SURFACE VEHICLE STANDARD

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Superseding J1677 DEC2016

Tests and Procedures for Carbon Steel and High Strength, Low Alloy Steel Tubing

RATIONALE

This SAE Standard has been revised as part of a Five-Year Review. Revisions include revised applicable and reference document sections, updated grammar and verbiage, and the additions of Figures 1 and 2 for the flattening and reverse flattening tests.

1. SCOPE

This SAE Standard is intended to establish uniform methods for testing certain types of carbon steel and high strength, low alloy steel tubing as listed in 2.1.1. The specified test and performance criteria applicable to each variety of tubing are set forth in the respective SAE J specifications.

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 +1 724-776-4970 (outside USA), www.sae.org.

SAE J356	Welded, Flash-Controlled, Low-Carbon Steel Tubing Normalized for Bending, Double Flaring, Beading, Forming, and Brazing
SAE J524	Seamless Low-Carbon Steel Tubing Annealed for Bending and Flaring
SAE J525	Welded and Cold Drawn Low-Carbon Steel Tubing Annealed for Bending and Flaring
SAE J526	Welded Low-Carbon Steel Tubing Suitable for Bending, Flaring, Beading, Forming, and Brazing
SAE J527	Brazed Double Wall Low-Carbon Steel Tubing
SAE J533	Flares for Tubing
SAE J1065	Nominal Reference Working Pressures for Steel Hydraulic Tubing

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J1677_202209/

SAE J1453-1 Specification for O-Ring Face Seal Connectors: Part 1 - Tube Connection Details and Common Requirements for Performance and Tests

SAE J1453-2 Specification for O-Ring Face Seal Connectors: Part 2 - Requirements, Dimensions, and Tests for Steel Unions, Bulkheads, Swivels, Braze Sleeves, Braze-on Tube Ends, Caps, and Connectors with ISO 6149-2 Metric Stud Ends and ISO 6162 4-Bolt Flange Heads

SAE J1453-3 Specification for O-Ring Face Seal Connectors: Part 3 - Requirements, Dimensions, and Tests for Steel Unions, Bulkheads, Swivels, Braze Sleeves, Caps, and Connectors with SAE J1926-2 Inch Stud Ends

SAE J2435 Welded Flash Controlled, SAE 1021 Carbon Steel Tubing, Normalized for Bending, Double Flaring, Cold Forming, Welding, and Brazing

SAE J2467 Welded and Cold-Drawn, SAE 1021 Carbon Steel Tubing Normalized for Bending, Single Flaring, Cold Forming, Welding, and Brazing

SAE J2592 Carbon Steel Tubing for General Use, Understanding Nondestructive Testing for Carbon Steel Tubing

SAE J2613 Welded Flash Controlled, High Strength (500 MPa Tensile Strength) Hydraulic Tubing, for Bending, Double Flaring, Cold Forming, Welding, and Brazing

SAE J2614 Welded and Cold-Drawn, High Strength (500 MPa Tensile Strength) Hydraulic Tubing, for Bending, Flaring, Cold Forming, Welding, and Brazing

SAE J2832 Welded Flash Controlled, High Strength (690 MPa Tensile Strength) Low Alloy Steel Hydraulic Tubing, Stress Relieved, Annealed for Bending, Double Flaring, Cold Forming, and Brazing

SAE J2833 Welded and Cold-Drawn, High Strength (690 MPa Tensile Strength) Low Alloy Steel Hydraulic Tubing, Stress Relieved, Annealed for Bending, Flaring, Cold Forming, and Brazing

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 A370 Standard Methods and Definitions for Mechanical Testing of Steel Products

ASTM A450/A450M Standard Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes

ASTM E8/E8M Test Methods for Tension Testing of Metallic Materials

ASTM E18 Standard Test Methods for Rockwell Hardness of Metallic Materials

2.2 Related Publications

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

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J514 Hydraulic Tube Fittings

SAE J1290 Automotive Hydraulic Brake System - Metric Tube Connections

SAE J2551-1 Recommended Practices for Fluid Conductor Carbon, Alloy and High Strength Low Alloy Steel Tubing Applications - Part 1: Design and Fabrication

SAE J2551-2 Recommended Practices for Fluid Conductor Carbon, Alloy and High Strength Low Alloy Steel Tubing Applications - Part 2: General Specifications and Performance Requirements

SAE J2551-3 Recommended Practice for Fluid Conductor Carbon, Alloy and High Strength Low Alloy Steel Tubing Applications - Part 3: Procurement

SAE J2593 Information Report for the Installation of Fluid Conductors and Connectors

2.2.2 ISO Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 2944 Fluid Power Systems and Components - Nominal Pressures

ISO 3305 Plain End Welded Precision Steel Tubes - Technical Conditions for Delivery

ISO 4397 Connectors and Associated Components - Nominal Outside Diameters of Tubes and Nominal Inside Diameters of Hoses

ISO 4399 Connectors and Associated Components - Nominal Pressures

ISO 4406 Hydraulic Fluid Power - Fluids - Method for Coding the Level of Contamination by Solid Particles

ISO 5598 Fluid Power Systems and Components - Vocabulary

ISO 6162-1 Hydraulic Fluid Power - Flange Connectors with Split or One-Piece Flange Clamps and Metric or Inch Screws - Part 1: Flange Connectors for Use at Pressures of 3.5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN127

ISO 6162-2 Hydraulic fluid Power - Flange Connectors with Split or One-Piece Flange Clamps and Metric or Inch Screws - Part 2: Flange Connectors for Use at Pressures of 35 MPa (350 bar) to 40 MPA (400 bar), DN 13 to DN 51

ISO 6605 Tests and Test Procedures

ISO 8434-1 Metallic Tube Connections for Fluid Power and General Use - Part 1: 24° Compression Connectors

ISO 8434-2 Metallic Tube Connections for Fluid Power and General Use - Part 2: 37° Flared Connectors

ISO 8434-3 Metallic Tube Connections for Fluid Power and General Use - Part 3: O-Ring Face Seal Connectors

ISO 8434-4 Metallic Tube Connections for Fluid Power and General Use - Part 4: 24° Cone Connectors with Ring Weld-on Nipples

ISO 10583 Test Methods for Tube Connections

ISO 10763 Plain-End, Seamless and Welded Steel Tubes - Dimensions and Nominal Working Pressures

ISO 19879 Metallic Tube Connections for Fluid Power and General Use - Test Methods for Hydraulic Fluid Power Connections

3. TEST PROCEDURES

Unless otherwise specified, the test procedures described in the current issue of ASTM A370 shall be followed.

However, in cases of conflict between the ASTM specifications and those described herein, this SAE specification shall take precedence.

3.1 Test Frequency

There are many factors which can affect the required frequency of these tests, including:

a. Tube size

b. Production run quantity

c. Type of production equipment

d. Production methods

e. End use

f. Material

Therefore, it shall be the responsibility of the manufacturer and user to establish the test type and test frequency that will produce tubing which conforms to the SAE Standards as well as the needs and requirements of the user.

4. TEST SPECIMENS

In accordance with ASTM A370, test specimens for mechanical tests shall be smooth on the ends and free from flaws. If any test specimen exhibits burrs, flaws, or defective machining before testing, it may be discarded and another specimen may be selected. Test specimens shall be taken from tubing which has not been subjected to subsequent operations after being manufactured to the applicable specification. All tests shall be conducted at room temperature.

5. PERFORMANCE TESTS

The tests listed in this section are selected and performed based on agreement between the supplier and customer.

5.1 Flattening Test

Test specimens approximately 75 mm in length shall not crack or show any flaws when flattened between parallel plates to a distance equal to three times the wall thickness of the section under test. For welded tubing, the weld shall be placed at 90 degrees from the direction of the applied flattening force as shown in Figure 1. Superficial ruptures resulting from minor surface imperfections shall not be considered cause for rejection.

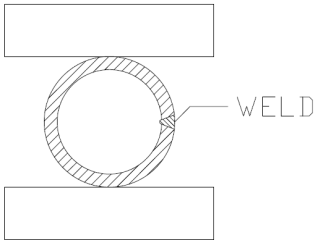

Figure 1 - Flattening test

5.2 Reverse Flattening Test

For welded tubing, test specimens shall be split longitudinally 90 degrees on each side of the weld. The section containing the weld shall be opened and flattened with the weld at the point of maximum bend as shown in Figure 2. There shall be no evidence of cracks or metal flaking, or lack of weld penetration or overlaps resulting from flash control or flash removal in the weld.

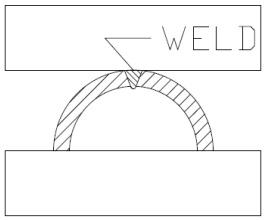

Figure 2 - Reverse flattening test

5.3 Bending Test

If a bend is required, the customer shall specify a suitable test method at the time of purchase.

5.4 Expansion Test

Test specimens shall be subjected to expansion over a hardened tapered plug having a slope of 0.1 to 1.0, until the outside diameter has been expanded 25% without evidence of cracking or flaws.

5.5 Flaring Test

5.5.1 SAE J533 37 Degree and 45 Degree Flares

5.5.1.1 Double Flare - Method A

Test sections having squared and deburred ends shall withstand being double flared at one end to the dimensions shown in SAE J533. The test section shall be held firmly and squarely in the die and the punch, while being forced down, and shall be guided parallel to the axis of the tubing. The flare shown in Figure 3 shall exhibit no evidence of splitting or flaws.

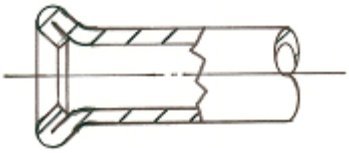

Figure 3 - 37 degree double flared tubing - method A
(Refer to SAE J533)

5.5.1.2 Double Flare - Method B

Test sections having squared and deburred ends shall withstand being double flared at one end to the dimensions shown in SAE J533. The test section shall be held firmly and squarely in the die and the punch, while being forced down and shall be guided parallel to the axis of the tubing. The flare shown in Figure 4 shall exhibit no evidence of splitting or flaws except that a separation of the outer lap joint shall be permissible providing it does not exceed 3.1 mm in length and is confined to the outer thickness only.

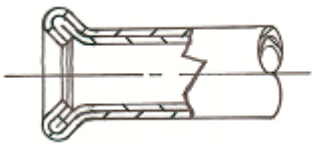

Figure 4 - 37 degree double flared double wall tubing - method B
(Refer to SAE J533)

5.5.1.3 Single Flare

Test sections having squared and deburred ends shall withstand being single flared at one end to the dimensions shown in SAE J533. The test section shall be held firmly and squarely in the die and the punch, while being forced down, and shall be guided parallel to the axis of the tubing. The flare shown in Figure 5 shall exhibit no evidence of splitting or flaws.

Figure 5 - 37 degree single flared tubing
(Refer to SAE J533)

5.5.2 SAE J1453 ORFS Flares

5.5.2.1 Double Flare

Test sections having squared and deburred ends shall withstand being double flared at one end to the dimensions shown in SAE J1453. The test section shall be held firmly and squarely in the die and the punch, while being forced down and shall be guided parallel to the axis of the tubing. The flare shown in Figure 6 shall exhibit no evidence of splitting or flaws.

Figure 6 - ORFS double flared tube end
(Refer to SAE J1453)

5.5.2.2 Single Flare

Test sections having squared and deburred ends shall withstand being single flared at one end to the dimensions shown in SAE J1453. The test section shall be held firmly and squarely in the die and the punch, while being forced down and shall be guided parallel to the axis of the tubing. The flare shown in Figure 7 shall exhibit no evidence of splitting or flaws.

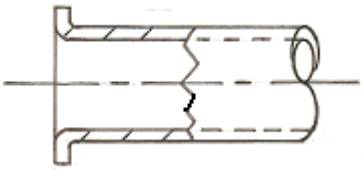

Figure 7 - ORFS single flared tube end
(Refer to SAE J1453)