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Automotive Air Brake Hose and Hose Assemblies—SAE J1402c

SAE Recommended Practice
Last Revised July 1976

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AUTOMOTIVE AIR BRAKE HOSE AND HOSE ASSEMBLIES—SAE J1402c

SAE Recommended Practice

Report of Motorcoach and Motor Truck Division approved January 1942 and last revised by Brake Committee July 1976. This material was formerly designated SAE 40Rz.

1. Scope—This recommended practice covers minimum requirements for air brake hose assemblies made from reinforced elastomeric hose and suitable fittings for use in automotive air brake systems including flexible connections from frame to axle, tractor to trailer, trailer to trailer and other unshielded air lines that are exposed to potential pull or impact. This hose is not to be used where temperatures, external or internal, fall outside the range of -40°F to $+200^{\circ}\text{F}$ (-40°C to $+93^{\circ}\text{C}$).

2. Hose Dimensions

2.1 For Permanently Attached Fittings—When the hose is assembled with permanently attached fittings, the hose portion of the hose assembly shall conform to the dimensional requirements of Table A.

TABLE A—INSIDE AND OUTSIDE DIAMETER OF HOSE

in (mm)	1/4 (6.4)	5/16 (7.9)	3/8* (9.5)	7/16* (11.1)	1/2 SP* (12.7)	5/8 (15.9)
Min. I.D.	0.227 (5.8)	0.289 (7.3)	0.352 (8.9)	0.407 (10.3)	0.469 (11.9)	0.594 (15.1)
Max. I.D.	0.273 (6.9)	0.335 (8.5)	0.398 (10.1)	0.469 (11.9)	0.531 (13.5)	0.656 (16.7)
Min. O.D.	0.594 (15.1)	0.656 (16.7)	0.719 (18.3)	0.781 (19.8)	0.844 (21.4)	1.031 (26.2)
Max. O.D.	0.656 (16.7)	0.719 (18.3)	0.781 (19.8)	0.843 (21.4)	0.906 (23.0)	1.094 (27.8)

* The sizes 3/8 in, 7/16 in, and 1/2 in SP can be assembled with reusable fittings if desired.

2.2 For Reusable Fittings—When the hose is assembled with reusable fittings, the hose portion of the hose assembly shall conform to the dimensional requirements of Table AI or AII, with the exceptions of 3/8 in, 7/16 in and 1/2 in SP from Table A.

TABLE AI—INSIDE AND OUTSIDE DIAMETER OF HOSE

in (mm)	3/16 (4.8)	1/4 (6.4)	5/16 (7.9)	13/32 (10.3)	1/2 (12.7)	5/8 (15.9)
Min. I.D.	0.188 (4.8)	0.250 (6.4)	0.312 (7.9)	0.406 (10.3)	0.500 (12.7)	0.625 (15.9)
Max. I.D.	0.214 (5.44)	0.281 (7.14)	0.343 (8.71)	0.437 (11.10)	0.539 (13.69)	0.667 (16.94)
Min. O.D.	0.472 (11.99)	0.535 (13.59)	0.598 (15.11)	0.714 (18.13)	0.808 (20.52)	0.933 (23.69)
Max. O.D.	0.510 (12.95)	0.573 (14.55)	0.636 (16.15)	0.760 (19.30)	0.854 (21.69)	0.979 (24.87)

TABLE AII—INSIDE AND OUTSIDE DIAMETER OF HOSE

in (mm)	3/16 (4.8)	1/4 (6.4)	5/16 (7.9)	13/32 (10.3)	1/2 (12.7)	5/8 (15.9)
Min. I.D.	0.188 (4.8)	0.250 (6.4)	0.312 (7.9)	0.406 (10.3)	0.500 (12.7)	0.625 (15.9)
Max. I.D.	0.214 (5.44)	0.281 (7.14)	0.343 (8.71)	0.437 (11.10)	0.539 (13.69)	0.667 (16.94)
Min. O.D.	0.500 (12.7)	0.562 (14.3)	0.656 (16.7)	0.742 (18.8)	0.898 (22.8)	1.054 (26.8)
Max. O.D.	0.539 (13.7)	0.602 (15.3)	0.695 (17.7)	0.789 (20.1)	0.945 (24.0)	1.101 (27.9)

2.3 Minimum Bend Radius

2.3.1 Table 1 contains the minimum bend radii recommended for vehicle installations; however, smaller radii have been successfully used in the flexure test and some installations.

TABLE 1—RECOMMENDED MINIMUM BEND RADIUS

Nominal Hose I.D.		Minimum Bend Radius (To Inside of Bend)	
in	mm	in	mm
3/16	4.8	2	51
1/4	6.4	2 1/2	64
5/16	7.9	3	76
3/8	9.5	3 1/2	89
13/32	10.3	3 1/2	89
7/16	11.1	4	102
1/2	12.7	4	102
5/8	15.9	4 1/2	114

3. Identification

3.1 Hose—Each hose manufacturer shall incorporate into the hose construction an identification yarn as assigned by the RMA and as shown in the appended "Color Assignments to Brake Hose Manufacturers."

Each air brake hose shall also be labeled in a color contrasting to that of the hose and labeling shall be repeated every 15 in (38 mm) or less along the entire length of hose in legible block capital letters at least 1/8 in (3.2 mm) high with the following minimum information in the order listed:

- The hose manufacturer's identification XXX.
- The words "Air Brake" to identify specific hose application.
- The nominal hose inside diameter in fractions of an inch such as 3/8.
- SAE J1402

EXAMPLE: XXX Air Brake 3/8 SAE J1402

In addition, each air brake hose shall be labeled with either an "A", AI, or AII identifying whether the hose has been manufactured to the dimensions of Table A, AI, or AII. This additional labeling need not appear on the same layline as the above (a), (b), (c), and (d) information, but shall have the same minimum requirements of color contrast, spacing, and letter height.

3.2 Fittings—Each reusable air brake hose fitting shall be permanently etched, embossed, or stamped in legible block capital letters at least 1/16 in (1.6 mm) high with the coupling manufacturer's identification and fractional hose size.

3.3 Assemblies—Each air brake hose assembly shall be identified by means of a band around the hose. The band may move freely along the length of the assembly as long as it is retained by the end fitting. The band shall be permanently etched, embossed, or stamped in legible block capital letters at least 1/8 in (3.2 mm) high with the following information:

- The month, day, and year or the month and year the assembly was made expressed in numerals. For example, 3/1/75 means March 1, 1975 or 3/75 means March 1975.
- The assembler's identification and additional information as required.

4. Performance

NOTE 1: In the interest of safety, all samples subjected to one or more performance tests other than Proof Pressure and Length Change shall be destroyed and discarded after completion of the tests and their analysis.

NOTE 2: Unless otherwise specified, all tests are to be performed in accordance with ASTM D 622.

4.1 Acceptance Performance—Hose or hose assemblies at the time of manufacture shall conform to the following:

4.1.1 PROOF PRESSURE—Assemblies subjected to a pressure test using 300 psi \pm 10 psi (2.07 MPa \pm .07 MPa) air or nitrogen under water for a minimum of 30 s shall show no leaks.

4.1.2 BURST STRENGTH—There shall be no hose burst or end fitting separation below 900 psi (6.21 MPa) when hose or hose assemblies are subjected to a hydrostatic burst test.

4.1.3 ASSEMBLY TENSILE STRENGTH—The hose assembly complete with couplings shall be subjected to a tensile test until separation of the hose from the couplings or rupture of the hose occurs. Failure of the 1/4 in (6.4 mm) and smaller nominal I.D. size shall occur at no less than 250 lb (1.112 KN) and larger sizes at no less than 325 lb (1.446 KN).

4.1.4 LENGTH CHANGE—Test for length change shall be conducted in accordance with ASTM D-622 except that the original measurement shall be made at 10 psi (0.07 MPa). The change in length shall be determined at 200 psi (1.38 MPa) and shall be from +5% to -7%.

4.1.5 ADHESION—Test for adhesion in all hose types, provided they are not wire reinforced hoses, shall be conducted in accordance with ASTM D-413 Machine Method, and the average load required to separate any adjacent layers shall be 8 lb/in of width (0.90 N·m) minimum. Test for adhesion in wire reinforced hoses shall be conducted per 4.1.5.1. The adhesion test is to be made only on the original unaged specimen.

TABLE 3—MATERIAL REQUIREMENTS

Requirement	Tube		Cover	
	Class A	Class B	Class A	Class B
Original properties				
Durometer, points	60-75	60-75	60-75	60-75
Tensile, min	1000 psi (6.89 MPa)			
Elongation, min, %	200	200	250	250
Oven aging conditions and change limits				
Hours	70	70	70	70
Temperature	100°C (212°F)	100°C (212°F)	100°C (212°F)	100°C (212°F)
Durometer, points	+15	+15	+15	+15
Tensile, max, %	-30	-30	-30	-30
Elongation, max, %	-40	-40	-40	-40
Oil immersion change limits				
Hours	70	Not required	70	Not required
Temperature	100°C (212°F)		100°C (212°F)	
Tensile, max, %	-60		-60	
Elongation, max, %	-50		-50	
Volume, %	+100		+100	
Fuel B immersion change limits, 48 h at room temperature				
Tensile, max, %	-40	Not required	—	—
Elongation, max, %	-40			
Volume, %	+80			

COLOR ASSIGNMENTS TO BRAKE HOSE MANUFACTURERS

[This listing is not considered a part of this SAE Standard] As of 1971 the Rubber Manufacturers Association, 444 Madison Ave., New York, N.Y. 10022, has assigned brake hose identification colors to the hose manufacturers as follows:

Yellow	B. F. Goodrich Co.	Green, Black,	Dunlop (India) Ltd.
Green	Goodyear Tire and Rubber Co.	Black	
Red	United States Rubber Co.	Green, Blue,	Lusite Ltd. (England)
Black	Inland Div., General Motors Corp.	Blue	
Blue	Raybestos-Manhattan Inc.	Green, Green,	Vincke S.A.
Brown	Republic Rubber Div. Aeroquip Corp.	Blue	
Violet	Firestone Tire and Rubber Co.	Green, Brown,	Hitachi Cable, Ltd. (Japan)
Orange	Dayton Rubber Co.	Brown	
Green and Yellow	Renault (France)	Green, Green,	P. B. Cow (Special Products) Ltd. (England)
Green and Red	Thermoid Div., H. K. Porter Co.	Brown	
Green and Black	Gates Rubber Co.	Yellow, Red,	STOP Freins
Green and Blue	Crown Products Co.	Red	Hydrauliques (France)
Green and Brown	Toyoda Gosei Co., Ltd. (Japan)	Yellow, Yellow,	Agas & Co. (Italy)
Yellow and Red	Swan Rubber Co.	Red	
Yellow and Black	Continental Gummi-Werke A. G. (Germany)	Yellow, Black,	Gates Rubber Co. of Canada Ltd.
Yellow and Blue	Hewitt-Robins, Inc.	Black	
Yellow and Brown	Plumley Rubber Co.	Yellow, Yellow,	Meiji Rubber & Chemical Co. Ltd. (Japan)
Red and Black	Dominion Rubber Co., Ltd. (Canada)	Black	
Red and Blue	Goodall Rubber Co.	Yellow, Blue,	Nichirin Rubber Industrial Co., Ltd.
Red and Brown	Continental Rubber Works	Blue	
Black and Blue	Electric Hose and Rubber Co.	Yellow, Yellow,	Kugelfischer Georz Schaefer & Co.
Black and Brown	Boston Woven Hose and Rubber Co.	Blue	
Blue and Brown	Societe Francaise de Freins Hydrauliques Lockheed	Red, Black,	Deutsche Tecalemit GMBH (Germany)
Green, Yellow, Red	Acme-Hamilton Rubber Manufacturing Co.	Black	
Green, Yellow, Black	Polymer Corp. of Pennsylvania	Red, Red, Black	Polymer Engrg. Div., Dunlop Co. Ltd. (England)
Green, Red, Red	BTR Hose Ltd. (England)	Red, Blue, Blue	Tecalemit Engineering Ltd. (England)
Green, Green, Red	Moldeados Industriales, S.A. (Mexico)	Red, Red, Blue	Tecalemit Pty. Ltd. (Australia)
		Red, Brown,	Tecalemit (India) Ltd.
		Red, Red, Brown	
		Black, Blue, Blue	Tecalon Brasileira de Autopecas (Brazil)
		Black, Black,	Imperial Eastman Corp.
		Blue	
		Black, Brown,	Tecalemit S.A. (France)
		Brown	
		Black, Black,	Tecalemit Italia (Italy)
		Brown	
		Black, Black,	Alfred Roberts & Sons Ltd. (England)
		Blue, Brown,	
		Brown	Pirelli S. p. A. (Italy)
		Blue, Blue,	
		Brown	Mundener Gummiwarenfabrik (Germany)

TABLE 4—VACUUM BRAKE HOSE TEST REQUIREMENTS

Hose	Tests							
	Nominal ID, in	Bend Test Maximum Collapse of OD		Burst Pressure		Proof Pressure		Recommended Minimum Installation Radius
		in	mm	psi	MPa	psi	MPa	
Heavy Wall								
1/4	0.09	2.29	1200	8.27	600	4.14	10 × OD	
3/8	0.16	4.06	1200	8.27	600	4.14	10 × OD	
1/2	0.22	5.59	1000	6.89	500	3.45	10 × OD	
5/8	0.22	5.59	1000	6.89	500	3.45	10 × OD	
3/4	0.22	5.59	800	5.52	400	2.76	10 × OD	
1	0.28	7.11	800	5.52	400	2.76	10 × OD	
Light Wall								
7/32	0.17	4.32	350	2.41	175	1.21	10 × OD	
11/32	0.20	5.08	350	2.41	175	1.21	10 × OD	
15/32	0.27	6.86	350	2.41	175	1.21	10 × OD	

Yellow Green	B. F. Goodrich Co. Goodyear Tire and Rubber Co.	Yellow and Blue Yellow and Brown	Hewitt-Robins, Inc. Plumley Rubber Co.	Green, Black, Black	Dunlop (India) Ltd.	Red, Black, Black	Deutsche Tecalemit GMBH (Germany)
Red	United States Rubber Co.	Red and Black	Dominion Rubber Co., Ltd. (Canada)	Green, Blue, Blue	Lusite Ltd. (England)	Red, Red, Black	Polymer Engrg. Div., Dunlop Co. Ltd. (England)
Black	Inland Div., General Motors Corp.	Red and Blue Red and Brown	Goodall Rubber Co. Continental Rubber Works	Green, Green, Blue	Vincke S.A.	Red, Blue, Blue	Tecalemit Engineering Ltd. (England)
Blue	Raybestos-Manhattan Inc.	Black and Blue	Electric Hose and Rubber Co.	Green, Brown, Brown	Hitachi Cable, Ltd. (Japan)	Red, Red, Blue	Tecalemit Pty. Ltd. (Australia)
Brown	Republic Rubber Div. Aeroquip Corp.	Black and Brown	Boston Woven Hose and Rubber Co.	Green, Green, Brown	P. B. Cow (Special Products) Ltd. (England)	Red, Brown, Brown	Tecalemit (India) Ltd.
Violet	Firestone Tire and Rubber Co.	Blue and Brown	Societe Francaise de Freins Hydrauliques Lockheed	Yellow, Red, Red	STOP Freins Hydrauliques (France)	Red, Red, Brown	Tecalon Brasileira de Autopecas (Brazil)
Orange	Dayton Rubber Co.	Green, Yellow, Red	Acme-Hamilton Rubber Manufacturing Co.	Yellow, Yellow, Red	Ages & Co. (Italy)	Black, Blue, Blue	Imperial Eastman Corp.
Green and Yellow	Renault (France)	Green, Yellow, Black	Polymer Corp. of Pennsylvania	Yellow, Black, Black	Gates Rubber Co. of Canada Ltd.	Black, Black, Blue	Tecalemit S.A. (France)
Green and Red	Thermoid Div., H. K. Parter Co.	Green, Red, Red	BTR Hose Ltd. (England)	Yellow, Yellow, Black	Meiji Rubber & Chemical Co. Ltd. (Japan)	Black, Brown, Brown	Tecalemit Italia (Italy)
Green and Black	Gates Rubber Co.	Green, Green, Red	Moldeados Industriales, S.A. (Mexico)	Yellow, Blue, Blue	Nichirin Rubber Industrial Co., Ltd.	Black, Black, Brown	Alfred Roberts & Sons Ltd. (England)
Green and Blue	Crown Products Co.			Yellow, Yellow, Blue	Kugelfischer Georz Schaefer & Co.	Blue, Brown, Brown	Pirelli S. p. A. (Italy)
Green and Brown	Toyoda Gosei Co., Ltd. (Japan)					Blue, Blue, Brown	Mundener Gummwarenfabrik (Germany)
Yellow and Red	Swan Rubber Co.						
Yellow and Black	Continental Gummi-Werke A. G. (Germany)						

4.1.5.1 Adhesion of Wire Reinforced Hose—The requirements and method of testing cover adhesion shall be the same as 4.1.5 for all other hose types. The integrity of the inner tube adhesion shall be tested by subjecting a length of hose not less than 15 in (381 mm) long to the following requirements.

Place a steel ball (of the size specified in the table below) in the bore of the hose. One end shall then be attached to a vacuum source and the other end plugged. A vacuum of 25 in (635 mm) of mercury shall be applied for a period of five (5) min while the hose is in an essentially straight position. At the conclusion of this period and while still under vacuum, the hose shall be bent 180 deg to the minimum bend radius in 2.3.1 in each of two directions 180 deg apart. After bending and returning to an essentially straight position and while still under vacuum, the ball shall be rolled from end to end of the hose. Failure of the ball to pass freely from end to end shall be indication of separation of the tube from the reinforcement layer and shall constitute failure. Ball sizes shall be in accordance with Table 2.

4.2 Qualification Performance—For initial qualification under this specification all of the requirements under Acceptance Performance, Qualification Performance and Flexure Test shall be met. Minimum sampling shall be per Table 3, including the specified sequential test procedure.

4.2.1 TEMPERATURE RESISTANCE

4.2.1.1¹ High Temperature Resistance—The hose shall show no cracks, charring, or disintegration externally or internally when straightened after being bent over a form for a period of 70 h ± 2 h while in an air oven at 212°F ± 3.6°F (100°C ± 2.0°C). The radius of the test form shall be in accordance with Table 4.

4.2.1.2¹ Low Temperature Resistance—The hose shall show no cracks internally or externally when bent 180 deg over a form having the radius shown in 2.3.1 after hose and form have been exposed for a period of 70 h ± 2 h in an air circulating chamber at -40°F ± 3.6°F (-40°C ± 2°C) and while still at this temperature. The hose and form shall be supported by a non-metallic surface during the entire period. The bend shall be completed in a period of 3-5 s.

4.2.2 RESISTANCE TO ENVIRONMENT

4.2.2.1 Oil—Specimens prepared from the inner tube and the cover shall show a volume increase when measured after removal from ASTM #3 Oil in which it has been immersed for 70 h ± 2 h at 212°F ± 3.6°F (100°C ± 2°C) of not more than 100%.

4.2.2.2 Water—Condition hose assembly by immersion in tap water at room temperature for a period of 168 h ± 2 h while bent over a form having the minimum bend radius shown in 2.3.1. Ends shall be completely capped during immersion. See Table 3 for next step.

4.2.2.3¹ Ozone—After being exposed for 70 h ± 2 h in an ozone cabinet containing 50 ppm by volume of ozone at a temperature of 104°F ± 3.6°F (40°C ± 2°C) and while bent over a form having the radius shown in 2.3.1, the hose shall show no cracking under 7X magnification.

4.2.2.4 Salt Spray Test—Hose assembly end fittings while assembled on hose shall withstand 24 h ± 1 h exposure to salt spray when tested in accordance with ASTM B 117 Method of Salt Spray (Fog) Testing. After this exposure, fittings shall show no base metal corrosion except red rust is acceptable in areas of identification stamping and crimp distortions. White corrosion products are acceptable.

¹The external surface of fabric covered hoses shall be exempt from inspection for cracks after 4.2.1.1, 4.2.1.2, and 4.2.2.3 as visual inspection is not practical.

TABLE 2—BALL SIZE FOR TESTING ADHESION OF WIRE REINFORCED HOSE

Hose I.D.	in (mm)	3/16 (4.7)	1/4 (6.4)	5/16 (7.9)	3/8 (9.5)	13/32 (10.3)	7/16 (11.1)	1/2 (12.7)	5/8 (15.9)
Ball Size	in (mm)	9/64 (3.6)	3/16 (4.8)	15/64 (6.0)	9/32 (7.1)	19/64 (7.5)	21/64 (8.3)	3/8 (9.5)	15/32 (11.9)

TABLE 3—MINIMUM SAMPLING AND SEQUENTIAL TEST PROCEDURE

Sample No.	Subjected to	Followed by
1	5 ^a	4.2.1.1 then 4.1.1
2	5 ^a	4.2.1.2 then 4.1.1
3	4.2.2.1	—
4	5 ^a	4.2.2.2 then 4.1.3
5	4.2.2.3	—
6	5 ^a	4.2.2.4 then 4.1.2
7	5 ^a	4.1.4 then 4.1.1 & 4.1.2
8	4.1.5	—
9	6 ^a	—

^aCouple hose before starting tests or aging.

TABLE 4—RADIUS FOR HIGH TEMPERATURE RESISTANCE TEST

Nominal Hose I.D.		Radius of Test Form	
in	mm	in	mm
3/16	4.8	1	25
1/4	6.4	1 1/2	38
5/16	7.9	1 3/4	45
3/8	9.5	1 3/4	45
12/32	10.3	1 7/8	48
7/16	11.1	2	51
1/2	12.7	2	51
5/8	15.9	2 1/2	64

5. End Fittings—End fittings shall be such as to permit conformance to all portions of this Recommended Practice. After assembly of the end fitting to the hose, the minimum I.D. of the end fitting or the hose shall not be less than 66% of the nominal hose I.D.

6. Flexure Test

6.1 Preparation of Test Samples

6.1.1 Prior to cutting the hose, apply a layline (of a color distinguishable from that of the hose cover) along the length of the hose (following the natural