POWER STEERING RETURN HOSE

GM6210M

1 SCOPE. This specification covers a 9.5 mm inside diameter hose made from textile reinforcement and synthetic rubber for use in hydraulic steering applications as a flexible connection between the power steering gear and the power steering pump or pump reservoir. It also covers hose assemblies with end fittings or user-applied clamps secured to the hose as required by engineering drawings.

1.1 RESTRICTED AND REPORTABLE CHEMICALS (GM1000M). All materials supplied to this specification must comply with the requirements listed in GM1000M, "Restricted and Reportable Chemicals."

2 REFERENCED STANDARDS.

GM1000M	ASTM D380	ASTM D865
GM4486P	ASTM D413	
9985010	ASTM D571	

3 CONSTRUCTION. The hose shall consist of a smooth bore tube of chlorinated polyethylene (CPE) or chlorosulfonated polyethylene (CSM) compound reinforced with textile braid, knit or helically wound plies (in multiples of 2) and a cover or CPE or CSM compound. Hose shall be black.

3.1 The inner tube shall resist deterioration by action of Type A or DEXRON® -II transmission fluids or hydraulic power steering fluids as specified by the purchaser.

3.2 The cover shall be abrasion resistant and resist exposure to long periods of heat and weather aging.

3.3 The hose and/or assembly shall give satisfactory service in an automobile with maximum working pressure of 1.7 MPa and temperatures of –40 to +135°C with intermittent operation at temperatures up to 150°C max.

3.4 The hose materials and workmanship shall be in accordance with good commercial practice and the resulting hose shall be free from splices, porous areas, wear sections, bubbles, nonfills, foreign material or other defects affecting serviceability.

4 DIMENSIONS. Bulk hose shall conform to the following dimensions:

Hose	mm	Inch
Inside Diameter	9.39 – 10.16	0.370 – 0.400
Outside Diameter	16.08 – 17.25	0.633 – 0.679
Concentricity, FIM (TIR)	0.76 max	0.030 max

4.1 The hose Inside Diameter is to be measured 25.4 mm from the end of the hose, utilizing a Mitutoyo 3-Prong Gauge (Part #HTD Series 468). Two measurements should be taken, 90 degrees apart, and averaged, to determine the Hose Inside Diameter.

5 TEST PROCEDURES. Procedures described in ASTM D380. Methods of Testing Rubber Hose, shall be followed wherever applicable. Tests on hose assemblies shall be performed 24 h min after ends are attached.

6 TENSILE STRENGTH AND ELONGATION.

Original Tensile Strength of tube and cover ..... 6.9 MPa, min
Original Elongation of tube and cover ..... 100% min

7 DRY HEAT RESISTANCE. After oven aging for 70 h at a temperature of 135°C, as specified in ASTM D865, the reductions in tensile strength and elongation of samples taken from tube and cover material shall not exceed the following values:

Original Tensile Strength of tube and cover ..... -20%
Original Elongation of tube and cover ..... -40%

8 OIL RESISTANCE. After 70 h immersion in ASTM No. 3 oil at a temperature of 150°C, the reductions in tensile strength and elongation of samples taken from the tube material shall not exceed the following values:

Original Tensile Strength ..... -50%
Original Elongation ..... -50%

8.1 In addition, the volume change of specimens taken from the tube and cover shall not exceed 0 to 85%.

9 ADHESION TEST. When tested in accordance with ASTM D413, a pull of not less than 35.5 N shall be required to separate a 25.4 mm wide ring section of the bond between any adjacent layers of the hose.

10 LOW TEMPERATURE FLEXIBILITY. Hose samples shall be subjected to a temperature of –40 ± 1°C for 24 h while in a straight position. After conditioning and without removal from the cold box, the hose shall be bent around a mandrel having a diameter of 8 times the nominal OD of the hose through 180 degrees within 4 s. Hose must not fracture or show any cracks, breaks or checks in the tube or cover.

11 BURST TEST. When tested in accordance with ASTM D571, samples shall meet a min burst strength requirement of 6.9 MPa.

12 KINK TEST. The change in OD of the hose at the center of the loop shall not exceed 10% when the ends of a 230 mm length of hose are placed in a locating fixture having 2 holes @ 18 to 19 mm dia, 25 mm deep, and 115 mm between center lines of holes.

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13 SEQUENTIAL TEST REQUIREMENT.

13.1 OIL RESISTANCE/ACCELERATED PRESSURE IMPULSE TEST – OZONE RESISTANCE.
Sample preparation shall consist of subjecting the hose samples to recirculating power steering fluid (9985010) while conducting the accelerated pressure impulse test under conditions outlined in 15 @ 150 °C for 100 000 cycles. Hose samples shall then be subjected to test procedures and apparatus in accordance with GM4486P (Test for Ozone Resistance of Elastomer Compounds) as described in 13.2, 13.3, and 13.4.

13.2 Bend sample of hose around a mandrel having an outside diameter of 8 times the nominal outside diameter of the hose under test. The 2 ends of the hose shall be tied where they cross one another with enameled copper or aluminum wire.

13.3 After mounting, permit the sample to rest in a relatively ozone-free atmosphere for 24 h at room temperature. Place mounted sample in a suitable ozone test chamber that is maintained at an ozone concentration of 100 ± 5 parts ozone per 100 million parts of air (volume basis) at sea level and an ambient chamber temperature of 38 ± 1°C.

13.4 After 72 h of exposure, remove samples from the chamber, permit to cool to room temperature, and then, while still on the mandrel, visually inspect for signs of cracking under 7X magnification. Inspection shall reveal no cracks.

14 TENSILE TEST (HOSE ASSEMBLIES).
When tested in accordance with ASTM D571, hose assemblies shall withstand the following tensile loads:

With permanent fitting	1333 N, min
With user-applied clamps	380 N, min
With crimped collar fittings	780 N, min

15 ACCELERATED PRESSURE IMPULSE TEST (APPLICABLE TO HOSE ASSEMBLIES ONLY).
When tested in Saginaw Division Laboratory test machine under conditions outlined in 14.2, hose shall not leak or burst prior to 400 000 cycles. A leak is defined as any visual loss of fluid.

NOTE: Although leaking as described above is the common definition for an accelerated impulse test failure, other criteria can and will be used to further evaluate a hose assembly during and after testing. After testing, the hose is to be sectioned and the condition of the end fittings, the condition of the inner tube (brittleness, axial splits, etc.), tube bulging, tube cutting under the fittings, and cover condition are to be noted and evaluated. All of the noted criteria are to be compared to previous test history and can be a cause for rejection.

15.1 After hoses are assembled, a 24 h min conditioning period at room temperature is required before testing.

15.2 Test conditions are as follows:

Test fluid (9985010)	
Cycle pressure	0.2–0.4 to 1.2 MPa
Cycle rate	65–75 CPM
Test cycle pressure impulse wave form	Figure 1
Pressure rise time	0.2 ± 0.02 s
Pressure dwell time	0.3 ± 0.05 s
Test fluid temperature (in hose)	150 ± 3°C
Ambient temperature	140–150°C
Manifold cycle rate (NOTE)	10 Hz
Manifold displacement (double amplitude) (NOTE)	12.7 mm
Test cycle (repeat for duration of test)	
Run	5 h
Cool down (machine shut off and cabinet open)	1 h
Run	5 h
Hot soak (stop pressure impulse and vibration only)	1 h

NOTE: Vibrating manifold test is optional.

16 COLD START TEST (APPLICABLE TO HOSE ASSEMBLIES ONLY).
When tested on test apparatus described in 15.2 and under conditions outlined in 15.3, hose shall not split or break prior to 15 cycles.

16.1 After hoses are assembled, the test apparatus shall be subjected to a cold soak of at least 12 h at test temperature of –40 °C.

16.2 The test apparatus shall consist of a suitable production power steering gear, power steering pump, pump drive motor and power steering cooler assembly. Hose assemblies with user applied clamps shall be 430 mm long and shall be installed without restrictions (for movement) with a 64 mm inside bend radius.

16.3 Test conditions are as follows:

(a) Start the pump drive motor with the rotary valve in the center position and allow pressure to build for one minute before actuating the shaft.
(b) Apply relief pressure four times each in right and left corner per cycle for a total of 3.5 cycles.
(c) Run the pump to 13 °C after pressure cycling to eliminate air from the system.
(d) Soak for 3 h at test temperature, then repeat the test cycle for the duration of the test.

16.4 Cycle life for acceptable performance must equal or exceed 15 start cycles.

17 HOSE PUSH-ON EFFORT TEST.
The test specimens shall consist of a fitting consisting of 9.78 mm tube diameter and 11.40 mm bead diameter (Saginaw Part #F-1658-98), and a hose sample of 76.2 mm length and 9.39 mm inside diameter, as measured per Section 4. When this hose

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sample, without lubrication, is pushed over the fitting, at a 50 mm/min rate for a maximum distance of 30 mm, the peak push-on effort shall not exceed a value of 133 N.

18 HOSE MARKING. The hose shall be legibly marked with the following information in the sequence stated: Hose manufacturer's code identification as designated by Rubber Manufacturers Association; vendor construction number; nominal inside diameter expressed as fraction of an inch (Ex: 3/8); the wording **P/S return** ; letter designation for manufacturing location; and date code. Such marketing shall be printed parallel to the axis in orange block letters not less than 3 mm high and repeated in 200 mm intervals.

18.1 The date code shall consist of 6 digits: The first 2 digits shall represent the month (01 through 12) of the year, the next 2 shall represent the day of the month (01 through 31), and the last 2 shall be the last 2 digits of the year.

18.2 Additionally, one or more colored tracers shall be incorporated into the wall of the hose identifying the hose manufacturer. The color(s) shall be as designated by the Rubber Manufacturers Association.

18.3 All material submitted for production use shall be subject to infrared spectrophotometric and/or gas chromatographic analysis and shall be equivalent in all characteristics to the material upon which approval was originally granted.

19 INITIAL SOURCE APPROVAL. No shipment shall be made by any supplier until representative initial production samples have been approved by engineering as meeting the requirements of this specification.

19.1 Completed copies of the Material Safety Data Sheet meeting GM information requirements must be submitted with any new submissions or whenever a composition change has occurred.

20 INSPECTION AND REJECTION. All shipments of material or parts under contract or purchase order manufactured to this specification shall be equivalent in every respect to the initial samples approved by engineering. There shall be no changes in either formulation or manufacturing processes permitted without prior notification and approval by engineering. Lack of notification by the supplier constitutes grounds for rejection of any shipment. While samples may be taken from incoming shipments and checked for conformance to this specification, the supplier shall accept the responsibility for incoming shipments meeting this specification without dependence upon purchaser's inspection.

21 APPROVED SOURCES. Engineering qualification of an approved source is required for this specification. Only sources listed in the GM Corporate Materials File under this specification number have been qualified by engineering as meeting the requirements of this specification. Sources are available through the on-line MATSPC System.

22 GENERAL INFORMATION. This standard was originated by the Saginaw Division in November 1981. The latest revisions include:

Rev	Date	Description
D	11/89	Revised 3, 5, 6, 9, 13, 14.2, 16.3
E	3/95	Revised 4, add 17

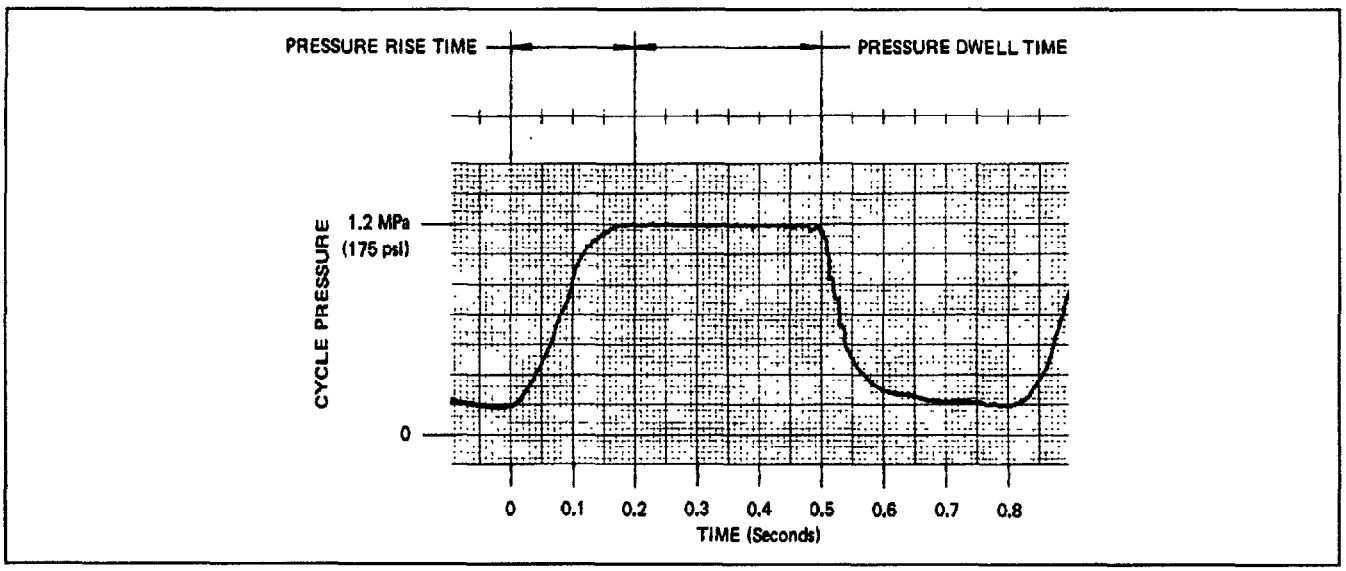

FIGURE 1 – PRESSURE IMPULSE WAVE FORM