GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16144

Multilayer Turbo Charger Hoses with Moderate Temperature Resistance

1 Scope

This specification covers the materials and performance of elastomeric turbocharger hoses for moderate temperature resistance.

1.1 Material Description. Materials covered by this specification are divided into Types A through D:

1.1.1 Type A. Chloropolyethylene (CM) lining, with intermediate layer made of a mixture of CM and Ethylene Propylene Diene Monomer, (EPDM) and cover of EPDM for +125 °C permanent and +150 °C peak temperatures.

1.1.2 Type B. Ethylene Acrylate (AEM) lining, with intermediate layer made of a mixture of AEM and EPDM and cover of EPDM for +150 °C permanent and +175 °C peak temperatures. Can be used for turbo charger systems with exhaust gas recirculation.

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

1.1.4 Type D. AEM lining, with intermediate layer made of EPDM for +150 °C permanent and cover of EPDM for +135 °C permanent and +175 °C peak temperatures. Can be used for turbo charger systems with exhaust gas recirculation. All hoses shall have textile reinforcement suitable to fulfill the requirements of the material and durability tests.

1.2 Symbols. Not applicable.

1.3 Applicability. Hoses in turbo charger applications.

2 References

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

2.1 External Standards/Specifications.

ASTM D2000	ISO 48	ISO 1431-1	SAE J200
ISO 36	ISO 188	ISO 1817	
ISO 37	ISO 815	ISO 23529	

2.2 GM Standards/Specifications.

GME L0005	GMW3059	GMW16153

2.3 Additional References.

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

3 Requirements

3.1 Requirements on Test Specimens. Not applicable

3.1.1 Resources

3.1.1.1 Test Samples. Unless otherwise specified, the shape and size of test pieces shall be in accordance with the relevant test procedure. Minimum six (6) test samples (hoses) are required for initial sample testing. Minimum three (3) test samples (hoses) are required for inspection testing.

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3.1.2 Samples are finished parts or to be taken from finished parts. Where the dimensions on the finished parts do not allow preparing of test pieces, tests are to be performed on sheet material of same production batch. The same state of cure between slabs or buttons and finished parts must be ensured by appropriate tests, (which must be described in the test report.) When presenting a new quality, sheet material of the same batch for all layers is recommended.

3.1.3 If not otherwise stated, mechanical properties in delivery state and after heat or fluid immersion are to be tested at +23 °C ± 5 °C and with the same test methods. Unless otherwise stated, ambient temperature test conditions shall be held to +23 °C ± 5 °C. Unless otherwise stated, all other temperatures except +23 °C ± 5 °C, shall be held to ±3 °C.

3.1.4 Conditioning. Conditioning shall be as specified in the relevant test procedure. The minimum time between vulcanization and testing of elastomers shall be 72 h.

3.1.5 Equipment. Conforming to the relevant test procedures.

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

3.1.7 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.

3.1.8 Facilities. Conforming to the relevant test procedures.

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

3.2 Material and Performance Requirements.

3.2.1 Design or Product Validation Testing. Material and performance properties are summarized in Table 1 through Table 4. For full approval of a hose, compliance to the requirements of Table 1 through Table 4 is needed. Six (6) samples of material shall be tested to each of the requirements for Design or Product Validation testing.

3.2.2 Audit/Inspection Testing. If not defined otherwise, the following testing should be done for production audit testing.

- Three (3) samples of material shall be tested to each of the requirements for Audit/Inspection Testing.
- All tests per Table 1 through Table 4, except Long Term Aging Resistance, Ozone Resistance, and Durability Tests.

Table 1: Material and Performance Properties - Requirements to the Lining

Property	Test Procedure	Unit	Value
Hardness			
Type A	ISO 48 Method M	IRHD	70 ± 5
Type B, D	ISO 48 Method M	IRHD	50 to 65
Type C	As specified on drawing/math data file		As specified on drawing
Elongation at Break			
Type A	ISO 37, Type 2 dumbell or Type 4 dumbbell, 200 mm/minute ±20 mm/minute	%	250 minimum
Type B, D	ISO 37, Type 2 dumbell or Type 4 dumbbell, 200 mm/minute ±20 mm/minute	%	200 minimum
Type C	As specified on drawing/math data file	%	As specified on drawing
Tensile Strength			
Type A, B, D	ISO 37, Type 2 dumbell or Type 4 dumbbell, 200 mm/minute ±20 mm/minute	MPa	10 minimum
Type C	As specified on drawing/math data file	MPa	As specified on drawing

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Property	Test Procedure	Unit	Value
Age Resistance (Heat Aging)			
Type A	ISO 188 Method B, 72 h -2 h at +150 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +10 maximum 150 minimum -50 maximum 9 minimum -30 maximum
Type A	ISO 188 Method B, 1008 h -2 h at +125 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +10 maximum 150 minimum -50 maximum 10 minimum -30 maximum
Type B	ISO 188 Method B, 168 h -2 h at +175 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +15 maximum 150 minimum -50 maximum 10 minimum -30 maximum
Type B	ISO 188 Method B, 1008 h -2 h at +150 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +15 maximum 150 minimum -50 maximum 10 minimum -30 maximum
Type C	As specified on drawing/math data file		As specified on drawing
Type D	ISO 188 Method B, 72 -2 h at +175 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +15 maximum 150 minimum -50 maximum 10 minimum -30 maximum
Type D	ISO 188 Method B, 1008 h -2 h at +150 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength	 IRHD % % MPa %	 +15 maximum 120 minimum -50 maximum 10 minimum -30 maximum
Oil Resistance			
Type A	ISO 1817 to pre-aged engine oil (GME L0005); 168 h -2 h; at +125 °C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength Change in Volume	 IRHD % % % MPa %	 -15 to +5 maximum 200 minimum -50 maximum 10 minimum -30 maximum -5 to +15 maximum
Type B, D	ISO 1817 to pre-aged engine oil (GME L0005); 168 h -2 h; at +150 C ± 3 °C Change in Hardness Elongation at Break Change in Elongation at Break Tensile Strength Change in Tensile Strength Change in Volume	 IRHD % % % MPa %	 -20 to +10 maximum 200 minimum -35 maximum 10 minimum -30 maximum -5 to +15 maximum
Type C	As specified on drawing/math data file		As specified on drawing

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