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TEST METHOD SECTION 106

Brake Hoses

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TEST METHOD SECTION 106 — BRAKE HOSES

1. INTRODUCTION

Subsections 2 to 6, Figures 1 to 4 and Tables I to V of this section make up test methods referred to in section 106 of Schedule IV to the Motor Vehicle Safety Regulations, to demonstrate compliance with the requirements of section 106 of Schedule IV to the said Regulations.

(Original signed by)

Harvey J. Layden
for the Minister of Transport
Ottawa, Ontario

2. DEFINITIONS

[See subsection 2(1) of the Motor Vehicle Safety Regulations.]

2.1 CROSS REFERENCES

The following table cross-references the performance requirements of section 106 of the Motor Vehicle Safety Regulations and the appropriate test procedures of this test method.

	TEST METHOD PROCEDURES	REQUIREMENTS CMVSS 106
HYDRAULIC BRAKE HOSE TESTS		
Constriction		(11) (a)
Expansion and Burst Strength	3.1, 3.2	(11) (b)
Whip Resistance	3.3	(11) (c)
Tensile Strength	3.4	(11) (d)
Water Absorption and Burst Strength	3.5, 3.2	(11) (e)
Water Absorption and Tensile Strength	3.5, 3.4	(11) (f)
Water Absorption and Whip Resistance	3.5, 3.3	(11) (g)
Low Temperature Resistance and Flexibility	3.6	(9) (a)
Brake Fluid Compatibility, Constriction and Burst Strength	3.7, 3.2	(11) (h)
Ozone Resistance	3.8	(9) (b)
End Fitting Corrosion Resistance	3.9	(10)
AIR BRAKE HOSE TESTS		
Constriction		(20) (a)
High Temperature Resistance	4.1	(18) (a)
Low Temperature Resistance	4.2	(18) (b)
Oil Resistance	4.3	(18) (c)
Ozone Resistance	4.4	(18) (d)
Length Change	4.5	(18) (e)
Adhesion	4.6	(18) (f)
Air Pressure	4.7	(20) (b)
Burst Strength	4.8	(20) (c)
Tensile Strength	4.9	(20) (d), (e)
Water Absorption and Tensile Strength	4.10	(20) (f), (g)
Zinc Chloride Resistance	4.11	(18) (g)
End Fitting Corrosion Resistance	4.12	(19)
Coiled Nylon Tubing		(21)
VACUUM BRAKE HOSE TESTS		
Constriction		(31)
High Temperature Resistance	5.1	(27) (a)
Low Temperature Resistance	5.2	(27) (b)
Ozone Resistance	5.3	(27) (c)
Burst Strength	5.4	(27) (d)
Vacuum	5.5	(27) (e)
Bend	5.6	(27) (f)
Swell	5.7	(27) (g)
Adhesion	5.8	(27) (h)
Deformation	5.9	(27) (i), (28), (29)
End Fitting Corrosion Resistance	5.10	(30)

3. TEST PROCEDURES - HYDRAULIC BRAKE HOSE, BRAKE HOSE ASSEMBLIES AND BRAKE HOSE END FITTINGS

3.1 EXPANSION TEST

3.1.1 Apparatus. Utilize a test apparatus as shown in Figure 1 which consists of:

- (a) source for required fluid pressure;
- (b) test fluid of water without any additives and free of gases;
- (c) reservoir for test fluid;
- (d) pressure gauges;
- (e) brake hose end fittings in which to mount the hose vertically; and
- (f) graduated burette with 0.05 mL increments.

3.1.2 Preparation

- (a) Measure the free length of the hose assembly.
- (b) Mount the hose so that it is in a vertical straight position without tension when pressure is applied.
- (c) Fill the hose with test fluid and bleed all gases from the system.
- (d) Close the valve to the burette and apply 10 342 kPa (1,500 psi) for 10 seconds; then release pressure.

TABLE I
Maximum Expansion of Free Length Brake Hose, mL/m (mL/ft.)

Hydraulic Brake Hose Inside Diameter*	Test Procedure			
	6 895 kPa (1,000 psi)		10 342 kPa (1,500 psi)	
	Regular Expansion Hose	Low Expansion Hose	Regular Expansion Hose	Low Expansion Hose
3 mm (1/8 inch) or less	2.17 (0.66)	1.08 (0.33)	2.59 (0.79)	1.38 (0.42)
4 to 5 mm (or 3/16 inch)	2.82 (0.86)	1.80 (0.55)	3.35 (1.02)	2.36 (0.72)
6 mm (1/4 inch) or more	3.41 (1.04)	2.69 (0.82)	4.27 (1.30)	3.84 (1.17)

* Both millimetre and inch dimensions are listed to provide test values for hoses manufactured in these sizes. They do not represent conversions.

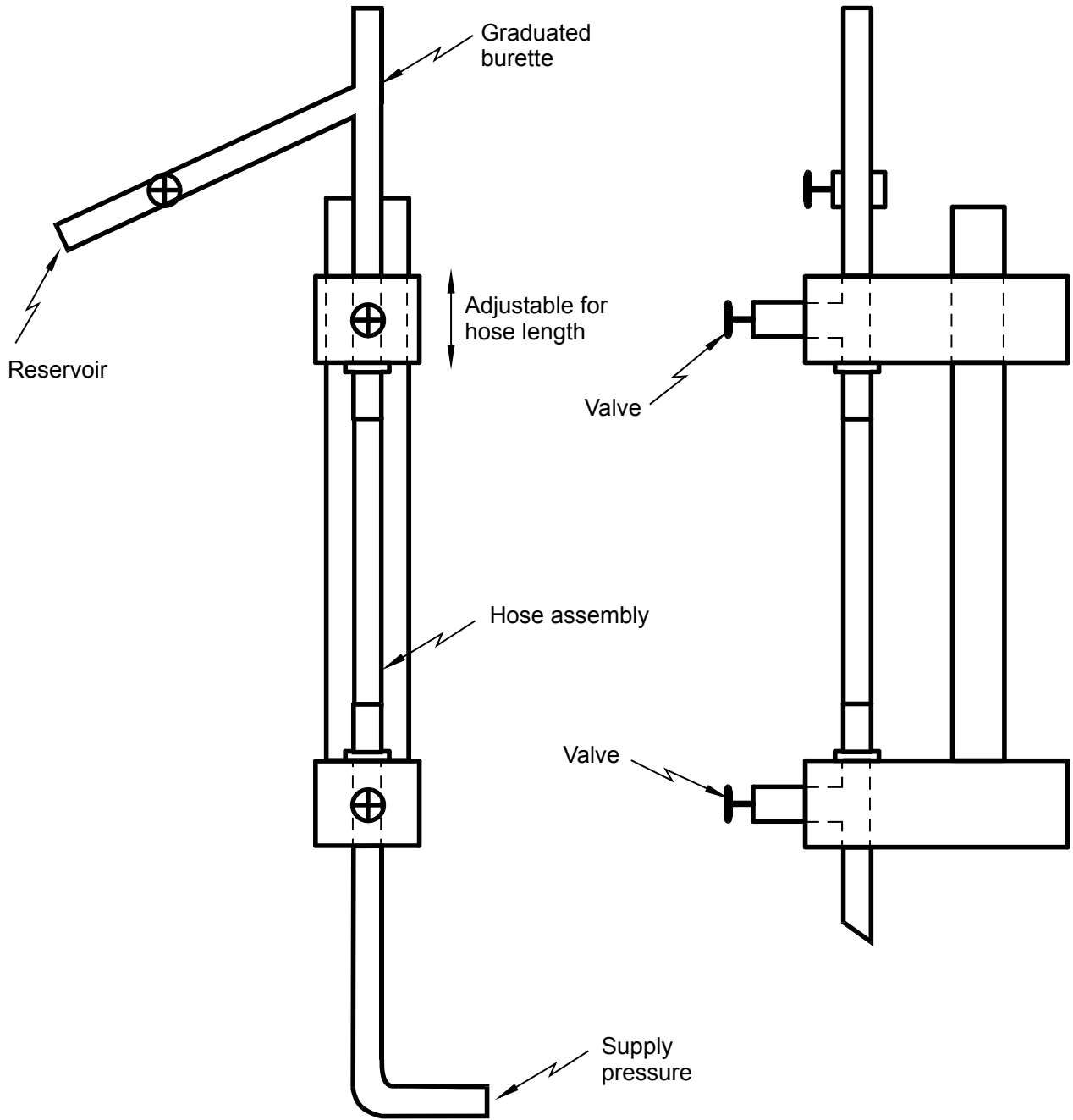


Figure 1 - Expansion Test Apparatus

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- 3.1.3 Calculation of expansion at 6 895 and 10 342 kPa (1,000 and 1,500 psi). (Table I)
- (a) Adjust the fluid level in the burette to zero.
 - (b) Close the valve to the burette, apply pressure at the rate of 103 420 kPa (15,000 psi) per minute, and seal 6 895 kPa (1,000 psi) in the hose (10 342 kPa (1,500 psi) in second series).
 - (c) After 3 seconds open the valve to the burette for 10 seconds and allow the fluid in the expanded hose to rise into the burette.
 - (d) Repeat the procedure in steps (b) and (c) twice. Measure the amount of test fluid which has accumulated in the burette as a result of the three applications of pressure.
 - (e) Calculate the volumetric expansion per metre by dividing the total accumulated test fluid by 3 and further dividing by the free length of the hose in metres.

3.2 BURST STRENGTH TEST

- 3.2.1 Connect the brake hose to a pressure system and fill it completely with water, allowing all gases to escape.
- 3.2.2 Apply water pressure of 27 579 kPa (4,000 psi) at a rate of 103 420 kPa (15,000 psi) per minute.
- 3.2.3 After 2 minutes at 27 579 kPa (4,000 psi), increase the pressure at the rate of 103 420 kPa (15,000 psi) per minute until the pressure exceeds 34 474 kPa (5,000 psi).

3.3 WHIP RESISTANCE TEST

This test is not required of sections of brake hose or brake hose assemblies which, when installed in the vehicle, join two points which cannot move relative to each other. For instance, where a brake hose assembly has an intermediate support point, the whip test shall be applied only to the section joining the moveable end to the fixed support point.

- 3.3.1 Apparatus. Utilize test apparatus that is dynamically balanced and includes:
- (a) a movable header consisting of a horizontal bar equipped with capped end fittings and mounted through bearings at each end to points 101.6 mm (4 inches) from the centre of two vertically rotating disks whose edges are in the same vertical plane;
 - (b) an adjustable stationary header parallel to the movable header in the same horizontal plane as the centres of the disks, and fitted with open end fittings;
 - (c) an elapsed time indicator; and
 - (d) a source of water pressure connected to the open end fittings.
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- 3.3.2 Preparation
- (a) Except for the supplemental support specified in 3.3.2(d), remove all external appendages including, but not limited to, hose armour, chafing collars, mounting brackets, spring guards and date bands, if any.
 - (b) Measure the hose free length.
 - (c) Mount the hose in the whip test machine, introducing slack as specified in Table II for the size of hose tested, measuring the projected length parallel to the axis of the rotating disks. The manufacturer may, at his option, adapt the fitting attachment points to permit mounting hose assemblies equipped with angled or other special fittings in the same orientation as hose assemblies equipped with straight fittings.
 - (d) In the case of a brake hose assembly equipped with a permanent supplemental support integrally attached to the assembly, the assembly may be mounted using the supplemental support and associated means of simulating its attachment to the vehicle. Mount the supplemental support in the same vertical and horizontal planes as the stationary header end of the whip test fixture described in 3.3.1(b). Mount or attach the supplemental support so that it is positioned in accordance with the recommendation of the assembly manufacturer for attaching the supplemental support on a vehicle.

TABLE II**Hose Lengths**

free length between end fittings	Slack, mm (inches)	
	3 mm (1/8 inch) or less	More than 3 mm (1/8 inch)
203.2 to 393.7 mm (8 to 15½ inches) inclusive	44.45 mm (1.75 inches)	
254 to 393.7 mm (10 to 15½ inches) inclusive		25.4 mm (1.0 inch)
Over 393.7 to 482.6 mm (15½ to 19 inches), inclusive	31.75 mm (1.25 inches)	
Over 482.6 to 609,6 mm (19 to 24 inches), inclusive	19.05 mm (0.75 inches)	

- 3.3.3 Operation
- (a) Apply 1 620 kPa (235 psi) water pressure and bleed all gases from the system.
 - (b) Drive the movable head at 800 rpm.

3.4 TENSILE STRENGTH TEST

Utilize a tension testing machine conforming to the requirements of the standard "Methods of Verification of Testing Machines" (1964, American Society for Testing and Materials, Designation E4), and provided with a recording device to give the total pull in Newtons (pounds).

- 3.4.1 Preparation. Mount the hose assembly to ensure straight, evenly distributed machine pull.
- 3.4.2 Operation. Apply tension at a rate of 25.4 mm (1 inch) per minute travel of the moving head until separation occurs.

3.5 WATER ABSORPTION SEQUENCE TESTS

- 3.5.1 Preparation. Prepare three hose assemblies as follows:
- (a) Remove 28.6 mm (1 1/8 inches) of hose cover, if any, from the centre of the hose assemblies without injury to any reinforcing material or elongation of the hose assemblies.
 - (b) Measure the free length of the hose assemblies.
- 3.5.2 Immersion and sequence testing.
- (a) Immerse the hose assemblies in distilled water for 70 hours.
 - (b) Thirty minutes after removal from water, conduct test 3.2, 3.3, and 3.4 using a different hose for each sequence.

3.6 LOW TEMPERATURE RESISTANCE TEST

- 3.6.1 Preparation
- (a) Remove hose armour, if any, and condition a hose in a straight position in air at -40°C (-40°F) for 70 hours.
 - (b) Condition a cylinder in air at -40°C (-40°F) for 70 hours, using a cylinder of 63.5 mm (2½ inches) diameter for tests of hose less than 3.18 mm (1/8 inch), 76.2 mm (3 inches) for tests of 3.18 mm (1/8 inch) hose, 88.9 mm (3½ inches) for tests of 4.76 mm (3/16-inch) and 6.35 mm (1/4 inch) hose, and 101.6 mm (4 inches) for tests of hose greater than 6.35 mm (1/4-inch) in diameter.
- 3.6.2 Flexibility testing. Bend the conditioned hose 180 degrees around the conditioned cylinder at a steady rate in a period of 3 to 5 seconds. Examine without magnification for cracks.

3.7 BRAKE FLUID COMPATIBILITY TEST

- 3.7.1 Preparation
- (a) Attach a hose assembly below a 0.473 L (1-pint U.S.) reservoir filled with 100 mL of SAE Compatibility Fluid as shown in Figure 2.
 - (b) Fill the hose assembly with SAE Compatibility Fluid, seal the lower end, and place the test assembly in an oven in a vertical position.

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- 3.7.2 Oven treatment
- (a) Condition the hose assembly at 93.3°C (200°F) for 70 hours.
 - (b) Cool the hose assembly at room temperature for 30 minutes.
 - (c) Drain the brake hose assembly, immediately determine that every inside diameter of any section of the hose assembly, except for that part of an end fitting which does not contain hose, is not less than 64 percent of the nominal inside diameter of the hose, and conduct the test specified in 3.2.

3.8 OZONE RESISTANCE TEST

Utilize a cylinder with a diameter eight times the nominal outside diameter of the brake hose excluding armour.

- 3.8.1 Preparation. After removing any armour, bend a hydraulic brake hose 360° around the cylinder. In the case of hose shorter than the circumference of the cylinder, bend the hose so that as much of its length as possible is in contact.
- 3.8.2 Exposure to ozone
- (a) Condition the hose on the cylinder in air at room temperature for 24 hours.
 - (b) Immediately thereafter, condition the hose on the cylinder for 70 hours in an exposure chamber having an ambient air temperature of 40°C (104°F) during the test and containing air mixed with ozone in the proportion of 50 parts of ozone per 100 million parts of air by volume.
 - (c) Examine the hose for cracks under 7-power magnification, ignoring areas immediately adjacent to or within the area covered by binding.

3.9 END FITTING CORROSION RESISTANCE TEST

Utilize the apparatus described in ASTM standard B117-64, "Salt Spray (Fog) Testing".

- 3.9.1 Construction. Construct the salt spray chamber so that:
- (a) the construction material does not affect the corrosiveness of the fog;
 - (b) the hose assembly is supported or suspended 30° from the vertical and parallel to the principal direction of the horizontal flow of fog through the chamber;
 - (c) the hose assembly does not contact any metallic material or any material capable of acting as a wick;

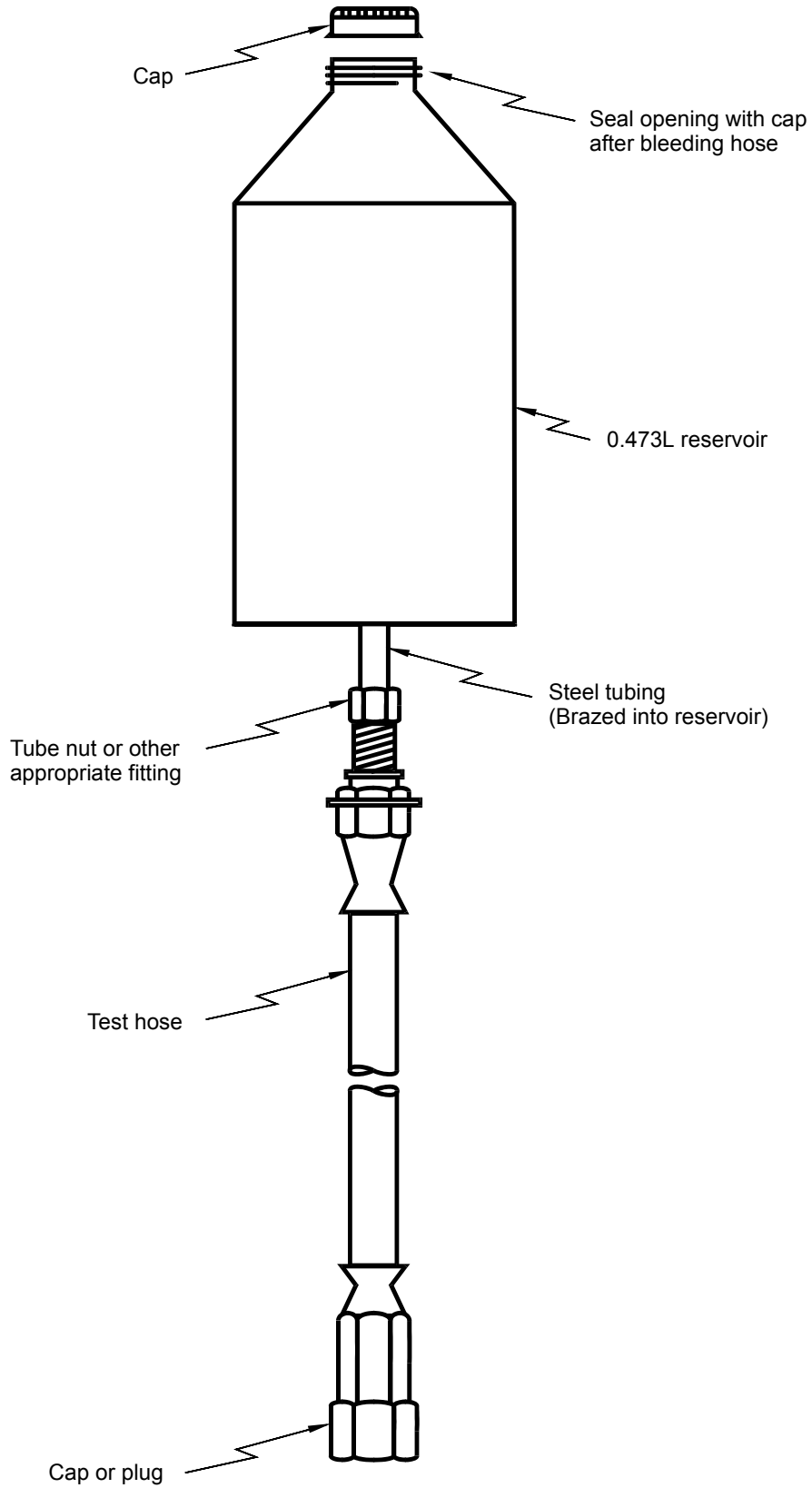


Figure 2 - Brake Fluid Compatibility Apparatus

- (d) condensation which falls from the assembly does not return to the solution reservoir for respraying;
 - (e) condensation from any source does not fall on the brake hose assemblies or the solution collectors; and
 - (f) spray from the nozzles is not directed onto the hose assembly.
- 3.9.2 Preparation
- (a) Plug each end of the hose assembly.
 - (b) Mix a salt solution five parts by weight of sodium chloride to 95 parts of distilled water, using sodium chloride substantially free of nickel and copper, and containing on a dry basis not more than 0.1 percent of sodium iodide and not more than 0.3 percent total impurities. Ensure that the solution is free of suspended solids before the solution is atomized.
 - (c) After atomization at 35°C (95°F) ensure that the collected solution is in the PH range of 6.5 to 7.2. Make the PH measurements at 25°C (77°F).
 - (d) Maintain a compressed air supply to the nozzle or nozzles free of oil and dirt between 68.9 and 172.37 kPa (10 and 25 psi).
- 3.9.3 Operation. Subject the brake hose assembly to the salt spray continuously for 24 hours.
- (a) Regulate the mixture so that each collector will collect 1 to 2 mL of solution per hour for each 80 cm² of horizontal collecting area.
 - (b) Maintain exposure zone temperature at 35°C (95°F).
 - (c) Upon completion, remove the salt deposit from the surface of the hoses by washing gently or dipping in clean running water not warmer than 37.8°C (100°F) and then drying immediately.

4. TEST PROCEDURES - AIR BRAKE HOSE, BRAKE HOSE, BRAKE HOSE ASSEMBLIES, AND BRAKE HOSE END FITTINGS

4.1 HIGH TEMPERATURE RESISTANCE TEST

- 4.1.1 Utilize a cylinder having the radius indicated in Table III for the size of hose tested.

TABLE III

Air Brake Hose Diameters and Test Cylinder Radii

Nominal hose diameter* mm (inches)	3 (1/8)	4.5 (3/16)	6 (1/4)	8 (5/16)	(3/8)	10 (13/32)	(7/16)	12 (1/2)	16 (5/8)
Test cylinder radius mm (inches)	38.1 (1.5)	50.8 (2)	63.5 (2.5)	76.2 (3)	88.9 (3.5)	88.9 (3.5)	101.6 (4)	101.6 (4)	114.3 (4.5)

* Both millimetre and inch dimensions are listed to provide test values for hoses manufactured in these sizes. They do not represent conversions.

- 4.1.2 Bind the hose around the cylinder and condition it in an air oven for 70 hours at 100°C (212°F).
- 4.1.3 Cool the hose to room temperature, remove it from the cylinder and straighten it.
- 4.1.4 Without magnification, examine the hose externally and cut the hose lengthwise and examine the inner tube.

4.2 LOW TEMPERATURE RESISTANCE TEST

- 4.2.1 Utilize a cylinder having the radius indicated in Table III for the size of hose tested.
- 4.2.2 Condition the cylinder and the brake hose in a straight position, in a cold box at -40°C (-40°F) for 70 hours.
- 4.2.3 With the hose and cylinder at -40°C (-40°F), bend the hose 180 degrees around the cylinder at a steady rate in a period of 3 to 5 seconds.

4.3 OIL RESISTANCE TEST

Utilize three test specimens and average the results.

- 4.3.1 Preparation. Fashion a test specimen by cutting a rectangular block 50.8 mm (2 inches) long and not less than 8.5 mm (1/3 inch) in width, having a thickness of not more than 1.6 mm (1/16 inch), from the brake hose and buff the specimen on both faces to ensure smooth surfaces.
- 4.3.2 Measurement
- (a) Weigh each specimen to the nearest milligram in air (W1) and in distilled water (W2) at room temperature. If wetting is necessary to remove air bubbles, dip the specimen in acetone and thoroughly rinse it with distilled water.
 - (b) Immerse each specimen in ASTM No. 3 oil for 70 hours at 100°C (212°F) and then cool in ASTM No. 3 oil at room temperature for 30 to 60 minutes.
 - (c) Dip the specimen quickly in acetone and blot it lightly with filter paper.

- (d) Weigh each specimen in a tared weighing bottle (W3) and in distilled water (W4) within 5 minutes of removal from the cooling liquid.
- (e) Calculate the percentage increase in volume as follows:

$$\text{Percent of Increase} = [(W3-W4) - (W1-W2)] / (W1-W2) \times 100$$

4.4 OZONE RESISTANCE TEST

Conduct the test specified in 3.8 using air brake hose.

4.5 LENGTH CHANGE TEST

- 4.5.1 Position a test hose in a straight, horizontal position, and apply air pressure of 68.9 kPa (10 psi) thereto.
- 4.5.2 Measure the hose to determine original free length.
- 4.5.3 Without releasing the 68.9 kPa (10 psi) pressure, raise the air pressure to the test hose to 1 379 kPa (200 psi).
- 4.5.4 Measure the hose under 1 379 kPa (200 psi) pressure to determine final free length. An elongation or contraction is an increase or decrease, respectively, in the final free length from the original free length of the hose.

4.6 ADHESION TEST

- 4.6.1 Apparatus. Utilize a power driven tension testing machine that applies a constant rate of extension and measures the force required to separate the layers of the test specimen. It shall be constructed so that:
 - (a) The recording head includes a freely rotating form with an outside diameter substantially the same as the inside diameter of the hose specimen to be placed on it.
 - (b) The freely rotating form is mounted so that its axis of rotation is in the plane of the ply being separated from the specimen and so that the applied force is perpendicular to the tangent of the specimen circumference at the line of separation.
 - (c) The rate of travel of the power-actuated grip is a uniform 25.4 mm (1 inch) per minute and the capacity of the machine is such that maximum applied tension during the test is not more than 85 percent nor less than 15 percent of the machine's rated capacity.
 - (d) The machine produces a chart with mm (inches) of separation as one coordinate and applied tension in N (lb) as the other.

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- 4.6.2 Preparation
- (a) Cut a test specimen of 25.4 mm (1 inch) or more in length from the hose to be tested and cut the layer to be tested of that test specimen longitudinally along its entire length to the level of contact with the adjacent layer.
 - (b) Peel the layer to be tested from the adjacent layer to create a flap large enough to permit attachment of the power-actuated clamp of the apparatus.
 - (c) Mount the test specimen on the freely rotating form with the separated layer attached to the power-actuated clamp.
- 4.6.3 Calculations
- (a) The adhesion value of the layer under test shall be the minimum force recorded on the chart excluding those portions of the chart corresponding to the initial and final 20 percent of movement along the displacement axis.
 - (b) Express the force in N/m (lb/in) of length.

4.7 AIR PRESSURE TEST

- 4.7.1 Connect the air brake hose assembly to a source of air pressure.
- 4.7.2 Apply 1 379 kPa (200 psi) air pressure to the hose and seal the hose from the source of air pressure.
- 4.7.3 After 5 minutes, determine the air pressure remaining in the test specimen.

4.8 BURST STRENGTH TEST

- 4.8.1 Utilize an air brake hose assembly.
- 4.8.2 Fill the hose assembly with water allowing all gases to escape. Apply water pressure at a uniform rate of increase of approximately 6 895 kPa (1,000 psi) per minute until the hose ruptures.

4.9 TENSILE STRENGTH TEST

Utilize a tension testing machine conforming to the requirements of the standard "Methods of Verification of Testing Machines" (1964, American Society for Testing and Materials, Designation E4), and provided with a recording device to register total pull in Newtons (pounds).

- 4.9.1 Attach an air brake hose assembly to the testing machine to permit straight, even, machine pull on the hose.
- 4.9.2 Apply tension at a rate of 25.4 mm (1 inch) per minute travel of the moving head until separation occurs.

4.10 WATER ABSORPTION AND TENSILE STRENGTH TEST

Immerse an air brake hose assembly in distilled water at room temperature for 70 hours. Thirty minutes after removal from the water, conduct the test specified in 4.9.

4.11 ZINC CHLORIDE RESISTANCE TEST

Immerse an air brake hose in a 50 percent zinc chloride aqueous solution at room temperature for 200 hours. Remove it from the solution and examine it under 7-power magnification for cracks.

4.12 END FITTING CORROSION RESISTANCE TEST

Conduct the test specified in 3.9 using an air brake hose assembly.

5. TEST PROCEDURES - VACUUM BRAKE HOSE, BRAKE HOSE, BRAKE HOSE ASSEMBLIES, AND BRAKE HOSE END

5.1 HIGH TEMPERATURE RESISTANCE TEST

Conduct the test specified in 4.1 using vacuum brake hose with the cylinder radius specified in Table IV for the size of hose tested.

5.2 LOW TEMPERATURE RESISTANCE TEST

Conduct the test specified in 4.2 using vacuum brake hose with the cylinder radius specified in Table IV for the size of hose tested.

TABLE IV
Vacuum Brake Hose Test Requirements

Hose Nominal Inside Diameter*		<u>High Temperature Resistance</u>				<u>Low Temperature Resistance</u>				<u>Bend Test</u>				<u>Deformation</u>	
		Hose Length		Radius of cylinder		Hose Length		Radius of cylinder		Hose Length		Max. collapse of outside diameter		Collapsed Inside Diameter (Dimension D)	
mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)	mm	(inches)
5	7/32	203.2	8.0	38.10	1.50	444.5	17.5	76.2	3.0	177.8	7.0	4.37	0.17	1.19	0.05
6	1/4	228.6	9.0	38.10	1.50	444.5	17.5	76.2	3.0	203.2	8.0	2.38	0.09	1.59	0.06
	9/32	228.6	9.0	44.45	1.75	482.6	19.0	88.9	3.5	228.6	9.0	4.76	0.19	1.59	0.06
8	11/32	228.6	9.0	44.45	1.75	482.6	19.0	88.9	3.5	279.4	11.0	5.16	0.20	1.98	0.08
10	3/8	254.0	10.0	44.45	1.75	482.6	19.0	88.9	3.5	304.8	12.0	3.97	0.16	2.38	0.09
	7/16	279.4	11.0	50.80	2.00	520.7	20.5	101.6	4.0	355.6	14.0	6.75	0.27	1.98	0.08
	15/32	279.4	11.0	50.80	2.00	520.7	20.5	101.6	4.0	355.6	14.0	6.75	0.27	1.98	0.08
12	1/2	279.4	11.0	50.80	2.00	520.7	20.5	101.6	4.0	406.4	16.0	5.56	0.22	3.18	0.13
16	5/8	304.8	12.0	57.15	2.25	558.8	22.0	114.3	4.5	558.8	22.0	5.56	0.22	3.97	0.16
	3/4	355.6	14.0	63.50	2.50	609.6	24.0	127.0	5.0	711.2	28.0	5.56	0.22	4.76	0.19
	1	406.4	16.0	82.55	3.25	723.9	28.5	165.1	6.5	914.4	36.0	7.14	0.28	6.35	0.25

*Both millimetre and inch dimensions are listed to provide test values for hoses manufactured in these sizes. They do not represent conversions.

5.3 OZONE RESISTANCE TEST

Conduct the test specified in 3.8 using a vacuum brake hose.

5.4 BURST STRENGTH TEST

Conduct the test specified in 4.8 using a vacuum brake hose.

5.5 VACUUM TEST

- 5.5.1 Utilize a 304.8 mm (12 inch) vacuum brake hose assembly sealed at one end.
- 5.5.2 Measure the outside diameter of the hose.
- 5.5.3 Attach the hose to a source of vacuum and subject it to a vacuum of 88 kPa (26 inches of Hg) for 5 minutes.
- 5.5.4 Measure the hose to determine the minimum outside diameter while the hose is still subject to vacuum.

5.6 BEND TEST

- 5.6.1 Bend a vacuum brake hose, of the length prescribed in Table IV, in the direction of its normal curvature until the ends just touch, as is shown in Figure 3.
- 5.6.2 Measure the outside diameter of the specimen at point A before and after bending.
- 5.6.3 The difference between the two measurements is the collapse of the hose outside diameter on bending.

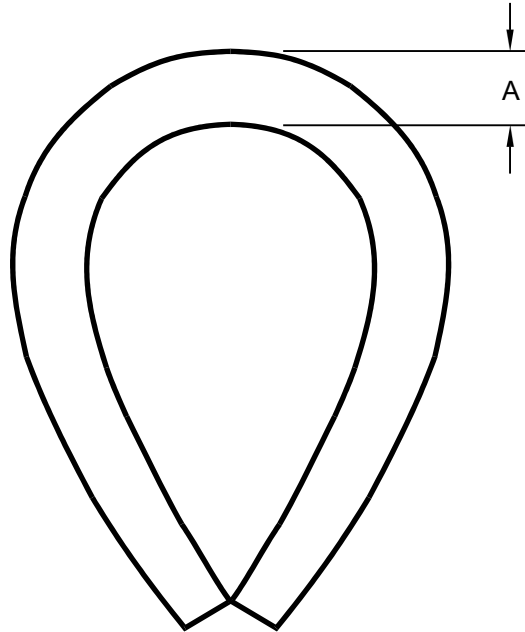


Figure 3 - Bend Test of Vacuum Brake Hose

5.7 SWELL TEST

- 5.7.1 Fill a specimen of vacuum brake hose 304.8 mm (12 inches) long with Reference Fuel A as described in the standard "Method of Test for Change in Properties of Elastomeric Vulcanizers Resulting from Immersion in Liquids" (1964, American Society for Testing and Materials, designation D471).
- 5.7.2 Maintain reference fuel in the hose under atmospheric pressure at room temperature for 48 hours.
- 5.7.3 Remove fuel and determine that every inside diameter of any section of the brake hose is not less than 75 percent of the nominal inside diameter of the hose for heavy-duty hose and 70 percent of the nominal inside diameter of the hose for light-duty hose.
- 5.7.4 Subject the hose specimen to a vacuum of 88 kPa (26 inches of Hg) for 10 minutes.
- 5.7.5 Examine for leakage and separation of the inner tube from the fabric reinforcement.

5.8 ADHESION TEST

Conduct the test specified in 4.6 using vacuum brake hose.

5.9 DEFORMATION TEST

TABLE V

Dimensions of Test Specimen and Feeler Gauge for Deformation Test

Interior Diameter of Hose*		Specimen Dimensions (See Figure 4)				Feeler Gauge Dimensions			
		D		L		Width		Thickness	
mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
5	(7/32)	1.19	(3/64)	25.4	(1)	3.18	(1/8)	1.19	(3/64)
6	(1/4)	1.59	(1/16)	25.4	(1)	3.18	(1/8)	1.59	(1/16)
	(9/32)	1.59	(1/16)	25.4	(1)	3.18	(1/8)	1.59	(1/16)
8	(11/12)	1.98	(5/64)	25.4	(1)	4.76	(3/16)	1.98	(5/64)
10	(3/8)	1.38	(3/32)	25.4	(1)	4.76	(3/16)	2.38	(3/32)
	(7/16)	1.98	(5/64)	25.4	(1)	6.35	(1/4)	1.98	(5/64)
	(15/32)	1.98	(5/64)	25.4	(1)	6.35	(1/4)	1.98	(5/64)
12	(1/2)	1.18	(1/8)	25.4	(1)	6.35	(1/4)	1.18	(1/8)
16	(5/8)	3.97	(5/32)	25.4	(1)	6.35	(1/4)	3.97	(5/32)
	(3/4)	4.76	(3/16)	25.4	(1)	6.35	(1/4)	4.76	(3/16)
	(1)	6.35	(1/4)	25.4	(1)	6.35	(1/4)	6.35	(1/4)

* Both millimetre and inch dimensions are listed to provide test values for hoses manufactured in these sizes. They do not represent conversions.

Table V specifies the test specimen dimensions.

5.9.1 Apparatus. Utilize a compression device, equipped to measure a force of at least 445 N (100 pounds) and feeler gauges of sufficient length to be passed completely through the test specimen.

5.9.2 Operation

(a) Position the test specimen longitudinally in the compression device with the fabric laps not in the line of the applied pressure.

Apply gradually increasing force to the test specimen to compress its inside diameter to that specified in Table V for dimension D (see Figure 4) for the size of hose tested.

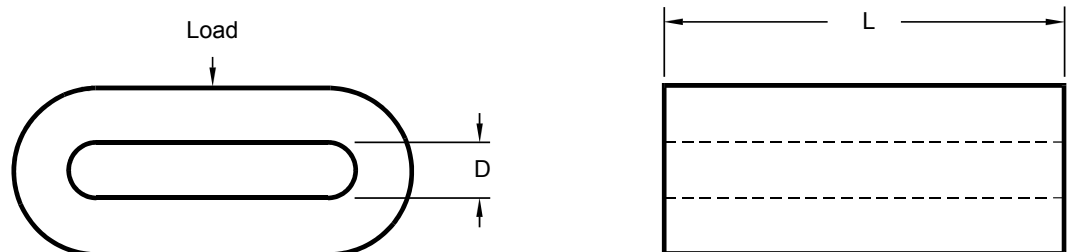


Figure 4 – Deformed Specimen of Vacuum Brake Hose

(c) After 5 seconds release the force and record the peak load applied.

- (d) Repeat the procedure four times permitting a 10-second recovery period between load applications.

5.10 END FITTING CORROSION RESISTANCE TEST

Conduct the test specified in 3.9 using a vacuum brake hose assembly.

6. TEST CONDITIONS

Each hose assembly or appropriate part thereof shall be able to meet the requirements of 3, 4 and 5 under the following conditions.

- 6.1 The temperature of the testing room is 23.9°C (75°F).
- 6.2 Except for 3.6, 4.2 and 5.2, the test samples are stabilized at test room temperature prior to testing.
- 6.3 The brake hoses and brake hose assemblies are at least 24 hours old, and unused.