Metallic Air Brake System Tubing and Pipe—SAE J1149

SAE Standard
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LAND SEA AIR SPACE

PREPRINT

METALLIC AIR BRAKE SYSTEM TUBING AND PIPE—SAE J1149

SAE Standard

This standard was formerly designated SAE J844 approved June 1963 and completely revised July 1976.

Scope—This SAE standard covers minimum requirements for two *types* of metallic tubing and pipe as used in automotive air brake systems. It includes material and performance specifications, corrosion precautions, and installation recommendations. Copper tubing is designated *Type 1*, and galvanized steel pipe *Type 2*.

Corrosion Precautions—In the design and selection of air brake system components, adequate provision shall be made to control corrosion due to galvanic coupling of widely dissimilar metals and alloys when such materials used for tubing, pipe, fittings, and attaching or supporting parts are in intimate contact with each other. Also, adequate provision shall be made to protect the tubing, pipe, and fittings from oxygen concentration cell type of corrosion. Where soft nonmetallic cushions are used to prevent metal-to-metal contact between supporting components and the tubing, pipe, and fittings, the cushioning material shall be such that it will not absorb and retain significant amounts of water.

Installation Recommendations—The tubing or pipe installed in air brake systems shall be supported in such a manner as to minimize fatigue conditions. Metal-to-metal contact should be avoided by the use of soft nonmetallic cushions at points of support to control chafing and fretting. Tubing or pipe shall be protected against road hazards either by installation in a protected location or by providing adequate shielding at vulnerable areas. Protective loom, where used, shall be both water and acid resistant.

Specifications

Type 1—Copper Tubing

Scope—This material specification covers the minimum requirements for seamless annealed copper tubing that shall be used for automotive air brake lines.

Manufacture—The tubing shall be seamless cold drawn to size and bright annealed as a final operation in such a manner as to produce a finished product which will meet all requirements of this standard.

Dimensions and Tolerances—The finished tubing shall conform to the dimensions and tolerances shown in Table 1, for the nominal diameter specified by the purchaser.

Quality—The finished tubing shall be clean, smooth, and round, free from internal and external mechanical imperfections, corrosion, scale, seams, and cracks.

Material—The tubing shall be made from phosphorized, low residual phosphorus copper conforming to SAE J463, UNS C12200 which has the following chemical composition:

Element	Ladle Analysis % by Weight
Copper	99.90 min
Phosphorus	0.015-0.040

Mechanical Properties—The finished tubing shall have mechanical properties as tabulated below:

Yield Strength psi (MPa) min[a]	Tensile Strength psi (MPa) max	Elongation in 2 in (50 mm), % min Tubing O.D. 3/4 in (19 mm) and smaller	Over 3/4 (19 mm)
9000 (62)	30 000 (210)	30	40

[a] At 0.5% extension under load.

Grain Size—The tubing shall be furnished in either of two temper conditions with grain size as tabulated below:

Temper	Grain Size, mm
Light Annealed	0.015-0.040
Soft Annealed	0.040 min

Performance Requirements—The finished tubing shall satisfactorily meet the following performance tests. Test specimens shall be taken from tubing which has not been subjected to cold working after the anneal of the finished sized tubing.

Flaring Test—A test section cut from the finished tubing, having squared and deburred ends, shall withstand being flared at one end over a polished tapered mandrel of 60 deg included angle until the actual average outside diameter is increased 40% without evidence of splitting or flaws. The axis of the mandrel and axis of the tubing shall be kept parallel during the flaring process and the test may be made in a die to restrict the expansion to 40%.

Pressure Proof Test—Unless otherwise specified, tubing supplied under this standard shall withstand, with no evidence of failure, a hydrostatic proof test at a pressure equivalent to a yield stress of 9000 psi (62 MPa). The test pressures shall be as determined from Barlow's formula for thin hollow cylinders under tension:

$$P = \frac{2000\ TS}{D}$$

TABLE 1—DIMENSIONS AND TOLERANCES OF AIR BRAKE TUBING

Nominal Tubing O.D. (in)	Outside Diameter[a] Specified in	Specified mm	Tolerance ± in	Tolerance ± mm	Wall Thickness (min) in	Wall Thickness (min) mm
1/4	0.250	6.35	0.002	0.05	0.0295	0.75
5/16	0.312	7.92	0.002	0.05	0.0295	0.75
3/8	0.375	9.52	0.002	0.05	0.0295	0.75
7/16	0.437	11.10	0.002	0.05	0.0455	1.160
1/2	0.500	12.70	0.002	0.05	0.0455	1.160
5/8	0.625	15.87	0.002	0.05	0.0455	1.160
3/4	0.750	19.05	0.0025	0.06	0.0455	1.160
1	1.000	25.40	0.0025	0.06	0.0455	1.160

[a] The actual outside diameter shall be the average of the maximum and minimum outside diameters as determined at any one cross section through the tubing.

where:

D = outside diameter of tubing, in (mm)
P = hydrostatic pressure, psi (kPa)
S = allowable unit stress of material = 9000 psi (62 MPa)
T = minimum wall thickness of tubing, in (mm)

The test pressure at a yield strength of 9000 psi (62 MPa) for the minimum wall thicknesses allowed are given in Table 2.

Air Pressure Test—Each length of finished tubing shall be tested at the maximum operating air pressure, as specified by the purchaser. The tubing shall show no leakage at the test pressure. An electric eddy current test may be substituted for the air pressure test, providing the rejection limits are such that the hydrostatic and air pressure requirements can be guaranteed.

Identification—Tubing shall be permanently and legibly marked at intervals not greater than 15 in (381 mm) with the words *Air Brake*.

Methods of Test—All tests to determine conformance with the foregoing specifications shall be conducted in accordance with the following ASTM Standards:

Chemical Analysis—See ASTM E 62, Method of Test for Antimony in Copper and Copper Base Alloys.

Grain Size—See ASTM E 79, Methods for Estimating the Average Grain Size of Wrought Copper and Copper Base Alloys.

Tensile—See ASTM E 8, Methods of Tension Testing of Metallic Materials.

Type 2—Galvanized Steel Pipe

Scope—This material specification covers the minimum requirements for pipe that shall be used in automotive air brake lines.

Specifications—Welded or seamless steel pipe shall be Schedule 40, Zinc Coated (galvanized by the hot dip process), and manufactured in accordance with ASTM A 120, Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses.

Dimensions and Tolerances—The finished pipe shall conform to the dimensions and tolerances listed for the several nominal sizes in Table 3.

Pipe Threads—Both ends of lengths of pipe shall be threaded after coating, unless there is specific authorization to the contrary, to conform to Dryseal American Standard Taper Pipe Thread (NPTF). Specifications for pipe threads are given in detail in SAE J476.

TABLE 2—HYDROSTATIC TEST PRESSURES FOR AIR BRAKE TUBING

Nominal Tubing O.D., in	Hydrostatic Test Pressure		Nominal Tubing O.D., in	Hydrostatic Test Pressure	
	psi	kPa		psi	kPa
1/4	2100	14 500	1/2	1600	11 000
5/16	1700	11 700	5/8	1300	8950
3/8	1400	9650	3/4	1000	6900
7/16	1800	12 400	1	800	5500

TABLE 3A—DIMENSIONS AND TOLERANCES OF PIPE FOR AIR BRAKE USE, in

Nominal Pipe Size	Outside Diameter			Inside Diameter (Ref)	Wall Thickness		Threads Per in	Weight Per Ft,[a] lb ±5%
	Specified	Tolerance Plus	Tolerance Minus		Specified	min		
1/8	0.405	0.016	0.031	0.269	0.068	0.060	27	0.24
1/4	0.540	0.016	0.031	0.364	0.088	0.077	18	0.42
3/8	0.675	0.016	0.031	0.493	0.091	0.080	18	0.57
1/2	0.840	0.016	0.031	0.622	0.109	0.095	14	0.85
3/4	1.050	0.016	0.031	0.824	0.113	0.099	14	1.13
1	1.315	0.016	0.031	1.049	0.133	0.116	11.5	1.68

[a]Nominal Weight Plain Ends

TABLE 3B—DIMENSIONS AND TOLERANCES OF PIPE FOR AIR BRAKE USE (mm)

Outside Diameter mm	Tolerance		Inside Diameter (Ref)	Wall Thickness		Threads Per in	Nominal Weight Plain Ends kg/m ± 5%	Nominal in Size
Specified	min	max		Specified	min			
10.29	9.50	10.67	6.83	1.73	1.52	27	0.36	1/8
13.72	12.93	14.10	9.25	2.24	1.96	18	0.63	1/4
17.14	16.36	17.53	12.52	2.31	2.03	18	0.85	3/8
21.34	20.55	21.72	15.80	2.77	2.41	14	1.27	1/2
26.67	25.88	27.05	20.93	2.87	2.51	14	1.68	3/4
33.40	32.61	33.78	26.64	3.38	2.95	11.5	2.50	1