



Turbo Charger Hoses with High Temperature Resistance

1 Scope

This specification covers the materials and performance of turbo charger hoses either in four (4) layer extruded constructions or in wrapped elastomeric constructions for higher temperature resistance.

1.1 Material Description. Materials covered by this specification are divided into the following types: "continuous and excursion". Temperature limits are defined by the Vehicle Technical Specifications (VTS).

1.1.1 Type A: Fluoroelastomer (FKM) lining, peroxide cured with Silicone Elastomer (VMQ) intermediate layer and cover for +180 °C continuous and +200 °C excursion.

1.1.2 Type B: FKM lining, bisphenolic cure system with higher elongation, with VMQ intermediate layer and cover for +200 °C continuous and +225 °C excursion.

1.1.3 Type C: FKM lining, peroxide cured with VMQ intermediate layer and cover for +200 °C continuous and +225 °C excursion.

1.1.4 Type D: Fluorosilicone elastomer (FVMQ) lining with VMQ intermediate layer and cover for +180 °C continuous and +200 °C excursion.

1.1.5 Type E: Drawing defined (e.g., using SAE J200 or ASTM D2000 line callout).

1.1.6 Type F: FKM lining, peroxide cured with better dynamic properties, intermediate layer and cover of VMQ for +200 °C continuous and +225 °C excursion. This material is resistant to exhaust gas and can be used for turbo charger systems with Exhaust Gas Recirculation.

1.1.7 Type G: FVMQ or FKM lining with wrapped construction of reinforcement embedded in VMQ for +200 °C continuous and +225 °C excursion. Lining shall be specified selecting one (1) of Type B to Type F.

1.1.8 Type H: FKM lining, peroxide cured with better dynamic properties for +225 °C continuous and +250 °C excursion; intermediate layer and cover of VMQ for +210 °C continuous and +250 °C excursion. This material is resistant to exhaust gas and can be used for turbo charger systems with Exhaust Gas Recirculation. For this specification, if no type is defined, the type required by default is Type A.

All extruded hoses shall have textile reinforcement between the intermediate and cover layers that is suitable to fulfill the requirements of the material and durability tests.

1.2 Symbols. Not applicable.

1.3 Applicability. Turbo Charger Hoses.

2 References

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

2.1 External Standards/Specifications.

ASTM D2000	ISO 37	ISO 815	ISO 1817
ISO 34-1	ISO 48	ISO 815-1	ISO 23529
ISO 36	ISO 188	ISO 1431-1	SAE J200

2.2 GM Standards/Specifications.

GMW3059	GMW16153	GMW17245
GMW14270	GMW16955	

2.3 Additional References.

Vehicle Technical Specification (VTS)

3 Requirements

3.1 Resources.

3.1.1 Test Samples. Unless otherwise specified, the shape and size of test pieces shall be in accordance with the relevant test procedure. Report both individual and averaged values.

3.1.1.1 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 assured 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.

3.1.1.2 If not otherwise stated, mechanical properties in delivery state and after heat or fluid immersion are to be tested at $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and with the same test methods. Unless otherwise stated, ambient temperature test conditions shall be held to $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. Unless otherwise stated, all other temperatures except $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ shall be held to $\pm 3\text{ }^{\circ}\text{C}$.

3.1.1.3 Test specimens for compression set shall be taken at the end of the hose where the end clamp is located, especially if the end form is calibrated for tighter dimensional tolerance. Test only for hose surfaces and distances that allow a 13 mm diameter finished test specimens in compliance with ISO 815-1. A sufficient hose area shall exist to permit clamping to flatten the hose for die cutting per ISO 23529 Method A and to eliminate cupping from cutting. When cupping (the formation of a concave surface) is a problem, the test piece shape is improved by cutting it in two (2) stages:

- First, cut an oversize test piece and then trim it to the exact dimensions with a second cutter.
- Cut down with the hose cover on top and run compression test in the same orientation.
- Test a sufficient number of hose end forms from the same lot to satisfy 3.2.1 minimum sample requirements.

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

3.1.3 Equipment. Conforming to the relevant test procedures.

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 procedures.

3.1.7 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, Table 2, Table 3, and Table 4. For full approval of a hose, compliance to the requirements of Table 1, Table 2, Table 3, and Table 4 is needed. Six (6) samples of material from at least three (3) different hoses 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 from at least two (2) different hoses shall be tested to each of the requirements for Audit/Inspection Testing.

- All tests per Table 1, Table 2, Table 3 and Table 4 except Long Term Aging Resistance, Ozone Resistance, and Durability Tests.

3.3 All materials supplied to this standard must comply with GMW3059, Restricted and Reportable Substances, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

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

Property	Test Procedure	Unit	Value
Hardness			
Type A, Type C, Type F, Type H	ISO 48 Method M	IRHD	75 -5 + 10
Type B	ISO 48 Method M	IRHD	70 ± 5
Type D	ISO 48 Method M	IRHD	60 -5 + 10
Type E	As specified on drawing/math data file		As specified on drawing
Elongation at Break			
Type A, Type C, Type D	ISO 37, Type 2 or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	%	200 minimum
Type B, Type F, Type H	ISO 37, Type 2 or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	%	400 minimum
Type E	As specified on drawing/math data file	%	As specified on drawing
Tensile Strength			
Type A, Type C, Type F, Type H	ISO 37, Type 2 or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	MPa	10 minimum
Type B	ISO 37, Type 2 or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	MPa	8 minimum
Type D	ISO 37, Type 2 or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	MPa	6 minimum
Type E	As specified on drawing/math data file	MPa	As specified on drawing
Tear Strength			
Type A, Type C,	Tear strength to ISO 34-1 Method A (trouser test piece)	N/mm	2 minimum
Type B	Tear strength to ISO 34-1 Method A (trouser test piece)	N/mm	5 minimum
Type D	Tear strength to ISO 34-1 Method A (trouser test piece)	N/mm	1.5 minimum
Type E	As specified on drawing/math data file		As specified on drawing
Type F, Type H	Tear strength to ISO 34-1 Method A (trouser test piece)	N/mm	8 minimum
Age Resistance (Heat Aging)			
Type A, Type C	ISO 188 Method B, 168 h -2 h at +200 °C ± 3 °C Change in Hardness Change in Elongation at Break Change in Tensile Strength Tear Strength	IRHD % % N/mm	-2 to +5 maximum -40 maximum -20 maximum 2 minimum

Property	Test Procedure		Unit	Value
Type A	ISO 188 Method B, 1008 h -2 h at +175 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength		IRHD % MPa	± 5 maximum 200 minimum 8 minimum
Type B	ISO 188 Method B, 168 h -2 h at +225 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength Tear Strength		IRHD% % MPa N/mm	-2 to +5 maximum 200 minimum 8 minimum 4 minimum
Type B	ISO 188 Method B, 1008 h -2 h at +200 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength		IRHD % %	± 10 maximum 150 minimum 8 MPa minimum
Age Resistance (Heat Aging), continued				
Type C	ISO 188 Method B, 168 h -2 h at +225 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength Tear Strength		IRHD% % MPa N/mm	-2 to +5 maximum 200 minimum 12 minimum 2 minimum
Type C	ISO 188 Method B, 1008 h -2 h at +200 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength		IRHD % MPa	± 5 maximum 200 minimum 8 minimum
Type D	ISO 188 Method B, 168 h -2 h at +200 °C ± 3 °C Change in Hardness Change in Elongation at Break Elongation at Break Change in Tensile Strength Tensile Strength Tear Strength		Shore A % % MPa N/mm	-2 to +10 maximum -40 maximum 200 minimum -30 maximum 6 minimum 2 minimum
Type D	ISO 188 Method B, 1008 h -2 h at +175 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength		IRHD % MPa	-2 to +10 maximum 150 minimum 6 minimum
Type E	As specified on drawing/math data file			As specified on drawing
Type F	ISO 188 Method B, 168 h -2 h at +225 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength Tear Strength		IRHD% % MPa N/mm	+10 maximum 250 minimum 10 minimum 4 minimum
Type F	ISO 188 Method B, 72 h -2 h at +250 °C ± 3 °C Change in Hardness Change in Elongation at Break Change in Tensile Strength Tear Strength		IRHD% % % N/mm	+12 maximum -40 maximum -20 maximum 4 minimum

Property	Test Procedure	Unit	Value
Type F	ISO 188 Method B, 1008 h -2 h at +200 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength	IRHD% % MPa	+10 maximum 300 minimum 10 minimum
Type H	ISO 188 Method B, 168 h -2 h at +250 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength Tear Strength	IRHD% % MPa N/mm	+12 maximum 250 minimum 10 minimum 4 minimum
Type H	ISO 188 Method B, 72 -2 h at +275 ± 3 °C Change in Hardness Change in Elongation at Break Change in Tensile Strength Tear Strength	IRHD % % % N/mm	+12 maximum -40 maximum -40 maximum 4 minimum
Type H	ISO 188 Method B, 1008 h -2 h at +225 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength	IRHD% % MPa	+10 maximum 300 minimum 10 minimum
Oil Resistance			
Type A, Type C	ISO 1817 to heat aged engine oil to GMW17245; 168 h -2 h; at +175 °C ± 3 °C Change in Hardness Change in Elongation at Break Elongation at Break Change in Tensile Strength Tensile Strength Change in Volume Tear Strength	IRHD % % % MPa % N/mm	± 10 maximum -50 maximum 150 minimum -25 maximum 7 minimum -2 to +12 maximum 2 minimum
Type B	ISO 1817 to heat aged engine oil to GMW17245; 168 h -2 h; at +175 °C ± 3 °C Change in Hardness Elongation at Break Tensile Strength Change in Volume Tear Strength	IRHD % MPa % N/mm	2 to +10 maximum 150 minimum 7 minimum -2 to +12 maximum 5 minimum
Type D	ISO 1817 to heat aged engine oil to GMW17245; 168 h -2 h; at +175 °C ± 3 °C Change in Hardness Change in Elongation at Break Elongation at Break Change in Tensile Strength Tensile Strength Change in Volume Tear Strength	Shore A % % % MPa % N/mm	± 10 maximum -50 maximum 150 minimum -50 maximum 5 minimum -2 to +12 maximum 2 minimum
Type E	As specified on drawing/math data file		As specified on drawing