

# AUTOMOTIVE AIR BRAKE HOSE AND HOSE ASSEMBLIES—SAE J1402 JUN85

## SAE Recommended Practice

Report of the Motorcoach and Motor Truck Division, approved January 1942, last revised, Brake Committee, June 1985. 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 to +200°F (-40 to +93°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.

**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  $\frac{3}{8}$  in,  $\frac{7}{16}$  in and  $\frac{1}{2}$  in SP from Table A.

### 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.

### 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 Appendix B of SAE J1401.

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 (381 mm) or less along the entire length of hose in legible block capital letters at least  $\frac{1}{8}$  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  $\frac{3}{8}$ .
- SAE J1402

EXAMPLE: XXX Air Brake  $\frac{3}{8}$  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  $\frac{1}{16}$  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  $\frac{1}{8}$  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.

TABLE A—INSIDE AND OUTSIDE DIAMETER OF HOSE

in (mm)	1/4 (6.4)	5/16 (7.9)	3/8 <sup>a</sup> (9.5)	7/16 <sup>a</sup> (11.1)	1/2 SP <sup>a</sup> (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)

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

(b) 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  $\pm$  0.07 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  $\frac{1}{4}$  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).

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 (5.4)	0.281 (7.1)	0.343 (8.7)	0.437 (11.1)	0.539 (13.7)	0.667 (16.9)
Min O.D.	0.472 (12.0)	0.535 (13.6)	0.598 (15.1)	0.714 (18.1)	0.808 (20.5)	0.933 (23.7)
Max O.D.	0.510 (13.0)	0.573 (14.6)	0.636 (16.2)	0.760 (19.3)	0.854 (21.7)	0.979 (24.9)

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 (5.4)	0.281 (7.1)	0.343 (8.7)	0.437 (11.1)	0.539 (13.7)	0.667 (16.9)
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)

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

**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 (14 N/cm) minimum. Test for adhesion in wire reinforced hoses shall be conducted per paragraph 4.1.5.1. The adhesion test is to be made only on the original unaged specimen.

**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 Table 2) 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.

**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

**4.2.1.1<sup>1</sup> 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 ± 2 h while in an air oven at 212 ± 3.6°F (100 ± 2.0°C). The radius of the test form shall be in accordance with Table 4.

**4.2.1.2<sup>1</sup> Low Temperature Resistance**—The hose shall show no cracks internally or externally when bent 180 deg over a form having the radius shown in paragraph 2.3.1 after hose and form have been exposed for a period of 70 ± 2 h in an air circulating chamber at -40 ± 3.6°F (-40 ± 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 ± 2 h at 212 ± 3.6°F (100 ± 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 ± 2 h while bent over a form

<sup>1</sup>The 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. <sup>a</sup>	4.2.1.1 then 4.1.1
2	5. <sup>a</sup>	4.2.1.2 then 4.1.1
3	4.2.2.1	—
4	5. <sup>a</sup>	4.2.2.2 then 4.1.3
5	4.2.2.3	—
6	5. <sup>a</sup>	4.2.2.4 then 4.1.2
7	5. <sup>a</sup>	4.1.4 then 4.1.1 and 4.1.2
8	4.1.5	—
9	6. <sup>a</sup>	—

<sup>a</sup> Couple 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
13/32	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

having the minimum bend radius shown in 2.3.1. Ends shall be completely capped during immersion. See Table 3 for next step.

**4.2.2.3<sup>1</sup> Ozone**—After being exposed for 70 ± 2 h in an ozone cabinet containing 50 pphm by volume of ozone at a temperature of 104 ± 3.6°F (40 ± 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 ± 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.

**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 hose curvature which results from the hose being coiled in a roll—see Fig. 1).

**6.1.2** Cut the hose to provide a hose assembly sample with a free hose length as shown in Fig. 2. Free hose length is the outside exposed hose length between the fittings in the finished hose assembly.

**6.1.3** Fittings are to be assembled on the hose in accordance with the manufacturer's instructions.

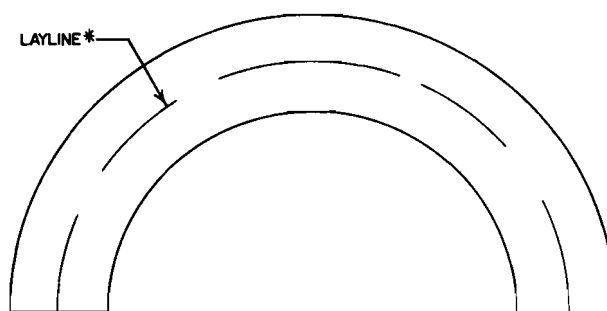
**6.2 Preconditioning**—Subject each sample hose assembly to the preconditioning specified in paragraph 6.2.1, followed by the preconditioning specified by paragraph 6.2.2.

**6.2.1 SALT SPRAY CONDITIONING**—With the ends plugged, subject the hose assembly samples to 24 ± 1 h exposure to salt spray testing in accordance with ASTM B 117, Method of Salt Spray (Fog) Testing.

**6.2.1.1** Allow no more than 168 h elapsed time between completion of salt spray conditioning and the starting of high temperature aging per paragraph 6.2.2.

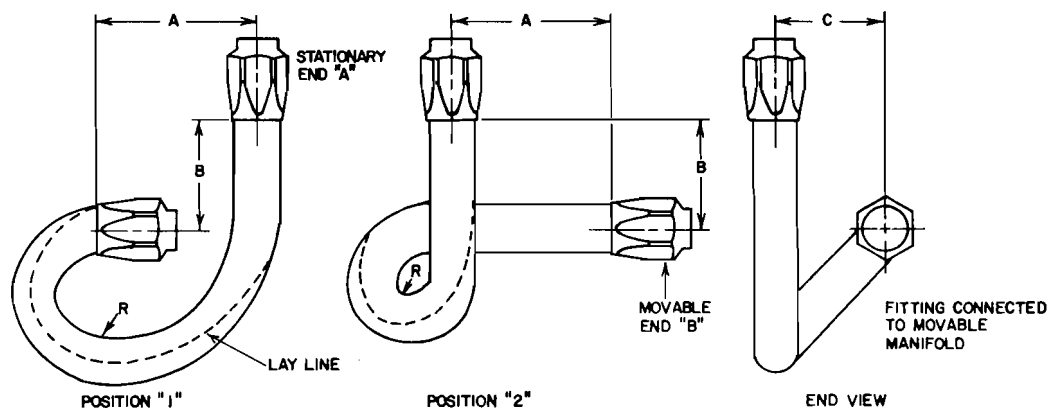
**6.2.2 HIGH TEMPERATURE AGING**—With each hose assembly sample in a straight position, age the samples in air at a temperature of 212 ± 1.8°F (100 ± 1°C) for a period of 70 ± 2 h. During the entire conditioning period, the hose bore of each sample is to be exposed to the air within the oven.

**6.2.2.1** Allow no more than 168 h elapsed time between completion of high temperature aging and starting of flex tests per paragraphs 6.3 and 6.4.



\* MARKED WHEN PREPARING SAMPLES FOR TEST PER 6.1.1. NOT MANUFACTURER'S LAYLINE.

FIG. 1



POSITION "1" ILLUSTRATES THE "LEFT" EXTREME OF TRAVEL.  
POSITION "2" ILLUSTRATES THE "RIGHT" EXTREME OF TRAVEL.

Free Hose Length $\pm 1/16$ (1.6 mm)	Hose I.D., in (mm)	Dimensions							
		Position "1"				Position "2"			
		"A"	"B"	"C"	"R" <sup>a</sup>	"A"	"B"	"C"	"R" <sup>a</sup>
10 in (254 mm)	3/16 1/4 (4.8) (6.3)	3 in (76 mm)	2.75 in (70 mm)	3.75 in (95 mm)	1.4 in (34 mm)	3 in (76 mm)	2.75 in (70 mm)	3.75 in (95 mm)	1.2 in (30 mm)
11 in (279 mm)	5/16 3/8 13/32 (7.9) (9.7) (10.4)	3 in (76 mm)	3.5 in (89 mm)	4.5 in (114 mm)	1.7 in (43 mm)	3 in (76 mm)	3.5 in (89 mm)	4.5 in (114 mm)	1.3 in (33 mm)
14 in (355 mm)	7/16 1/2 5/8 (11.2) (12.7) (16.0)	3 in (76 mm)	4 in (102 mm)	5 in (127 mm)	2.2 in (56 mm)	3 in (76 mm)	4 in (102 mm)	5 in (127 mm)	1.8 in (46 mm)

<sup>a</sup> This is an approximate average radius.

FIG. 2

**6.3 Installation of Samples in the Test Setup**—After the samples have been preconditioned, they are to be installed in the test setup in the configuration specified in Fig. 2. The installation procedure is as follows:

6.3.1 With the movable manifold of the flex test machine at the center of its stroke, fitting "B" is connected to the movable manifold in such a manner that the layline is located at the top-center position (see Fig. 2).

6.3.2 After fitting "B" has been coupled with the movable manifold, the "A" fitting is then connected to the stationary manifold without imparting any twist to the hose, but allowing the hose to seek its natural curvature.

**6.4 Test Procedure**—Flex the samples by moving fitting "B" from the center stroke position to 3 in (76 mm) either side of center ("A" dimension in Fig. 2) alternating between Position "1" and "2" while simultaneously cycling the air pressure on for 1 min and off for 1 min.

#### 6.4.1 FLEXURE/PRESSURE CYCLING TEST PARAMETERS

6.4.1.1 *Total Flexure Stroke*—6 in (152 mm) Tolerance:  $\pm 1/16$  in (1.6 mm).

6.4.1.2 *Flexure Stroke Frequency*— $100 \pm 5$  cpm.

6.4.1.3 *Ambient Temperature*—70–80°F (21–27°C).

6.4.1.4 *Internal Air Pressure on Test Samples*—150 psi  $\pm$  10 psi (1.03  $\pm$  0.07 MPa). The air pressure shall be alternately fully "on" for 1 min  $\pm$  5 s and fully "off" for 1 min  $\pm$  5 s.

**6.5** The failure point (number of flex stroke cycles) shall be determined by loss of air pressure through the failed sample. As the air pressure is alternately fully "on" for 1 min and fully "off" for 1 min, pressure loss shall be further described as failure of the system to be repressurized to 150 psi  $\pm$  10 psi (1.03 MPa  $\pm$  0.07 MPa) through a 0.062 + 0.001/−0.000 in (1.6 + 0.03/−0.00 mm) diameter orifice within 2 min. Failure shall not occur before completing one million flex cycles.

## PACKAGING, STORAGE, AND SHELF LIFE OF HYDRAULIC BRAKE HOSE ASSEMBLIES —SAE J1288 APR99

### SAE Information Report

Report of the Hydraulic Brake Systems Actuating Committee, approved June 1985. Reaffirmed by the Automotive Brake and Steering Hose Standards Committee March 1990 and April 1999.

**Foreword**—This Reaffirmed Document has not changed other than to put it into the new SAE Technical Standards Board Format.

**1. Scope**—This SAE Information Report is the listing of recommendations for the proper packaging, storage, and shelf life limitations of new and unused hydraulic brake hose assemblies. The document embodies the testing, analysis, and experience of many users and manufacturers. Where specific manufacturer's

recommendations are made, those recommendations shall supersede the recommendations of this document.

This document describes the successful procedures and practices associated with brake hose assemblies usage by a wide cross section of manufacturers and users over several years. The practices are expected to be applicable to all brake hose assemblies which qualify under SAE J1401.