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SURFACE VEHICLE STANDARD

SAE J1131

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An American National Standard

Performance Requirements for SAE J844 Nonmetallic Tubing and Fitting Assemblies Used in Automotive Air Brake Systems

1. ***Scope—***This SAE Standard is intended to establish uniform methods of testing SAE J844 tubing and fitting assemblies as used in automotive air brake systems.

This document also establishes minimum qualifications for tensile and pressure capabilities, vibrational durability under cyclic temperatures, serviceability, and fitting compatibility requirements. The specific tests and performance criteria applicable to the tubing are set forth in SAE J844.

NOTE—The test values contained in this document are for test purposes only. For environmental and usage limitations see SAE J844. Fittings—A type of fitting for use with SAE J844 nonmetallic tubing is included in SAE J246; however, it is not intended to restrict or preclude the use of other designs of fittings that comply with this document.

2. ***References***

2.1 **Applicable Publications—**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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J246—Spherical and Flanged Sleeve (Compression) Tube Fittings
SAE J844—Nonmetallic Air Brake System Tubing

3. ***Tension Tests***

3.1 **Description—**Both hot and cold tensile tests shall be conducted with different unaged assemblies (fittings attached within 30 days of test date). Tests consist of subjecting the assembly to increasing tension load in a suitable testing machine until the specified force values or elongation percentages are obtained.

3.2 **Apparatus—**A tension testing machine with suitable indicating device shall be used for the tension test. The fixtures for holding the test specimens shall be arranged so that the tubing and fittings have a straight center line corresponding to the direction of the machine pull. The lower part of the fixture shall be equipped with a container of sufficient dimensions to submerge the required length of tubing in water. A means of heating the water to boiling shall be provided.

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3.3 Test Specimens—Obtain tubing specimens from current production stock and cut to a length sufficient to obtain 152 mm ± 0.625 mm (6 in ± 0.25 in) of tubing between end fittings after assembly. Assemble fittings to the tubing using the manufacturer's recommendations.

3.4 Procedure

3.4.1 HOT PULL—Place the test specimen in the tensile machine with the lower fitting and 102 mm $^{+0.625}_{-0.0}$ (4 in $^{+0.25}_{-0.0}$) of tubing submerged below the surface of the boiling distilled water such that the outside diameter is exposed to the water. Continue boiling for 5 min $^{+0.5}_{-0.0}$ min. Apply load at a rate of pull of 25 mm (1 in) per min.

3.4.2 CONDITIONED PULL TEST—Soak test specimen in air at –40 °C ± 3 °C (–40 °F ± 5 °F) for 30 min $^{+0.5}_{-0.0}$ min, normalize at room temperature, and submerge in boiling water for 15 min. Repeat for a total of four complete cycles. Allow the test specimen to normalize at room temperature for 30 min. Conduct the tensile test within 30 min after the normalizing period while at ambient temperature of 24 °C ± 3 °C (75 °F ± 5 °F). Apply load at a rate of pull of 25 mm (1 in) per min.

3.5 Requirements—The test specimen shall elongate 50%, that is, 152 mm (6 in) increased to 229 mm (9 in), or shall withstand the load shown in Table 1, without causing separation from the fitting.

TABLE 1—REQUIREMENTS

Nominal Tubing OD mm(1)	Nominal Tubing OD in	Tensile Load N	Tensile Load lb
3.2	1/8	67	15
4.0	5/32	178	40
4.8	3/16	178	40
6.4	1/4	222	50
7.9	5/16	334	75
9.5	3/8	667	150
12.7	1/2	890	200
15.9	5/8	1446	325
19.0	3/4	1557	350

1. For reference only.

4. Vibration Test

4.1 Description—This test is designed to evaluate the effects of vibration under varying ambient temperatures on a tubing and fitting assembly. Leakage rate is used to gage acceptability.

4.2 Apparatus—Equipment capable of vibrating one end of the test specimen at 600 cpm through 12.7 mm (0.5 in) displacement in a plane perpendicular to the tube while the other end is held rigid. The distance between the static and vibrating heads is to be such that when the assembly is displaced 0.5 in, no parallel pull to the longitudinal axis of the assembly will occur. The equipment must be capable of controlling the ambient air temperature between –40 °C ± 3 °C (–40 °F ± 5 °F) and 104 °C ± 3 °C (220 °F ± 5 °F) and of applying 827 kPa ± 69 kPa (120 psig ± 10 psig) dry air to the test lines. A mass flow meter capable of determining air leakage shall be provided.

4.3 Test Specimens—Cut tubing specimens to a length sufficient to obtain 457 mm (18 in) between fittings after assembly. Assemble identical fittings to the tubing using the manufacturer's recommendations. Fitting attaching nuts are not permitted to be retightened during the test.

4.4 **Procedure—**Allowing 12.7 mm (0.5 in) slack, mount the lines straight in the vibration machine. Oscillate one end of the lines at 600 cycles per min ± 20 cycles per min through a total stroke of 12.7 mm (0.5 in) for a total of 1 000 000 $^{+50\ 000}_{-0.0}$ cycles, while maintaining an internal pressure of 827 kPa ± 69 kPa (120 psig ± 10 psig) using dry air. Starting at 104 °C ± 3 °C (220 °F ± 5 °F), vary the ambient air temperature from 104 °C ± 3 °C (220 °F ± 5 °F) to –40 °C ± 3 °C (–40 °F ± 5 °F) at 250 000 vibration cycle intervals approximately 7 h intervals). Using a mass flow meter observe for fitting leakage during and after the test. Check nut tightness after completing the test.

4.5 **Requirements—**The test specimen is considered a failure if leakage exceeds 50 cm^3/min at –40 °C ± 3 °C (–40 °F ± 5 °F) or 25 cm^3/min at 21 °C ± 3 °C (70 °F ± 5 °F). The fitting is considered a failure if the attaching nut becomes loose. This is defined as follows:

1. Record the initial tightening torque.
2. At the conclusion of the test, attempt to tighten the nut further by applying 20% of the initial tightening torque in the tightening direction. Do not apply a higher torque and do not apply any torque or force in the loosening direction.
3. If the nut moves at all under the 20% torque, it shall be defined as a loose nut and failure of the test. Record the movement in degrees to reach 20%.

5. Proof and Burst Pressure Test

5.1 **Description—**This test is intended to evaluate fitting retention at proof pressure (50% of minimum burst) and at minimum burst pressure as listed in the latest issue of SAE J844.

5.2 **Apparatus—**The test apparatus consists of a suitable source of hydraulic pressure and the necessary gages and piping.

5.3 **Test Specimen—**Cut tubing specimens to obtain 305 mm (12 in) between fittings after assembly. Assemble fittings to the tubing using the manufacturer's recommendations.

5.4 **Procedure—**Plug one end of the test specimen and mount in the apparatus with the end unrestrained. Apply proof pressure at room temperature, 24 °C ± 3 °C (75 °F ± 5 °F) to the test specimen and hold for 30 s. Increase pressure at a constant rate so as to reach the specified minimum burst pressure within a time period of 3 to 15 s.

5.5 **Requirements—**Fittings shall not separate from the tubing nor shall the assembly visibly leak at less than specified minimum burst pressure.

6. Serviceability Test

6.1 **Description—**This test is intended to evaluate the effects of repeated assembly and disassembly of a tubing and fitting assembly. Leakage rate is used to gage acceptability.

6.2 **Apparatus—**The test apparatus consists of a suitable source of pneumatic pressure and the necessary gages and piping. A mass flow meter capable of determining air leakage shall be provided.

6.3 **Test Specimens—**Cut tubing specimens to obtain 305 mm (12 in) between fittings after assembly. Assemble fittings to the tubing using manufacturer's recommendations.

6.4 **Procedure—**The tubing and fitting connections shall be disassembled and reassembled for a minimum of five times. After the fifth reassembly, pressurize the test specimens with air to 827 kPa ± 69 kPa (120 psig ± 10 psig) at room temperature, 24 °C ± 3 °C (75 °F ± 5 °F), and check for leakage.

6.5 **Requirements—**Leakage rate must not exceed 25 cm^3/min.

7. Fitting Compatibility Test

7.1 Description—This test is intended to evaluate the effects of high and low temperatures on fitting performance.

7.2 Apparatus—The test apparatus consists of a suitable source of hydraulic pressure, 3103 kPa ± 69 kPa (450 psig ± 10 psig), and necessary gages and piping in environmental test chambers at 93 °C ± 3 °C (200 °F ± 5 °F) and –40 °C ± 3 °C (–40 °F ± 5 °F).

7.3 Test Specimens—Cut tubing specimens to obtain 305 mm (12 in) between fittings after assembly. Assemble fittings to the tubing using manufacturer's recommendations.

7.4 Procedure—Fill test specimens with hydraulic fluid and subject to 93 °C ± 3 °C (200 °F ± 5 °F) and atmospheric pressure for 24 h $^{+1}_{-0.0}$ h then apply internal pressure of 3103 kPa ± 69 kPa (450 psig ± 10 psig) for 5 min while maintaining temperature of 93 °C ± 3 °C (200 °F ± 5 °F). Reduce to atmospheric pressure and permit test specimens to return to room temperature; then subject test specimens to –40 °C ± 3 °C (–40 °F ± 5 °F) and atmospheric pressure for 24 h. Apply internal pressure of 3103 kPa ± 69 kPa (450 psig ± 10 psig) for 5 min $^{+0.5}_{-0.0}$ min while maintaining temperature of –40 °C ± 3 °C (–40 °F ± 5 °F).

7.5 Requirements—Tubing shall not rupture or disconnect from the fittings.

PREPARED BY THE SAE FLUID CONDUCTORS AND CONNECTORS TECHNICAL COMMITTEE SC4—AIR BRAKE TUBING AND TUBE FITTINGS