SAE International™

SURFACE VEHICLE STANDARD

SAE J533 | REV. SEP2007

Issued 1947-02
Revised 2007-09

Superseding J533 DEC1999

(R) Flares for Tubing

RATIONALE

This document was rewritten and reorganized to improve flow. This specification has been updated for the purpose of the five year review and to include performance requirements as specified in Section 4. To be consistent with SAE document format, optional flare dimensions for 37° single flares were moved from the body of this document and placed in Appendix A.

1. SCOPE

This SAE Standard covers specifications and performance requirements for 37° and 45° single and double flares for tube ends intended for use with SAE J512, SAE J513, SAE J514, and ISO 8434-2 connectors. Considerations such as the effects of wall thickness selection for specific working pressures, identifying appropriate length of thread engagements for specific applications with mating connectors and other associated criteria, shall be the responsibility of the user. For applicable nominal reference working pressures for hydraulic tubing see SAE J1065 and ISO 10763.

1.1 Relationship of SAE Standard to ISO Standard

Flares as described in this updated document are compatible with ISO 8434-2—Metallic tube connections for fluid power and general use—Part 2: 37° flared connectors.

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.

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

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 TSB 003 Rules for Use of SI (Metric) Units

SAE J512 Automotive Tube Fittings

SAE J513 Refrigeration Tube Fittings—General Specifications

SAE J514 Hydraulic Tube Fittings

SAE J1065 Nominal Reference Working Pressures for Steel Hydraulic Tubing

SAE J2658 Metallic Tube Conductor Assemblies for Fluid Power and General Use—Test Methods for Hydraulic Fluid Power Metallic Tube Assemblies

2.1.2 ISO Publications

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

ISO 8434-2 Metallic tube connections for fluid power and general use

ISO 10763 Plain-end, seamless and welded steel tubes—Dimensions and nominal working pressures

2.2 Related Publications

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

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 J356 Welded Flash-Controlled Low-Carbon Steel Tubing Normalized for Bending, Double Flaring, and Beading

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

SAE J527 Brazed Double Wall Low-Carbon Steel Tubing

SAE J1176 External Leakage Classifications for Hydraulic Systems

SAE J1273 Recommended Practices for Hydraulic Hose Assemblies

SAE J1290 Automotive Hydraulic Brake System—Metric Tube Connections

SAE J1677 Tests and Procedures for Steel and Copper Nickel Tubing

SAE J2551 Recommended Practices for Fluid Conductor Metallic Tubing Applications

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

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 2944 Fluid power systems and components—Nominal pressures

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 5598 Fluid power systems and components—Vocabulary

ISO 6605 Tests and test procedures

ISO 10583 Test methods for tube connections

ISO 13486-1 Road vehicles—Hydraulic braking systems—Double-flare pipes, tapped holes, male fittings and tube seats

3. GENERAL SPECIFICATIONS

3.1 Dimensions

Dimensions in this document are based on and, unless designated otherwise, are specified in metric units.

3.1.1 Single and double 45° flares shall conform to the dimensions specified in Figure 1 and Table 1. The recommended maximum nominal wall thicknesses listed allow adequate thread engagement of tube nut to tubing normally considered suitable for flaring. Adequate thread engagement may be impaired when using wall thicknesses greater than those listed.

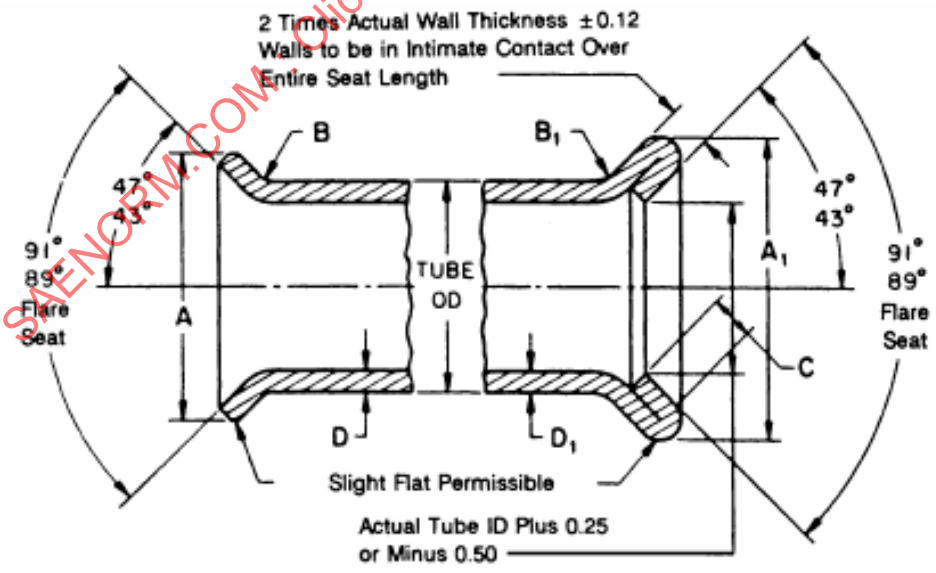

FIGURE 1 - SINGLE AND DOUBLE 45° FLARES FOR TUBING

TABLE 1 - DIMENSIONS OF SINGLE AND DOUBLE 45° FLARES FOR TUBING
SEE FIGURE 1 FOR DIMENSION CALLOUTS

Nominal Tube OD mm	Nominal Tube OD Inch	SAE Dash Sizes	A Single Flare Diameter Max mm	A Single Flare Diameter Min mm	A1 Double Flare Diameter Max mm	A1 Double Flare Diameter Min mm	B Single Flare Radius ±0.3 mm	B1 Double Flare Radius ±0.3 mm	C Double Flare Coined Seat Length Min mm	D Single Flare Wall Thickness Max mm	D1 Double Flare Wall Thickness Max mm
3.18	1/8	-2	4.6	4.4	5.4	5.0	0.5	1.0	1.0	0.89	0.63
4.76	3/16	-3	6.3	6.1	7.1	6.7	0.5	1.0	1.0	0.89	0.71
6.35	1/4	-4	8.3	8.0	9.1	8.7	0.5	1.0	1.0	1.24	0.83
7.94	5/16	-5	10.3	9.9	10.8	10.4	0.5	1.0	1.6	1.24	0.89
9.52	3/8	-6	12.4	12.0	12.7	12.3	0.5	1.0	1.6	1.65	1.24
11.11	7/16	-7	14.2	13.9	14.5	14.1	0.5	1.0	1.6	1.65	1.24
12.70	1/2	-8	15.8	15.4	16.3	15.9	0.5	1.0	1.6	2.11	1.24
14.29	9/16	-9	17.2	16.8	18.1	17.7	0.5	1.0	1.6	2.11	1.24
15.88	5/8	-10	19.0	18.6	19.6	19.2	0.5	1.0	1.6	2.41	1.24
19.05	3/4	-12	23.3	22.9	23.2	22.8	0.5	1.0	1.6	2.77	1.24
22.22	7/8	-14	26.4	26.0	27.3	26.7	0.5	1.0	1.6	2.77	1.24
25.40	1	-16	29.4	29.0	30.3	29.9	0.5	1.0	1.6	3.05	1.24

3.1.2 Single and double 37° flares shall conform to the dimensions specified in Figure 2 and Table 2. The recommended maximum nominal wall thicknesses listed allow adequate thread engagement of tube nut to tubing normally considered suitable for flaring. Adequate thread engagement may be impaired when using wall thicknesses greater than those listed.

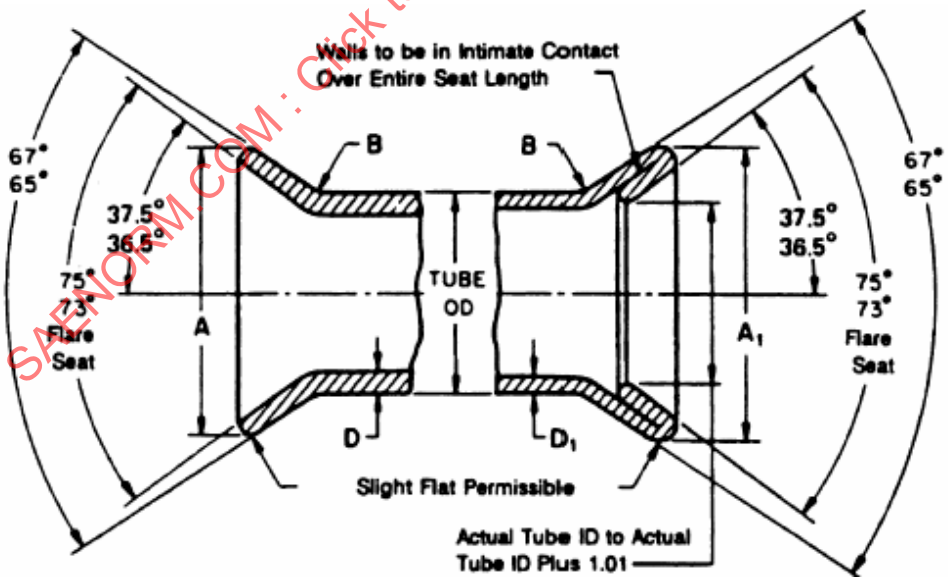

FIGURE 2 - SINGLE AND DOUBLE 37° FLARES FOR TUBING

TABLE 2 - DIMENSIONS OF SINGLE AND DOUBLE 37° FLARES FOR TUBING
SEE FIGURE 2 FOR DIMENSION CALLOUTS

Nominal Tube OD mm	Nominal Tube OD Inch	SAE Dash Sizes	**A** Single Flare Diameter Max mm	**A** Single Flare Diameter Min mm	**A1** Double Flare Diameter Max mm	**A1** Double Flare Diameter Min mm	**B** Radius ±0.5 mm	**D**(1) Single Flare Wall Thickness Max mm	**D1** Double Flare Wall Thickness Max mm
3.18	1/8	-2	5.1	4.6	5.1	4.6	0.8	0.89	0.63
4.76	3/16	-3	7.1	6.6	7.1	6.6	0.8	0.89	0.71
6.35	1/4	-4	9.1	8.6	9.1	8.6	0.8	1.65	0.89
7.94	5/16	-5	10.9	10.2	10.9	10.2	0.8	1.65	0.89
9.52	3/8	-6	12.4	11.7	12.4	11.7	1.0	1.65	1.24
12.70	1/2	-8	16.8	16.0	16.8	16.0	1.5	2.11	1.24
15.88	5/8	-10	20.1	19.3	20.1	19.3	1.5	2.41	1.24
19.05	3/4	-12	24.1	23.4	24.1	23.4	2.0	2.77	1.24
22.22	7/8	-14	27.2	26.4	27.2	26.4	2.0	2.77	1.65
25.40	1	-16	30.5	29.7	30.5	29.7	2.3	3.05	1.65
28.58	1 1/8	-18	35.1	34.3	35.1	34.3	2.3	3.05	1.65
31.75	1 1/4	-20	38.4	37.6	38.4	37.6	2.3	3.05	1.65
38.10	1 1/2	-24	43.9	43.2	43.9	43.2	2.8	3.05	1.65
44.45	1 3/4	-28	53.6	52.8	53.6	52.8	2.8	3.05	1.65
50.80	2	-32	59.9	59.2	59.9	59.2	2.8	3.40	1.65

1. For optional improved flare contact for 37° single flares, see Annex A for tube end preparation dimensions to enhance the contact area to the associated 37° flare connector.

3.2 Deburring Prior to Flaring

To assure producing satisfactory flares, it may be necessary to perform deburring operations on the tube end prior to flaring. Smoothly breaking the inside corner before single flaring ferrous, and some nonferrous tubing, is normally required to eliminate the cutoff burr which might otherwise create leakage paths across a substantial portion of the flare. Smoothly breaking the outside corner prior to single flaring, or both outside and inside corners prior to double flaring, shall be permissible on any tube material to minimize splitting.

3.3 Concentricity

The flare seat shall be concentric with the tube outside diameter within 0.38 mm full indicator reading (FIR). To promote uniformity in checking concentricity of the flare seat to the tube outside diameter, it is recommended to use the gauging method depicted in Figure 3 and the following procedure, or equivalent means.

3.3.1 Mount the tube in precision collets, dividing head, or equivalent rotational centering and clamping device with the rear of flare not more than 3 mm ahead of the collets. A minimum straight length of tube behind the flare of 25.4 mm, or twice the tube outside diameter, whichever is greater, must be available for mounting purposes.

3.3.2 Place stylus of indicator gage on the coined portion of flare seat.

3.3.3 Rotate the mounted tube through full 360 degree revolution.

3.3.4 Read the full indicator reading occurring over the 360 degrees of rotation.