

	SURFACE VEHICLE STANDARD		SAE J524	REV. DEC2007
	Issued	1954-01		
	Revised	2007-12		
		Superseding	J524 FEB1996	
Seamless Low-Carbon Steel Tubing Annealed for Bending and Flaring				

RATIONALE

This five year review of this standard resulted in changes identified by the bar on the left side of the page and are described as follows:

- Added SAE and other international standards to the "Related Publications" section because these documents are related to SAE J524 tubing.
- In Section 8, Performance Requirements, removed un-needed SAE J1677 paragraph numbering to eliminate unnecessary confusion.
- In Section 8, Performance Requirements, added reverse flattening, hardness, tensile and elongation test.

1. SCOPE

This SAE Standard covers cold drawn and annealed seamless low-carbon steel pressure tubing intended for use as hydraulic lines and in other applications requiring tubing of a quality suitable for flaring and bending.

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 version of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE, 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 J409 Product Analysis—Permissible Variations from Specified Chemical Analysis of a Heat or Cast of Steel

SAE J1677 Tests and Procedures for Steel and Copper Nickel Tubing

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this document.

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2.2.1 SAE Publications

Available from SAE, 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 J514	Hydraulic Tube Fittings
SAE J533	Flares for Tubing
SAE J1065	Nominal Reference Working Pressures for Steel Hydraulic Tubing
SAE J1453	Fitting—O-Ring Face Seal
SAE J2551	Recommended Practices for Fluid Conductor Metallic Tubing Applications
SAE J2592	Carbon Steel Tubing for General Use—Understanding Nondestructive Testing for Carbon Steel Tubing
SAE J2658	Metallic Tube Conductor Assemblies for Fluid Power and General Use—Test Methods for Hydraulic Fluid Power Metallic Tube Assemblies

2.2.2 ISO Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 3304	Plain end seamless precision steel tubes, technical conditions for delivery
ISO 5598	Fluid power systems and components—Vocabulary
ISO 8434-2	Metallic tube connections for fluid power and general use—Part: 2 37° flare fittings
ISO 8434-3	Metallic tube connections for fluid power and general use—Part: 3 ORFS fittings
ISO 10583	Hydraulic fluid power—Test methods for tube connections
ISO 10763	Hydraulic fluid power—Plain-end, seamless and welded steel tubes—Dimensions and nominal working pressures

2.2.3 ASTM Publications

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

ASTM A 513	Electric-Resistance-Welded Carbon and Alloy Steel Tubing
ASTM A519	Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A 450/A 450M	Standard Specifications for General Requirements for Carbon, Ferritic Alloy and Austenitic Alloy Steel Tubing

3. MANUFACTURE

The tubing shall be cold drawn to size and after forming shall be annealed in such a manner as to produce a finished product which will meet all requirements of this document.

4. DIMENSIONS AND TOLERANCES

The tolerances applicable to tubing outside diameter are shown in Table 1. The wall thickness shall not vary more than $\pm 10\%$ for tubing having 12.7 mm or larger, nominal inside diameter nor more than $\pm 15\%$ for tubing having a smaller nominal inside diameter. Tubing outside diameter and wall thickness shall be as specified by purchaser.

TABLE 1 - TUBING OUTSIDE DIAMETER TOLERANCES

Nominal Tubing OD ⁽¹⁾⁽²⁾ mm	OD Tolerance $\pm$ mm
Up to 25.4	0.10
Over 25.4 to 38.1 inclusive	0.15
Over 38.1 to 50.8 inclusive	0.20
Over 50.8 to 88.9 inclusive	0.25

1. 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.
2. Refer to SAE J514 for nominal tubing outside diameters to be used in conjunction with standard hydraulic tube fittings.

5. QUALITY

Lengths of finished tubing shall be reasonably straight and have smooth ends free from burrs. Tubing shall be free from scale and injurious defects and have a workmanlike finish. Surface imperfections such as handling marks, die marks, or shallow pits shall not be considered injurious defects provided the imperfections are within the tolerances specified for diameter and wall thickness. The removal of such surface imperfections is not required.

6. MATERIAL

Tubing shall be made from low-carbon steel conforming to the following chemical composition as shown in Table 2.

TABLE 2 - CHEMICAL REQUIREMENTS

Element	Cast or Heat Analysis ⁽¹⁾ % by Weight
Carbon	0.18 max
Manganese	0.30 to 0.60
Phosphorus	0.040 max
Sulfur	0.050 max

1. Check analysis tolerance shall be as specified in SAE J409, Table 1.

7. MECHANICAL PROPERTIES

The finished tubing shall have mechanical properties as tabulated in Table 3:

TABLE 3 - MECHANICAL PROPERTIES

Properties	Values
Yield Strength, min	170 MPa
Ultimate Strength, min	310 MPa
Elongation in 50 mm, min	35% ⁽¹⁾
Hardness (Rockwell B), max	65 ⁽²⁾

1. For tubing having nominal outside diameter of 9.5 mm or less, and/or wall thicknesses of 0.9 mm or less, a minimum elongation of 25% is permissible.
2. The hardness test shall not be required on tubing with a nominal wall thickness of less than 1.65 mm. Such tubing shall meet all other mechanical properties and performance requirements.

8. PERFORMANCE REQUIREMENTS

The finished tubing shall satisfactorily meet the following performance tests. All tests are to be conducted in accordance with the procedures in SAE J1677.

8.1 Flattening Test

8.2 Flaring Test

8.3 Reverse Flattening Test

8.4 Expansion Test

8.5 Hardness Test

8.6 Tensile Test

8.7 Elongation Test

8.8 Pressure Proof Test

Performed when agreed upon between the purchaser and the producer (where allowable unit stress of material(s) = 140 MPa (80% of minimum yield strength)).

8.9 Nondestructive Electronic Test

This test is to be conducted after all cold-working tube manufacturing operations are performed on the tubing.

9. TEST CERTIFICATES

A certificate of compliance to the performance requirements shall be furnished to the purchaser by the producer if requested in the purchase agreement.

10. CLEANLINESS

The inside of tubing shall be clean and free from any contamination that cannot be readily removed by cleaning agents normally used in manufacturing.