses shall have textile reinforcement suitable to fulfill the requirements of the material and durability tests.

2 References

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

2.1 External Standards/Specifications.

ASTM D2000	ISO 1431-1
ISO 36	ISO 1817
ISO 37	ISO 7619-1
ISO 188	ISO 23529
ISO 815	SAE J200

2.2 GM Standards/Specifications.

GME L0004	GMW3001
GME L0005	GMW3059
GME8760	

3 Requirements

3.1 Resources.

3.1.1 Test Samples. Unless otherwise specified, the shape, size and number of test pieces shall be in accordance with the relevant Test Method.

Unless otherwise specified, samples are finished parts or to be taken from finished parts. If not otherwise stated, mechanical properties in delivery state and after heat or fluid immersion are to be tested at +23°C and with the same test methods.

3.1.2 Conditioning. Conditioning shall be as specified in the relevant Test Method.

3.1.3 Equipment. Conforming to the relevant Test Methods.

3.1.4 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.5 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this specification shall be determined correctly with respect to its physical definition.

3.1.6 Facilities. Conforming to the relevant Test Methods.

3.1.7 Deviations. Deviations from the requirements of this specification shall have been agreed upon. Such deviations shall be specified on component drawings, test certificates, reports, etc.

3.2 Material and Performance Requirements. Material and performance requirements are summarized in Table 1, Table 2, and Table 3.

Table 1: Material & Performance Properties, Requirements for the lining.

Property	Test Method	Unit	Value
Hardness			
Type A	ISO 7619-1	Shore A	75 ± 5
Type B	ISO 7619-1	Shore A	65 ± 5
Type C	ISO 7619-1	Shore A	55 ± 5
Type D	As specified on drawing/math data file	Shore A	As specified on drawing
Elongation at Break			
Type A, B, C	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	%	200 minimum
Type D	As specified on drawing/math data file	%	As specified on drawing
Tensile Strength			
Type A	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	7 min
Type B	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	10 min
Type C	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	9 min
Type D	As specified on drawing/math data file	MPa	As specified on drawing
Age Resistance (Heat Aging)			
Type A	ISO 188 Method B, 168 -2 h at +100 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-40 max
	Change in Tensile Strength	%	-20 max
Type B	ISO 188 Method B, 168 -2 h at +175 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Change in Tensile Strength	%	-30 max
Type C	ISO 188 Method B, 504 -2 h at +175 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	130 min
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type C	ISO 188 Method B, 168 -2 h at +185 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	150 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type C	ISO 188 Method B, 72 -2 h at +200 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	150 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type D	As specified on drawing/math data file		As specified on drawing

Property	Test Method	Unit	Value
Oil Resistance			
Type A	ISO 1817 to pre-aged engine oil (GME L0005); 168 -2 h; at +70 ± 3°C		
	Change in Hardness	Shore A	+15 max
	Change in Volume	%	± 15 max
Type B	ISO 1817 to pre-aged engine oil (GME L0005); 168 -2 h; at +150 ± 3°C		
	Change in Hardness	Shore A	±10 max
	Change in Volume	%	-5 to +15 max
	Change in Elongation at Break	%	-50 max
	Change in Tensile Strength	%	-30 max
Type C	ISO 1817 to pre-aged engine oil (GME L0005); 168 -2 h; at +175 ± 3°C		
	Change in Hardness	Shore A	±10 max
	Change in Volume	%	-5 to +15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	180 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type D	As specified on drawing/math data file	%	As specified on drawing

Table 2: Material & Performance Properties, Requirements for the cover

Property	Test Method	Unit	Value
Hardness			
Type A, B	ISO 7619-1	Shore A	65 ± 5
Type C	ISO 7619-1	Shore A	55 ± 5
Type D	As specified on drawing/math data file	Shore A	As specified on drawing
Elongation at Break			
Type A, B, C	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	%	200 minimum
Type D	As specified on drawing/math data file	%	As specified on drawing
Tensile Strength			
Type A	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	7.5 minimum
Type B	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	10 minimum
Type C	ISO 37, Type 2 or 4 dumb-bell, 200 ± 20 mm/minute	MPa	8.5 minimum
Type D	As specified on drawing/math data file	MPa	As specified on drawing

Property	Test Method	Unit	Value
Age Resistance (Heat Aging)			
Type A	ISO 188 Method B, 168 -2 h at +100 ± 3°C		
	Change in Hardness	Shore A	+15 max
	Change in Elongation at Break	%	-40 max
	Change in Tensile Strength	%	-20 max
Type B	ISO 188 Method B, 168 -2 h at +175 ± 3°C		
	Change in Hardness	Shore A	+15 max
	Change in Elongation at Break	%	-50 max
	Change in Tensile Strength	%	-30 max
Type C	ISO 188 Method B, 504 -2 h at +175 ± 3°C		
	Change in Hardness	Shore A	+15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	130 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type C	ISO 188 Method B, 168 -2 h at +185 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	150 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type C	ISO 188 Method B, 72 -2 h at +200 ± 3°C		
	Change in Hardness	Shore A	+ 15 max
	Change in Elongation at Break	%	-50 max
	Elongation at Break	%	150 minimum
	Change in Tensile Strength	%	-30 max
	Tensile Strength	MPa	8 minimum
Type D	As specified on drawing/math data file		As specified on drawing
Oil Resistance			
Type A	ISO 1817 to engine oil (GME L0004); 72 -2 h; at +70 ± 3°C		
	Change in Volume	%	-10 to +30 max
Type B	ISO 1817 to engine oil (GME L0004); 72 -2 h; at +150 ± 3°C		
	Change in Volume	%	+20 max
Type C	ISO 1817 to engine oil (GME L0004); 72 -2 h; at +175 ± 3°C		
	Change in Volume	%	+20 max
Type D	As specified on drawing/math data file		As specified on drawing
Ozone Resistance			
Type A, B, C	ISO 1431-1, 50 pphm, 20 %, 40 C ± 2°C, visual examination (no magnification)		No cracks
Type D	As specified on drawing/math data file		As specified on drawing

Table 3: Material & Performance Properties, Requirements for the Assembly.

Property	Test Method	Unit	Value
Adhesion Strength			
Type A	ISO 36	N/mm	2.0 minimum
Type B	ISO 36	N/mm	4.0 minimum
Type C	ISO 36	N/mm	2.5 minimum
Type C	ISO 36, after aging 72 -2 h at +200 ± 3°C	N/mm	1.5 minimum
Type D	As specified on drawing/math data file	N/mm	As specified on drawing
Compression Set Test pieces are to be taken from calibrated ends, if available			
Type A	ISO 815, +100 ± 3°C, 24 -2 h, 25 % compressed	%	45 max
Type B	ISO 815, +150 ± 3°C, 24 -2 h, 25 % compressed	%	45 max
Type C	ISO 815, +175 ± 3°C, 24 -2 h, 25 % compressed	%	65 max
Type D	As specified on drawing/math data file	%	As specified on drawing
Cold Resistance			
Type A, B, C	ISO 23529, -30 ± 3°C; 22 +1 h Test piece 10 x 100 mm Bending test r=12.5 mm		No cracks
Type D	As specified on drawing/math data file	MPa	As specified on drawing
Durability Tests to GME8760 and additional requirements on drawing			

4 Manufacturing Process

The inner surface of the hose shall be free of excess soap, talc or other material which could affect serviceability and usage.

5 Rules and Regulations

5.1 All materials supplied to this specification must comply with the requirements of GMW3001, **Rules and Regulations for Material Specifications.**

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

6 Approved Sources

The responsible engineering group should be contacted to identify the approved sources in that individual country.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations and Symbols.

ACM Polyacrylate Rubber (Acrylic Esters Copolymer)

AEM Acrylic Ester/Ethylene Copolymer

CR Polychloroprene

FKM Fluorocarbon Rubber

NBR Nitrile Rubber (Acrylonitrile butadiene copolymer)

VMQ Silicone Rubbers

8 Coding System

This material specification shall be referenced in other documents, drawings, VTS, CTS, etc. as follows:

Material per GMW14726 Type "X", where X = material type as defined in Section 1.1.

9 Release and Revisions

9.1 Release. This standard originated in October 2005. It was first approved by the Global Elastomers Team in May 2006. It was first published in January 2007.

It supersedes all regional material specifications for turbocharger hoses for use on Global Engineered materials including but not limited to: QE 001222, QE 001223, GME14027, and GMW15022.