SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1402 AUG2010

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Superseding J1402 JAN2005

Automotive Air Brake Hose and Hose Assemblies

RATIONALE

This revision corrects an error on the direction of the layline in Figure 2 and adds an explanation of the meaning of a cycle in clause 8.4.

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 with air pressures up to 1 MPa, 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 +100 °C.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J517 Hydraulic Hose

SAE J1401 Road Vehicle—Hydraulic Brake Hose Assemblies for Use with Nonpetroleum-Base Hydraulic Fluids

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B 117 Standard Test Method of Salt Spray (Fog) Testing

ASTM D 380 Standard Test Methods for Rubber Hose

ASTM D 413 Test Methods for Rubber Property—Adhesion to Flexible Substrate

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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3. HOSE CONSTRUCTIONS AND DIMENSIONS

There are four distinct hose constructions used for air brake hose assemblies made from reinforced elastomeric hose. All dimensions are in accordance with Tables1 and 2.

Type A consists of an elastomeric tube, a fiber reinforcement and an elastomeric cover.

Type AI consists of an elastomeric tube, a wire or fiber reinforcement and a fiber braid cover.

Type AII consists of an elastomeric tube, a wire or fiber reinforcement and a fiber braid or elastomeric cover. This hose is dimensionally identical to SAE J517 100R5 hose.

Type AIII consists of an elastomeric tube, wire or fiber reinforcement and a fiber braid or elastomeric cover.

TABLE 1 - INSIDE AND OUTSIDE DIAMETERS FOR TYPE A AND AIII HOSES

All dimensions in mm, unless otherwise specified

Metric Size	Inch Size (Ref)	SAE Type A Dash Size (Ref)	Type A I.D. Min	Type A I.D. Max	Type A O.D. Min	Type A O.D. Max	SAE Type AIII Dash Size (Ref)	Type AIII I.D. Min	Type AIII I.D. Max	Type AIII O.D. Min	Type AIII O.D. Max
6.3	1/4	-4	5.8	6.9	15.1	16.7	-4	6.2	7.0	12.0	14.0
8	5/16	-5	7.3	8.5	16.7	18.3					
10	3/8	-6	8.9	10.1	18.3	19.8	-6	9.3	10.1	15.5	17.5
11.5	7/16	-7	10.3	11.9	19.8	21.4					
12.5 SP	1/2 SP	-8	11.9	13.5	21.4	23.0					
12.5	1/2						-8	12.3	13.5	19.0	21.0
16	5/8	-10	15.1	16.7	26.2	27.8	-10	15.5	16.7	22.7	24.7

NOTE: The sizes 3/8, 7/16 and 1/2 SP of Type A hose can be assembled with field attachable fittings if desired. These field attachable fittings are not the same as used with Types AI and AII hoses. AIII hoses are assembled with permanent crimp fittings only.

TABLE 2 - INSIDE AND OUTSIDE DIAMETERS FOR TYPE AI AND AII HOSES

All dimensions in mm, unless otherwise specified

Metric Size	Inch Size (Ref)	SAE Type AI and AII Dash Size (Ref)	Type AI and AII I.D. Min	Type AI and AII I.D. Max	Type AI O.D. Min	Type AI O.D. Max	Type AII O.D. Min	Type AII O.D. Max
5	3/16	-4	4.8	5.5	12.0	13.0	12.7	13.7
6.3	1/4	-5	6.4	7.2	13.6	14.6	14.3	15.3
8	5/16	-6	7.9	8.7	15.1	16.2	16.7	17.6
11	13/32	-8	10.3	11.1	18.1	19.3	18.9	20.0
12.5	1/2	-10	12.7	13.7	20.5	21.7	22.8	24.0
16	5/8	-12	15.9	17.0	23.7	24.9	26.8	28.0

4. FITTINGS

4.1 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 Type A or AIII hose in Table 1 and AI or AII hose in Table 2.

4.2 For Field Attachable Fittings

When the hose is assembled with field attachable fittings, the hose portion of the hose assembly shall conform to the dimensional requirements for all sizes of Type AI or AII hose in Table 2 or shall conform to the dimensional requirements of 3/8, 7/16 and 1/2 SP Type A hose from Table 1. The field attachable fittings for Type A hose are not the same as used with Types AI and AII hoses.

NOTE: The sizes 3/8, 7/16 and 1/2 SP of Type A hose can be assembled with field attachable fittings if desired. These field attachable fittings are not the same as used with Types AI and AII hoses.

5. MINIMUM BEND RADIUS

Table 3 contains the minimum bend radii recommended for vehicle installations.

TABLE 3 - RECOMMENDED MINIMUM BEND RADIUS

Metric Size	Inch Size (Ref)	Minimum Bend Radius To Inside of Bend (mm)
5	3/16	50
6.3	1/4	65
8	5/16	75
10	3/8	90
11	13/32	90
11.5	7/16	100
12.5 SP	1/2 SP	100
12.5	1/2	100
16	5/8	115

6. IDENTIFICATION

6.1 Hose

Each hose manufacturer shall incorporate into the hose construction an identification yarn as assigned by the RMA and as shown in Appendix A, Table A1 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 600 mm or less along the entire length of hose in legible block capital letters at least 3 mm high with the following minimum information in the order listed:

a. The hose manufacturer's identification XXXXX

b. The words "AIR BRAKE" to identify specific hose application

c. The hose metric size, such as Size 8

d. SAE J1402

Example: XXXXX AIR BRAKE Size 8 SAE J1402

In addition, each air brake hose shall be labeled with either an A, AI, AII, or AIII, identifying whether the hose has been manufactured to the dimensions of A, AI, AII, or AIII hose as shown in Tables 1 and 2. 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.

6.2 Fittings

Each field attachable air brake hose fitting shall be permanently etched, embossed or stamped in legible block capital letters at least 1.5 mm high with the coupling manufacturer's identification, hose size and whether they are intended for use with Type A, AI, or AII hose.

6.3 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 3 mm high with the following information:

a. 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.

b. The assembler's identification and additional information as required.

7. PERFORMANCE

NOTE 1: 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: Burst Strength and Assembly Tensile Strength tests are qualification tests and do not imply that the hose assemblies can be used under those conditions.

7.1 Acceptance Performance

Hose or hose assemblies at the time of manufacture shall conform to the following:

7.1.1 End Fittings

End fittings shall be such as to permit conformance to all portions of this recommended practice. After assembly of the end fittings to the hose, the minimum I.D. of the end fittings or the hose shall not be less than 66% of the minimum hose ID shown in Table 1. All hose assemblies shall pass this requirement prior to conducting any other test in this recommended practice.

7.1.2 Proof Pressure

Assemblies subjected to a pressure test using 2 MPa ± 0.1 MPa air or nitrogen under water for a minimum of 30 s shall show no leaks.

7.1.3 Burst Strength

There shall be no hose burst, leakage or end fitting separation below 6 MPa when hose or hose assemblies are subjected to a hydrostatic burst test using water.

7.1.4 Assembly Tensile Strength

450 mm long hose assemblies including the fittings shall be subjected to a longitudinal tensile test at a steady rate of 25 mm/min ± 2.5 mm/min until separation of the hose from the fittings or rupture of the hose occurs. Failure of the 6.3 mm and smaller size shall occur at no less than 1100 N and larger sizes at no less than 1450 N.

7.1.5 Length Change

Test for length change shall be conducted in accordance with ASTM D 380 (Elongation and Contraction) with the original measurement made at 0.1 MPa. The change in length shall be determined at 1.5 MPa and shall be from +5% to –7%.

7.1.6 Adhesion

Tests for adhesion shall be conducted only on original unaged specimens as follows:

7.1.6.1 Adhesion of Fiber Reinforced Hose

Test for adhesion shall be conducted in accordance with ASTM D 413 Machine Method, and the average load required to separate any adjacent layers shall be 1.4 N/mm minimum.

Type AIII consists of an elastomeric tube, wire or fiber reinforcement and a fiber braid or elastomeric cover.

7.1.6.2 Adhesion of Wire Reinforced Hose

The requirements and method of testing cover adhesion for Type AI, AII, and AIII hoses with wire reinforcement shall be as in 7.1.6.1. The integrity of the inner tube adhesion shall be tested by subjecting a length of hose not less than 380 mm long to the following requirements:

Place a steel ball of the size specified in Table 4 in the bore of the hose. One end of the hose shall be attached to a vacuum source and the other end plugged. A vacuum of 17 kPa absolute shall be applied for a period of 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 degrees to the minimum bend radius in Table 3 in each of two directions 180 degrees 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 inner tube from the reinforcement layer and shall constitute failure.

TABLE 4 - BALL SIZE FOR TESTING ADHESION OF WIRE REINFORCED HOSE

Metric Size	5	6.3	8	11	12.5	16
Inch Size (Ref)	3/16	1/4	5/16	13/32	1/2	5/8
Ball Size (mm)	3.5	4.5	6.0	7.5	9.5	12.0

7.2 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 5, including the specified sequential test procedure.

TABLE 5 - MINIMUM SAMPLING AND SEQUENTIAL TEST PROCEDURE

Sample No.	Subjected to	Followed by
1	7.1.1(1)	7.2.1.1 then 7.1.2
2	7.1.1(1)	7.2.1.2 then 7.1.2
3	7.2.2.1	–
4	7.1.1(1)	7.2.2.2 then 7.1.4
5	7.2.2.3	–
6	7.1.1(1)	7.2.2.4 then 7.1.3
7	7.1.1(1)	7.1.5 then 7.1.2 and 7.1.3
8	7.1.6	–
9	7.1.1(1)	8.

1. Couple hose before starting tests or aging.

7.2.1 Temperature Resistance

7.2.1.1 High Temperature Resistance

The hose portion of a hose assembly 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 100 °C ± 2 °C. The radius of the test form shall be in accordance with Table 3. The external surface of fiber braid covered hoses shall be exempt from inspection for cracks as visual inspection is not practical.

After completion of this test, the hose assembly shall be tested in accordance with 7.1.2.

7.2.1.2 Low Temperature Resistance

The hose shall show no cracks externally or internally when bent 180 degrees over a form having the radius shown in Table 3 after hose and form have been exposed for a period of 70 h ± 2 h in an air circulating chamber at –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 to 5 s. The external surface of fiber braid covered hoses shall be exempt from inspection for cracks as visual inspection is not practical.

7.2.2 Resistance to Environment

7.2.2.1 Oil

Specimens prepared from the inner tube and the cover shall show a volume increase when measured after removal from ASTM IRM 903 oil in which it has been immersed for 70 h ± 2 h at 100 °C ± 2 °C of not more than 100%.

7.2.2.2 Water

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

After completion of this test, the hose assembly shall be tested in accordance with 7.1.4.

7.2.2.3 Ozone

After being exposed for 70 h ± 2 h in an ozone test cabinet with an atmosphere comprised of air and ozone with an ozone partial pressure of 100 mPa (100 parts of ozone per 100 million parts of air) at standard atmospheric conditions at an ambient temperature of 40 °C ± 2 °C and while bent over a form having the radius shown in Table 3, the hose shall show no cracking under 7X magnification. This test only applies to elastomeric covered hoses.

7.2.2.4 Salt Spray Test

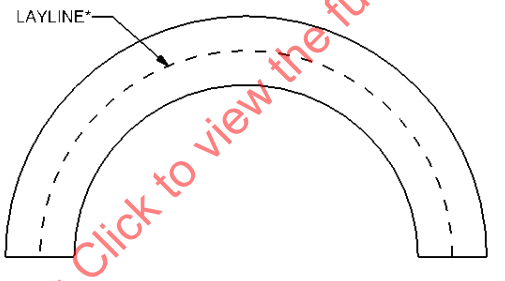
A hose assembly, while supported or suspended between 15 and 30 degrees from vertical, shall withstand 24 h ± 1 h exposure to salt spray when tested in accordance with ASTM B 117. After this exposure, fittings shall show no base metal corrosion except red rust is acceptable in areas of identification stamping and crimp distortions. White corrosion products are acceptable.

After completion of this test, the hose assembly shall be tested in accordance with 7.1.3.

8. FLEXURE TEST

8.1 Preparation of Test Samples

8.1.1 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) as shown in Figure 1.



MARKED WHEN PREPARING SAMPLES FOR
TEST PER 8.1.1, NOT MANUFACTURER'S LAYLINE

FIGURE 1 - HOSE MARKING

8.1.2 Cut the hose to provide a hose assembly sample with a free hose length as shown in Figure 2 and Table 6. Free hose length is the outside exposed hose length between the fittings in the finished hose assembly.

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

8.2 Preconditioning

Subject each sample hose assembly to the salt spray conditioning specified in 8.2.1, followed by the high temperature aging specified in 8.2.2.

8.2.1 Salt Spray Conditioning

With the ends plugged, subject the hose assembly samples to 24 h ± 1 h exposure to salt spray testing in accordance with ASTM B 117.

Allow no more than 168 h elapsed time between completion of the salt spray conditioning and the start of the high temperature aging per 8.2.2.