

Power Steering Pressure Hose—High Volumetric Expansion Type

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format. References have been added as Section 2. All other section numbers have been changed. Metric has been added throughout the document.

This document represents the minimum quality recognized by original equipment manufacturers and hose suppliers as essential for satisfactory and safe operation by the hose itself and other coating parts of the power steering system. The original equipment manufacturer may, at his option, add or alter tests through OEM specifications.

- 1. Scope**—This document covers two types of hose fabricated from fabric braid and synthetic rubber, assembled with end fittings for use in automotive power steering applications as flexible connections within the temperature range of -40°C to $+120^{\circ}\text{C}$ (-40°F to $+250^{\circ}\text{F}$) average, and 135°C (275°F) maximum peaks.

These hoses are intended for use in applications where reduction in amplitude of pump pressure pulsations is required.

Type 1 hose shall be suitable for 10.3 MPa (1500 psi) maximum working pressure.

Type 2 hose shall be suitable for 10.3 MPa (1500 psi) maximum working pressure.

- 2. References**

- 2.1 Applicable Publications**—The following publications form a part of the specification to the extent specified herein.

- 2.1.1 ASTM PUBLICATIONS**—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

ASTM D 380—Methods of Testing Rubber Hose

ASTM D 413—Tests for Adhesion of Vulcanized Rubber (Friction Test)

- 3. Hose Construction**—The construction of this hose embodies a smooth bore inner tube of suitable synthetic rubber material, reinforced with two plies of braided fabric and covered with a synthetic rubber outer cover.

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4. **Dimensions**—Concentricity based on full indicator reading between the inside bore and the outer surface of the hose shall not exceed 0.076 cm (0.030 in). See Table 1.

TABLE 1—HOSE DIMENSIONS

	Type 1	Type 2
ID	0.972/1.03 cm (0.365/0.405 in)	0.912/1.01 cm (0.359/0.398 in)
OD	1.91/2.07 cm (0.750/0.813 in)	1.91/2.07 cm (0.750/0.813 in)

5. **Test Procedures**—Procedures described in ASTM D 380, shall be followed wherever applicable.
6. **Qualification Tests**—To qualify hose under this document, all of the requirements shown in Section 8 must be met.
7. **Inspection Tests**—Production shipments or lots of qualified hose shall be tested in accordance with Table 2 and shall conform to the applicable test requirements, but the user may test hose or hose assemblies from any or all such production shipments or lots to all the test requirements. Fourteen sample hose assemblies, selected at random, as listed in Table 2, are required to conduct a complete test. In the event of a failure, the test or tests that have failed shall be retested using twice the number of samples indicated in Table 2. Failure of any of the retested samples shall be cause for rejection of the entire lot.

TABLE 2—INSPECTION TESTS

Test	Samples Required
1. Volumetric Expansion (9.7) followed by Length Change (9.11) followed by Bursting Strength (9.5)	3
2. Tensile (9.2)	3
3. Adhesion (9.4)	1
4. Low Temperature Flexibility (9.3)	1
5. Impulse (9.1)	6

8. **Frequency Of Testing For Inspection**—All inspection tests shall be performed on either a bulk hose lot or a coupled hose lot basis or tests may be split between a bulk hose lot and a coupled hose lot.

A coupled hose lot shall not exceed 10 000 hose assemblies and a bulk hose lot shall not exceed 6096 m (20 000 ft) of bulk hose.

9. Test Requirements

9.1 Impulse Test

9.1.1 TEST CONDITIONS

- a. Oil Temperature: 135 °C (275 °F)
- b. Ambient Temperature: 135 °C ± 6 °C (275 °F ± 10 °F)
- c. Cycle Rate: 30 to 40 per minute
- d. Cycle Date: Pressure rise time, 0.20 s ± 0.10 s. High pressure hold time, 0.65 s ± 0.20 s. Pressure drop time, 0.20 s ± 0.10 s.
- e. Pressure Variation: Type 1 0–0.69 to 10.3 MPa (0–100 to 1500 psi)
Type 2 0–0.69 to 10.3 MPa (0–100 to 1500 psi)

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- 9.1.2 HYDRAULIC FLUID AND TEST FIXTURE—As specified by the original equipment manufacturer.
- 9.1.3 CYCLE LIFE—Samples submitted to this test shall exceed 100 000 cycles for inspection acceptance and 225 000 cycles for qualification testing, without failure.
- 9.2 **Tensile Test**—When tested in accordance with ASTM D 380, hose assemblies shall withstand a minimum tensile load of 5337.9 N (1200 lb) without the fittings pulling off or rupture of the hose.
- 9.3 **Low Temperature Flexibility**—Samples shall be subjected to a temperature of $-40\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F} \pm 2\text{ }^{\circ}\text{F}$) for a period of 24 h, after which the hose shall be flexed in the cold chamber through 180 degrees from the centerline around a mandrel whose diameter is eight times the nominal hose OD. Flexing shall be accomplished within 3 to 5 s. Hose shall not fracture or show any cracks, checks, or breaks in the tube or cover.
- 9.4 **Adhesion Test**—When tested in accordance with ASTM D 413, a pull of not less than 44.48 N (10 lb) shall be required to separate a 2.54 cm (1 in) wide ring section of the bond between any adjacent layers of the hose.
- 9.5 **Bursting Strength**—Samples shall meet the following minimum bursting strength requirements:
- Type 1 – 41.4 MPa (6000 psi)
Type 2 – 41.4 MPa (6000 psi)
- 9.6 **Ozone Resistance**—The outer cover of the hose shall show no cracking when examining the cover of the hose under 7X magnification, ignoring the areas immediately adjacent to or within the area covered by the binding.
- Bend the hose around a cylinder, the diameter of which shall be seven times the nominal outside diameter of the hose, and bind the ends. The cylinder and binding shall be made of metal or materials that prevent the consumption of ozone. If the hose collapses when bent around the cylinder, provide for internal support of the hose.
- Condition the hose, on the cylinder, for $24.0\text{ h} \pm 0.5\text{ h}$ at room temperature, and then place it in an exposure chamber containing air mixed with ozone in the proportion of 50 ppm \pm 5 ozone in air by volume, for 70 to 72 h. Ambient air temperature in chamber during test shall be $40\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ ($104\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$).
- Examine the cover of the hose for cracks under 7X magnification, ignoring the areas immediately adjacent to or within the area covered by the binding.
- 9.7 **Volumetric Expansion**—Samples shall be installed on the test fixture in a manner that allows the hose to lie straight but not under tension when test pressure is applied. Samples shall be preconditioned at $8.97\text{ MPa} \pm 0.14\text{ MPa}$ ($1300\text{ psi} \pm 20\text{ psi}$) for $30\text{ s} \pm 5\text{ s}$ and allowed to recover at 0 psig for $2\text{ min} \pm 5\text{ s}$ prior to the test. Test pressure shall then be applied and held for $2\text{ min} \pm 5\text{ s}$. At the end of this period, the inlet valve shall be closed and the test fluid allowed to rise in the burette for a period of $1\text{ min} \pm 5\text{ s}$. The outlet valve shall then be closed and the reading taken. The average of three volumetric expansion readings per sample shall not exceed the values listed in Table 3:

TABLE 3—VOLUMETRIC EXPANSION, CC/FT AT 0 TO 8.97 MPa (0 TO 1300 psi)

	max	min
Type 1	8	3
Type 2	17	8

9.8 Tensile Strength and Elongation

- a. Original tensile strength of cover: 6.9 MPa (1000 psi) min
- b. Original tensile strength of tube: 6.9 MPa (1000 psi) min
- c. Original elongation of cover: 175% min
- d. Original elongation of tube: 150% min

9.9 Dry Heat Resistance—After oven aging for 70 h at a temperature of 100 °C (212 °F), the reduction in tensile strength and elongation of specimens taken from tube and cover material shall not exceed the following values:

- a. Original tensile strength: 20%
- b. Original elongation: 50%

9.10 Oil Resistance—After 70 h immersion in ASTM No. 3 oil at a temperature of 121 °C (250 °F), the reduction in tensile strength and elongation of specimens taken from the tube material shall not exceed the following values:

- a. Original tensile strength: 65%
- b. Original elongation: 50%

In addition, the volume change of specimens taken from the tube and cover material shall not exceed 0 to +100%.

9.11 Length Change—Type 1 hose shall not change in length more than +2%, -5% when pressure is increased from 0 to 10.3 MPa (0 to 1500 psig).

Type 2 hose shall not change in length more than +0%, -8% when pressure is increased from 0 to 10.3 MPa (0 to 1500 psig).

9.12 Identification Marking—Hose shall be identified with the SAE number, type, size of inside diameter in fractions, date code in days of the year, and last digit of the year (for example, 1707 represents the 170th day of 1987), and hose manufacturer's and/or coupling manufacturer's code marking. This marking shall appear on the outer cover of the hose at intervals of not greater than 10 in. Additional identification may be added as agreed on by user and supplier.

9.13 100% Proof Pressure Test—Each hose assembly shall be proof pressure tested using air, oil, or water as the pressure medium. Test pressure shall be 10.3 MPa (1500 psi) when tested with air and 13.8 MPa (2000 psi) when tested with oil or water. Test pressure shall be held for not less than 30 nor more than 60 s. Care should be taken when testing with air due to its explosive nature at high pressure.

10. Notes

10.1 Marginal Indicia—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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