



Coolant Hose Silicone – Heavy Duty

1 Scope

1.1 Material Description. This specification covers the requirements of silicone elastomer coolant hoses in four (4) classes of straight and formed coolant hose intended for use as radiator hose, heater hose and other flexible conduits for automotive engine cooling systems. Such products are intended to withstand the effects of circulating solutions containing glycols, small amounts of corrosion inhibitors and soluble oils, and operating under various pressure conditions at temperatures from -55 °C to +200 °C, and to withstand higher temperature environment than hoses covered by Ethylene Propylene Diene Monomer (EPDM) in GMW15024.

1.1.1 Class I, Class II and Class III. The tube and cover stocks of the hose shall be made from polysiloxane (silicone rubber) compound capable of operating to a maximum continuous temperature limit of +175 °C. The tube and cover compounds shall meet the requirements of Table 1. The cover shall be black.

1.1.2 Class IV: The tube and cover stocks of the hose shall be made from polysiloxane (silicone rubber) compound capable of operating to a maximum continuous temperature limit of +200 °C with +250 °C excursion temperature. The tube and cover compounds shall meet the requirements of Table 1. The cover shall be black.

1.1.3 The hoses shall be reinforced with a high temperature resistant vendee approved fiber construction. Class I shall be of wrapped plies of fabric to meet the requirements of Table 4. Class II, Class III and Class IV shall be of knitted, braided, or spiral construction to meet the requirements of Table 3 and Table 4.

1.1.4 Dimensions and Tolerances. Unless otherwise specified on the engineering drawing, dimensions and tolerances, inner diameter (ID), wall thickness, length and curved hose arm length for Class I hose, shall conform to those published in SAE J20, and Class II, Class III and Class IV hoses shall conform to those published in SAE J20 and SAE J30.

1.2 Symbols. Not applicable.

1.3 Applicability.

1.3.1 Class I, to Class IV may be specified for straight hose. Class II to Class IV are applicable to formed hose. Class I is only applicable to wrapped hump hose, in special cases the hose can be formed.

1.3.2 Hoses approved under this specification are not recommended for incorporation into crimped coolant hose assemblies, such as those described in GMW16295.

Note: See Appendix A; Table A1 for important information regarding bend radii and hose clamps to use with silicone rubber hose.

2 References

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

2.1 External Standards/Specifications.

ASTM D380	ASTM D624	ISO 188	ISO 23529
ASTM D412	ASTM D2240	ISO 815-1	SAE J20
ASTM D413	ISO 34-1	ISO 1431-1	SAE J30
ASTM D471	ISO 36	ISO 1817	SAE J536
ASTM D573	ISO 37	ISO 7619-1	

2.2 GM Standards/Specifications.

GM9902P	GMW14329	GMW16295	GMW16955
GMW3059	GMW15024	GMW16317	

3 Requirements

3.1 Resources.

3.1.1 Test Samples. Unless otherwise specified, the shape and size of the test pieces shall be in accordance with the relevant test method. 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 ensured by appropriate tests, which must be described in the test report.

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 method. The minimum time between vulcanization and testing of elastomers shall be 72 h.

3.1.3 Equipment. Conforming to the relevant test methods.

3.1.3.1 Test fixture Kink Resistance. Test fixture shall consist of a flat plate approximately 25 mm thick with holes not to exceed hose outer diameter (OD) by more than 1.6 mm and separated by the center distances specified in Table 3.

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.

3.2.1 Design Validation Testing. Material properties (material/compound approval) are summarized in Table 1, performance requirements (construction approval) in Table 2. For full approval of hose compliance to the requirements, Table 1 and Table 2 are needed.

3.2.2 Product Validation Testing. If not defined otherwise, the following testing should be done for production audit testing. Minimum six (6) test samples (hoses) are required for initial sample testing. Minimum three (3) test samples (hoses) are required for inspection testing.

- All tests per Table 1 except Long Term Heat Resistance, Long Term Immersion, Ozone Resistance, Bloom and Paint Compatibility.
- Burst Strength per Table 2.

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

- All tests per Table 1 except Long Term Heat Resistance, Long Term Immersion, Ozone Resistance, Bloom and Paint Compatibility.
- Burst Strength per Table 2.

Table 1: Material Properties
Properties for Tube and Cover

Property	Test Method	Unit	Value
Hardness Note 1			
All Classes	Hardness on specimens 6 mm thick, tested by plying together samples of the elastomeric compound. ASTM D2240, Read scale within 1 s. or ISO 7619-1, Read scale within 3 s	Shore A	55 to 75
Elongation at Break			
All Classes	ASTM D412 or ISO 37, Type 2 dumbbell or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	%	250 Minimum
Tensile Strength			
Class I and Class II	ASTM D412 or ISO 37, Type 2 dumbbell or Type 4 dumbbell, 200 mm/minute ± 20 mm/minute	MPa	6.2 Minimum
Class III			5.8 Minimum
Class IV			7.0 Minimum
Tear Strength			
Class I, Class II and Class II	ASTM D624, Die C, specimen are un-nicked or ISO 34-1, Method A	kN/m N/mm	12 Minimum 1.5 Minimum
Class IV	ISO 34-1, Method A	N/mm	5 Minimum
Age Resistance Note 1			
Class I and Class II	ASTM D573 or ISO 188 Method B, 168 h at +175 °C Change of hardness Change of elongation at break or Elongation at break Change of tensile strength Change in tear resistance	Shore A % % %	0 to +10 -35 Maximum 120 Minimum -15 Maximum -25 Maximum
Class III	ASTM D573 or ISO 188 Method B, 168 h at +175 °C Change of hardness Change of elongation at break or Elongation at break Change of tensile strength Change in tear resistance	Shore A % % % %	-5 to +15 -40 Maximum 120 Minimum -20 Maximum -25 Maximum
Class IV	ASTM D573 or ISO 188 Method B, 72 h -2 h at +250 °C Change of hardness Change of elongation at break Change of tensile strength	Shore A % %	0 to +15 -35 Maximum -35 Maximum
Class IV	ASTM D573 or ISO 188 Method B, 1008 h at +200 °C Change of hardness Change of elongation at break or Elongation at break Change of tensile strength	Shore A % % %	-5 to +15 -50 Maximum 120 Minimum -50 Maximum