INTERNATIONAL STANDARD

ISO 8434-2

Second edition
2007-09-01

Metallic tube connections for fluid power and general use —

Part 2:
37° flared connectors

Raccordements de tubes métalliques pour transmissions hydrauliques et pneumatiques et applications générales —

Partie 2: Connecteurs évasés à 37°



Reference number
ISO 8434-2:2007(E)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8434-2 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This second edition cancels and replaces the first edition (ISO 8434-2:1994), which has been technically revised.

ISO 8434 consists of the following parts, under the general title *Metallic tube connections for fluid power and general use*:

— *Part 1: 24° cone connectors*

— *Part 2: 37° flared connectors*

— *Part 3: O-ring face seal connectors*

— *Part 4: 24° cone connectors with O-ring weld-on nipple*

— *Part 6: 60° cone connectors with or without O-ring sealing*

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Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. In general applications, a fluid may be conveyed under pressure.

Components may be connected through their ports by connections (connectors), tubes and hoses. Tubes are rigid conductors; hoses are flexible conductors.

This part of ISO 8434 is based on the US standard ANSI/SAE J514 [1]. The threads for the 37° flared connection are unified inch threads in accordance with ISO 263. The inch threads were not changed to metric threads according to ISO 261 to allow connectors complying with this International Standard to be used in existing applications without requiring a change to tube or hose assemblies. Also, the thread-to-nut overtorque and seal performance have been extensively tested; to change to metric threads would require an extensive test program at considerable cost without providing any functional improvement. The threads are integral to themselves, connectors of this type match only to themselves and, other than having metric threads, no value in changing could be found. Major international companies that have used these connectors have adopted the design without noting any problems. All wrench flats specified in this part of ISO 8434 are dimensioned to be used with ISO standard metric wrenches.

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Metallic tube connections for fluid power and general use —

Part 2:
37° flared connectors

1 Scope

This part of ISO 8434 specifies general and dimensional requirements for the design and performance of 37° flared connectors that are suitable for use with ferrous and non-ferrous tubes with outside diameters from 6 mm to 50,8 mm, inclusive. These connectors are for use in fluid power and general applications within the limits of pressure and temperature specified in this part of ISO 8434.

They are intended for the connection of tubes and hose fittings to ports in accordance with ISO 6149-1, ISO 1179-1, ISO 9974-1 and ISO 11926-1. (See ISO 12151-5 for related hose fitting specification.)

These connectors provide full-flow connections with metal-to-metal sealing in hydraulic systems operating to the working pressures shown in Table 1. Because many factors influence the pressure at which a system performs satisfactorily, these values shall not be understood as guaranteed minimums. For every application, sufficient testing will need to be conducted and the results reviewed by both the user and manufacturer to ensure that required performance levels are met.

NOTE 1 For new designs in hydraulic fluid power applications, see the requirements given in 9.6. Where the requirements of the application allow for the use of elastomeric seals, connector designs that conform to International Standards and incorporate elastomeric sealing are preferred.

NOTE 2 For use under conditions outside the pressure and/or temperature limits specified, see 5.5.

Both metric and inch tubing can be accommodated by changing the sleeve (see Figure 7). In the past, these connectors have been used predominantly with inch tubing. For new and future designs, the use of metric tubing is preferred.

This part of ISO 8434 also specifies a performance and qualification test for 37° flared connectors.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 68-2, *ISO general-purpose screw threads — Basic profile — Part 2: Inch screw threads*

ISO 228-1:2000, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 263, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0.06 to 6 in*

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ISO 1127, *Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length*

ISO 1179-1[1)], *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*

ISO 1179-2:—[1)], *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 2: Heavy-duty (S series) and light-duty (L series) stud ends with elastomeric sealing (type E)*

ISO 1179-3:—[1)], *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 3: Light-duty (L series) stud ends with sealing by O-ring with retaining ring (types G and H)*

ISO 1179-4:—[1)], *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 4: Stud ends for general use only with metal-to-metal sealing (type B)*

ISO 3304, *Plain end seamless precision steel tubes — Technical conditions for delivery*

ISO 3305, *Plain end welded precision steel tubes — Technical conditions for delivery*

ISO 4759-1:2000, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 5864:1993, *ISO inch screw threads — Allowances and tolerances*

ISO 6149-1, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 1: Port with truncated housing for O-ring seal*

ISO 6149-3, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 3: Dimensions, design, test methods and requirements for light duty (L series) stud ends*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 9974-1, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing – Part 1: Threaded ports*

ISO 9974-2, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 2: Stud ends with elastomeric sealing (type E)*

ISO 9974-3:1996, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 3: Stud ends with metal-to-metal sealing (type B)*

ISO 10763, *Hydraulic fluid power — Plain-end seamless and welded precision steel tubes — Dimensions and nominal working pressures*

ISO 11926-1, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 1: Ports with O-ring seal in truncated housing*

ISO 11926-3:1995, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 3: Light-duty (L series) stud ends*

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1) To be published. (Revision of ISO 1179:1981)

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ISO 19879, *Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

3.1
adjustable stud end
stud end connector that allows for connector orientation through final tightening of the locknut to complete the connection

NOTE This type of stud end is typically used on shaped connectors (e.g. tees, crosses and elbows).

3.2
non-adjustable stud end
stud end connector that does not require specific orientation before final tightening of the connection because it is only used on straight connectors

3.3
fluid power
means whereby energy is transmitted, controlled and distributed using a pressurized fluid as the medium

[ISO 5598]

3.4
connector
connection
leakproof device to connect pipelines (conductors) to one another, or to equipment

3.5
fastening thread
terminal thread of a complete connector

3.6
run
two principal, axially aligned outlets of a tee or cross

3.7
branch
side outlet(s) of a tee or cross

3.8
chamfer
removal of a conical portion at the entrance of a thread to assist assembly and prevent damage to the start of the thread

3.9
assembly torque
torque to be applied in order to achieve a satisfactory final assembly

3.10
working pressure
pressure at which the apparatus is being operated in a given application

3.11
face-to-face dimension
distance between the two parallel faces of axially aligned outlets of a connector

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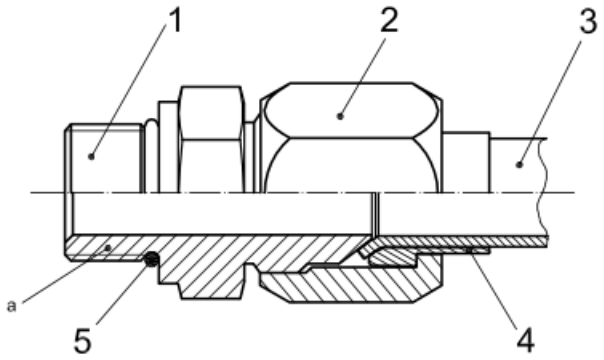
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3.12
face-to-centre dimension
distance from the face of an outlet to the central axis of an angularly disposed outlet

4 Requirements for materials

4.1 General

Figure 1 shows the cross-section and components of a typical 37° flared connector.



Key

1 straight stud connector body
2 tube nut
3 tube
4 sleeve
5 O-ring

a Stud end in accordance with ISO 1179-3, ISO 6149-3, ISO 9974-2 or ISO 11926-3.

Figure 1 — Cross-section of typical 37° flared connection

4.2 Connector bodies

Bodies shall be manufactured from carbon steel, stainless steels or copper alloys, which will provide the minimum requirements for the pressure/temperature ratings specified in Clause 5 when tested in accordance with Clause 15. They shall have characteristics that make them suitable for use with the fluid to be conveyed and to provide an effective joint.

4.3 Nuts

Nuts to be used with carbon steel bodies shall be made of carbon steel and those for use with stainless steel bodies shall be made of stainless steel unless otherwise specified. Nuts to be used with copper alloy bodies shall be made of a material similar to the bodies.

4.4 Sleeves

Sleeves shall be manufactured from a material similar to the bodies.

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5 Pressure/temperature requirements

5.1 The working pressure of the connector shall be the lower of the working pressure of the 37° flared connector connection given in Table 1 and the working pressure of the respective stud end.

5.2 Flared connectors in conformance with this part of ISO 8434 made of carbon steel shall meet or exceed without leakage the requirements to the working pressures given in Table 1 when used at temperatures from −40 °C to +120 °C with petroleum base hydraulic fluids.

5.3 Connectors made of stainless steel complying with this part of ISO 8434 shall be suitable for use at the working pressures given in Table 1 when used at temperatures from −60 °C to +50 °C. Pressure derating for connectors made from stainless steel and used at elevated temperatures shall be:

4 % at +50 °C;

11 % at +100 °C;

20 % at +200 °C.

Derating factors for temperatures between these values shall be interpolated.

5.4 Copper alloy connectors shall be suitable for use at the working pressures given in Table 1 when used at temperatures from −40 °C to +175 °C.

5.5 For applications under conditions outside the pressure and/or temperature limits given in Table 1 and in 5.1 to 5.3, the manufacturer shall be consulted.

5.6 Connectors conforming to this part of ISO 8434 shall be tested in accordance with Clause 15 to ensure that they meet or exceed the pressure requirements given in Table 1.

5.7 The pressure/temperature requirements given in Table 1 and in 5.1 to 5.5 are for tube connections and connector bodies only. For port and stud end pressure/temperature ratings, the values in the respective port and stud end standards shall apply.

5.8 To achieve these maximum working pressures with a 4:1 design factor, the maximum tube wall thicknesses shown in Table 1 are sufficient. See ISO 10763 to confirm the necessary tube wall thickness for the specified working pressure.

6 Designation of connectors

6.1 Connectors shall be designated by an alphanumeric code to facilitate ordering. They shall be designated by the word “Connector”, followed by ISO 8434-2, followed by a space, then the connector style letter symbols (see 6.2), followed by a hyphen, then, for the ends, the outside diameter of the tube with which they are to be connected, each separated by a multiplication symbol, ×. There shall be no space on either side of the multiplication symbol. For stud ends (connector ends), the thread designation of the stud end shall be added.

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Table 1 — Working pressures for 37° flared connections

Tube outside diameter (OD) [a]		Wall thickness of tube for flaring [b]		Working pressure [c]			
Metric	Inch	Metric tube	Inch tube	Carbon steel and stainless steel		Copper alloy [d]	
mm	in	mm	mm	MPa	(bar) [e]	MPa	(bar) [e]
6	1/4	1,5	1,65	35	(350)	20	(200)
8	5/16	1,5	1,65	35	(350)	20	(200)
10	3/8	1,5	1,65	35	(350)	16	(160)
12	1/2	2	2,1	31	(310)	16	(160)
16	5/8	2,5	2,41	24	(240)	12,5	(125)
20	3/4	3	2,76	24	(240)	12,5	(125)
25	1	3	3,05	21	(210)	10	(100)
30 and 32	1 1/4	3	3,05	17	(170)	8	(80)
38	1 1/2	3	3,05	14	(140)	6,3	(63)
50	2	3,5	3,4	10,5	(105)	5	(50)

[a] Metric tubing shall be preferred.

[b] Maximum wall thickness that can be flared, due to connector design.

[c] For working pressure applications higher than those given in this table, the manufacturer shall be consulted.

[d] The pressure values for copper alloy connectors and tubes were produced using brass connectors with phosphoresced soft annealed copper tubing.

[e] 1 bar = 10^5 N/m^2 = 10^5 Pa = 0,1 MPa.

6.2 The letter symbol designation of the connector style shall have three parts: 1) the connection end type immediately followed by 2) the shape of the connector and 3) by the indication that a complete connector is being ordered. The letters A and B shall be used to distinguish different styles, where such options exist.

6.3 Tube ends are assumed to be male and thus do not need to be included in the connection type code. However, if another type of end type is involved, it shall be designated.

6.4 Reducing connectors and elbows shall be designated by specifying the larger tube end first.

6.5 Stud connectors shall be designated by specifying the tube end first, then the thread size for the stud end.

6.6 For tee connectors, the order of designation of the connection ends shall be from the larger to the smaller tube end on the run, followed by the branch end.

6.7 For cross connectors, the order of designation of the connection ends shall be from left to right, followed by from top to bottom, with the larger ends on the left and at the top.

6.8 The following letter symbols shall be used:

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Connection end type	Letter
Bulkhead	BH
Swivel	SW
Reducer	RD
Stud	SD
Shape	**Letter**
Straight	S
Elbow	E
45° elbow	E45
Tee	T
Run tee	RT
Branch tee	BT
Cross	K
Long	L
Component type	**Letter**
Nut	N
Sleeve	SL
Locknut	LN
Plug	PL
Cap	CP
Nipple	NP
Metric	M
Inch	I
Completeness indication	**Letter**
Complete connector	C
Stud end sealing types	**Letter**
Metal-to-metal sealing	B
Elastomeric sealing	E
O-ring sealing	F

6.9 Examples of 37° flared connectors and designations are given in Figures 2 and 3.

EXAMPLE A straight stud connector (SDS), including O-ring without sleeve and nut, for use with 12 mm OD tubing with an 3/4-16 UNF stud end in accordance with ISO 11962-3 is designated for ordering as follows:

Connector ISO 8434-2 SDS-12×3/4-16

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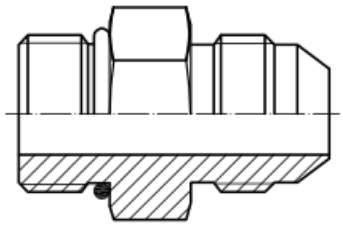


Figure 2 — Straight stud connector (SDS) with stud end in accordance with ISO 11962-3

EXAMPLE A complete straight stud connector (SDSC), including O-ring with sleeve and nut, for use with 12 mm OD tubing with an M16 × 1,5 UNF stud end in accordance with ISO 6149-3 is designated for ordering as follows:

Connector ISO 8434-2 SDSC-12×M16F

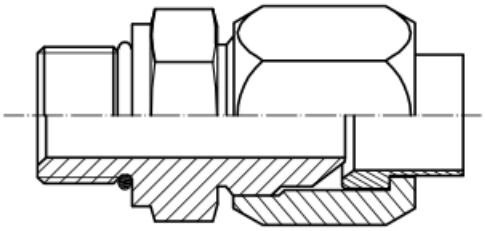


Figure 3 — Straight stud connector, complete (SDSC) with stud end in accordance with ISO 6149-3 (sealing type F)

7 Requirements for tubes

7.1 The connectors shall be suitable for use with tubes with limits of outside diameter as given in Tables 2 and 3. These limits include ovality.

7.2 Metric tubing shall be preferred. Tubing shall comply with the relevant dimensions given in Tables 2 or 3.

7.3 Carbon steel tubes shall, except for dimensions of inch tubes, comply with delivery condition R37 NBK as specified in ISO 3304 (seamless cold-finished as-drawn or annealed or normalized) or ISO 3305 (welded cold-finished as-drawn or annealed or normalized).

7.4 Stainless steel tubes shall, except for dimensions of inch tubes, comply with ISO 1127 (cold drawn and annealed or normalized).

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Table 2 — Metric tube sizes

Tube OD mm	Limits of OD mm	
	min.	max.
6	5,9	6,1
8	7,9	8,1
10	9,9	10,1
12	11,9	12,1
16	15,9	16,1
20	19,9	20,1
25	24,9	25,1
30	29,85	30,15
32	31,85	32,15
38	37,85	38,15
50	49,8	50,2
Metric tubing shall be preferred.		

Table 3 — Inch tube sizes

Tube OD		Limits of OD mm	
in	mm [a]	min.	max.
1/4	6,35	6,25	6,45
5/16	7,94	7,84	8,04
3/8	9,52	9,42	9,62
1/2	12,7	12,6	12,8
5/8	15,88	15,78	15,98
3/4	19,05	18,95	19,15
1	25,4	25,3	25,5
1 1/4	31,75	31,6	31,9
1 1/2	38,1	37,95	38,25
2	50,8	50,6	51
[a] Equivalent dimension in millimetres.			

8 Across flats dimensions and tolerances

8.1 The dimensions across flats of elbow, tee and cross connectors shall be as shown in the respective tables with minus tolerance only. For sizes up to and including 24 mm, tolerances for across-flats dimensions for forgings shall be 0/−0,8 mm, and for sizes larger than 24 mm they shall be 0/-1,0 mm.

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8.2 Hex tolerances across flats shall be in accordance with ISO 4759-1:2000, product grade C. Minimum across-corner hex dimensions are 1,092 times the width across flats. The minimum side flat is 0,43 times the nominal width across flats. Unless otherwise specified or shown, hex corners shall be chamfered 15° to 30° to a diameter equal to the width across flats, with a tolerance of 0/−0,4 mm.

9 Design

9.1 Connectors

The connectors shall conform to the requirements given in Figures 4 to 17 and Tables 7 to 20.

9.2 Dimensions

Dimensions specified apply to finished parts, including any plating or other treatments. The tolerance value for all dimensions not otherwise limited shall be ± 0,4 mm. The sealing seats of connectors shall be concentric, with straight thread pitch diameters within 0,25 mm full indicator reading (FIR).

9.3 Passage tolerances

Where passages in straight connectors are machined from opposite ends, the offset at the meeting point shall not exceed 0,4 mm. No cross-sectional area at a junction of passages shall be less than that of the smallest passage.

9.4 Angular tolerances

Angular tolerance on axes of end on elbows, tees, and crosses shall be ± 2,5° for tube sizes up to and including 10 mm and ±1,5° for all larger sizes.

9.5 Contour details

Details of contour shall be chosen by the manufacturer, provided the dimensions given in Tables 12 to 20 are maintained. Wrench flats on elbows and tees shall conform to the dimensions given in the relevant tables. Abrupt reduction of a section shall be avoided. Junctions of small external sections and adjoining sections that are relatively heavy shall be blended by means of ample fillets.

9.6 Stud ends

The dimensions for the stud ends shall conform to those given in ISO 6149-3. Stud ends in accordance with ISO 1179-3, ISO 9974-2 and ISO 11926-3 shall not be used for new designs in fluid power applications.

9.7 Reducing connectors

Dimension of reducing connectors shall be in accordance with Annex A.

10 Screw threads

10.1 The screw threads on the tube flared ends of the connectors shall be ISO inch screw threads in accordance with ISO 263 and ISO 68-2. Threads shall be chamfered at the face of the connector to an included angle of 90°. The diameter of the chamfer shall be equal to the minor diameter of the thread, with a tolerance of 0/−0,4 mm.

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10.2 The thread for stud ends (connection ends) of connectors shall be chosen from ISO 261 for ISO 6149-3, ISO 9974-2 and ISO 9974-3 stud ends; ISO 228-1:2000 (Class A) for ISO 1179-2, ISO 1179-3 and ISO 1179-4 stud ends; or ISO 263 for ISO 11926-3 stud ends. The dimensions of the stud ends shall comply with the requirements given in Tables 10 to 14 and the relevant stud end standards.

10.3 Parallel threads require an undercut with a sealing washer, O-ring or similar device to ensure a leakproof joint, unless the stud end undercut is designed for metal-to-metal sealing.

11 Manufacture

11.1 Construction

Carbon steel connectors made from multiple components shall be bonded together with materials having a melting point of not less than 1 000 °C.

11.2 Workmanship

Workmanship shall conform to the best commercial practice to produce high-quality connectors. Connectors shall be free from visual contaminants, all hanging burrs, loose scale and slivers which might be dislodged in use and any other defects that might affect the function of the parts. All machined surfaces shall have a surface roughness value of $Ra \leqslant 6{,}3$ µm, except where otherwise specified.

11.3 Finish

The external surface and threads on all carbon steel connectors, except braze-on type components and weld nipples, shall be protected with an appropriate coating to pass a minimum 72 h neutral salt spray test in accordance with ISO 9227, unless otherwise agreed upon by the manufacturer and user. Any appearance of red rust during the salt spray test on any area, except those noted below, shall be considered failure:

— all internal fluid passages;

— edges, such as hex points, serrations and crests of threads, where there may be mechanical deformation of the plating or coating typical of mass-produced parts or shipping effects;

— areas where there is mechanical deformation of the plating or coating caused by crimping, flaring, bending and other post-plate metal forming operations;

— areas where the parts are suspended or affixed in the test chamber where condensate can accumulate.

Fluid passages shall be excluded from the plating and/or coating requirements but shall be protected from rust.

Parts manufactured in accordance with this part of ISO 8434 shall not be cadmium plated.

Changes in plating may affect assembly torques and require re-qualification, when applicable.

11.4 Connector protection

By a method agreed between manufacturer and user, the face of the connectors and threads (both internal and external) shall be protected by the manufacturer from nicks and scratches that would be detrimental to the function of the connector. Passages shall be securely covered to prevent the entrance of dirt or other contaminants. Nuts and sleeves that are furnished separately from the connector shall be protected from rust, but do not require capping.

11.5 Corners

Unless otherwise noted, all sharp corners shall be broken to 0,15 mm max.

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12 Assembly instructions

The assembly of the connectors with the connecting tubes shall be carried out without external loads. The manufacturer shall draw up assembly instructions for the use of the connectors. These instructions shall include at least the following:

— details relating to material and quality of suitable tubes;

— details concerning the preparation of selected tube;

— instructions regarding the assembly of the connector, such as number of wrenching turns or assembly torque;

— recommendations regarding the tools to be used for assembly.

13 Procurement information

The following information should be supplied by the purchaser when making an inquiry or placing an order:

— description of connector;

— material of connector;

— material and size of tube;

— fluid to be conveyed;

— working pressure;

— fluid working temperature range;

— ambient temperature range.

14 Marking of components

Connector bodies and nuts shall be permanently marked with the manufacturer's name, trademark or code identifier, unless otherwise agreed upon by the user and manufacturer. Nuts to be used with connectors used with 30 mm and 32 mm tubes shall be marked with the relevant tube outside diameter.

15 Performance and qualification test

15.1 Performance requirements

The connectors shall meet or exceed the pressure requirements given in Tables 4 or 5 when tested in accordance with 15.1.1, 15.1.2, 15.1.3 and 15.1.4.

15.1.1 Proof test

For each size, nine test assemblies in accordance with ISO 19879 shall be subjected to the proof test procedure specified in ISO 19879, prior to burst and cyclic endurance tests. They shall not leak at the respective proof pressures given in Tables 4 and 5.

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Table 4 — Test pressures for steel and stainless steel 37° flared connections

Tube OD		Working pressure [b]		Test pressures					
				Proof		Burst		Cyclic endurance	
Metric [a] mm	Inch in	MPa	(bar) [c]	MPa	(bar)	MPa	(bar)	MPa	(bar)
6	1/4	35	(350)	70	(700)	140	(1400)	46,6	(466)
8	5/16	35	(350)	70	(700)	140	(1400)	46,6	(466)
10	3/8	35	(350)	70	(700)	140	(1400)	46,6	(466)
12	1/2	31	(310)	62	(620)	124	(1240)	41,2	(412)
16	5/8	24	(240)	48	(480)	96	(960)	31,9	(319)
20	3/4	24	(240)	48	(480)	96	(960)	31,9	(319)
25	1	21	(210)	42	(420)	84	(840)	27,9	(279)
30 and 32	1 1/4	17	(170)	34	(340)	68	(680)	22,6	(226)
38	1 1/2	14	(140)	28	(280)	56	(560)	18,6	(186)
50	2	10,5	(105)	21	(210)	42	(420)	14	(140)

[a] Metric tubing shall be preferred.

[b] For working pressure applications higher than those given in Table 1, the manufacturer shall be consulted.

[c] 1 bar = 10^5 N/m^2 = 10^5 Pa = 0,1 MPa.

Table 5 — Test pressures for copper alloy 37° flared connections

Tube OD		Working pressure [b]		Test pressures					
				Proof		Burst		Cyclic endurance	
Metric [a] mm	Inch in	MPa	(bar) [c]	MPa	(bar) [c]	MPa	(bar) [c]	MPa	(bar) [c]
6	1/4	20	(200)	40	(400)	80	(800)	26,6	(266)
8	5/16	20	(200)	40	(400)	80	(800)	26,6	(266)
10	3/8	16	(160)	32	(320)	64	(640)	21,3	(213)
12	1/2	16	(160)	32	(320)	64	(640)	21,3	(213)
16	5/8	12,5	(125)	25	(250)	50	(500)	16,6	(166)
20	3/4	12,5	(125)	25	(250)	50	(500)	16,6	(166)
25	1	10	(100)	20	(200)	40	(400)	13,3	(133)
30 and 32	1 1/4	8	(80)	16	(160)	32	(320)	10,6	(106)
38	1 1/2	6,3	(63)	12,6	(126)	25,2	(252)	8,4	(84)
50	2	5	(50)	10	(100)	20	(200)	6,7	(67)

The pressure values for copper alloy connectors and tubes were produced using brass connectors with phosphoresced soft-annealed copper tubing.

[a] Metric tubing shall be preferred.

[b] For working pressure applications higher than those given in Table 1, the manufacturer shall be consulted.

[c] 1 bar = 10^5 N/m^2 = 10^5 Pa = 0,1 MPa.

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15.1.2 Burst test

Three of the test assemblies that had been subjected to the proof test in 15.1.1 shall be used for the burst test. The test shall be conducted in accordance with the burst test procedure specified in ISO 19879 and at the minimum torque values given in Table 6. The test assemblies shall meet or exceed the minimum required burst pressures given in Tables 4 and 5.

Table 6 — Qualification test torque requirements

Tube OD mm	Thread	Torque [a] N·m +10 % 0 %	Overtorque N·m
6	7/16-20 UNF	15	24
8	1/2-20 UNF	19	31
10	9/16-18 UNF	24	42
12	3/4-16 UNF	49	80
16	7/8-14 UNF	77	114
20	1 1/16-12 UN	107	160
25	1 5/16-12 UN	147	214
30/32	1 5/8-12 UN	172	271
38	1 7/8-12 UN	215	339
50	2 1/2-12 UN	332	497

[a] These torque values are for qualification testing only and may differ from the assembly torques supplied by the manufacturer.

15.1.3 Cyclic endurance (impulse) test

The remaining six test assemblies that were subjected to the proof test in 15.1.1 shall be subjected to the cyclic endurance test procedure as specified in ISO 19879. The test shall be conducted at the minimum torque values given in Table 6. The test assemblies shall pass a cyclic endurance test for 1 000 000 cycles at the respective impulse pressures given in Tables 4 and 5.

15.1.4 Overtightening test

For each connector size, three samples each of the tube nut (N) and sleeve (SL) and the 90° swivel elbow (SWE) nut shall be subjected to the overtightening test as specified in ISO 19879. Connector swivel nuts shall be capable of withstanding the overtorque qualification test with no indication of failure when torqued to the overtorque values given in Table 6.

15.1.5 Re-use of test samples

Parts used for cyclic endurance, burst or overtightening test shall not be tested further, used or returned to stock.

15.2 Test data form

Test data shall be reported on the test data form in ISO 19879.

16 Identification statement (reference to this part of ISO 8434)

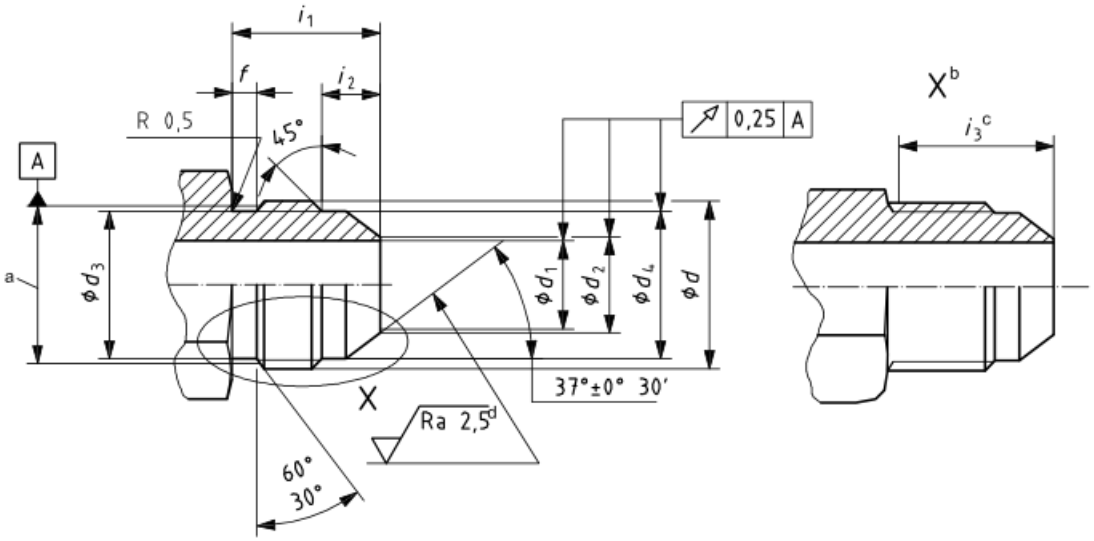
Use the following statement in test reports, catalogues and sales literature when electing to comply with this part of ISO 8434:

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"Dimensions and design for 37° flared metallic connectors in accordance with ISO 8434-2:2007, *Metallic tube connections for fluid power and general use — Part 2: 37° flared connectors*."

Dimensions in millimetres
Surface roughness in micrometres



[a] Pitch diameter.

[b] Optional construction for shapes.

[c] Minimum full thread depth.

[d] No axial tool marks are allowed on this surface; for spiral tool marks, a surface roughness value $Ra \leqslant 1{,}6$ µm shall be used.

Figure 4 — 37° flared connection

Table 7 — Dimensions of 37° flared connections

Dimensions in millimetres

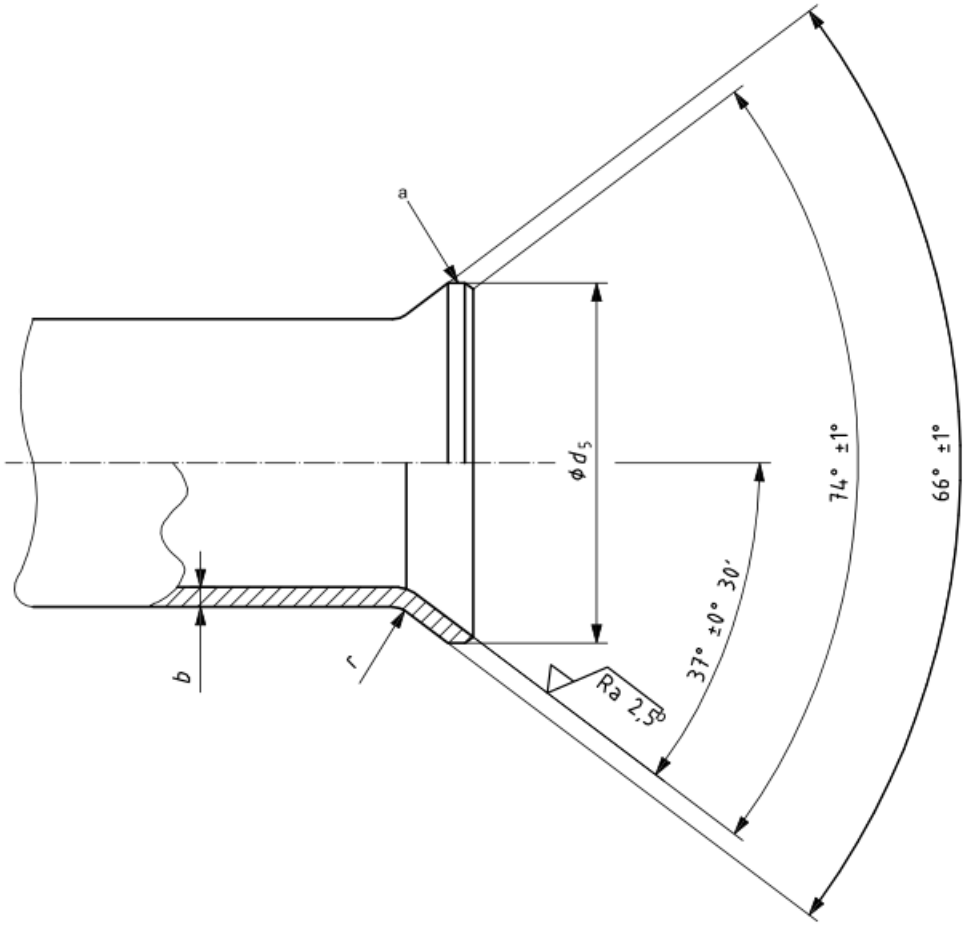
Tube OD	**Thread** [a] d	d_1		d_2	d_3	d_4	f	i_1	i_2	i_3
		nom.	tol.	± 0,08	± 0,15	± 0,15	± 0,4	± 0,4	± 0,2	min.
6	7/16-20 UNF	4,4	±0,1	4,9	9,15	9,15	2,3	14	5,1	13,6
8	1/2-20 UNF	6	±0,2	6,5	10,7	10,7	2,3	14	5,1	13,6
10	9/16-18 UNF	7,5	±0,2	8,1	12,1	12,1	2,5	14,1	5,2	13,75
12	3/4-16 UNF	9,9	±0,2	10,8	16,85	16,65	2,8	16,7	6,6	16,3
16	7/8-14 UNF	12,3	±0,2	13,7	19,5	19,5	3,1	19,3	7	18,85
20	1 1/16-12 UN	15,5	±0,2	16,85	23,85	23,85	3,6	21,9	8,2	21,55
25	1 5/16-12 UN	21,5	±0,2	23,2	30,2	30,2	3,6	23,1	8,2	22,75
30/32	1 5/8-12 UN	27,5	±0,3	29,15	38,15	38,15	3,6	24,3	9,5	23,95
38	1 7/8-12 UN	33,5	±0,3	35,1	44,5	44,5	3,6	27,5	9,8	27,15
50	2 1/2-12 UN	45	±0,3	47,75	60,35	60,35	3,6	33,9	11,9	33,5

[a] For the general plan of threads, see ISO 263; also see provisions for screw threads in ISO 68-2 and ISO 5864:1993, class 2A.

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Dimensions in millimetres
Surface roughness in micrometres



[a] Slight flat permissible.

[b] No axial tool marks are allowed on this surface; for spiral tool marks, a surface roughness value $Ra \leqslant 1{,}6$ µm shall be used.

Figure 5 — 37° single flare for tubes

Table 8 — Dimensions of 37° single flare for metric and inch tubes

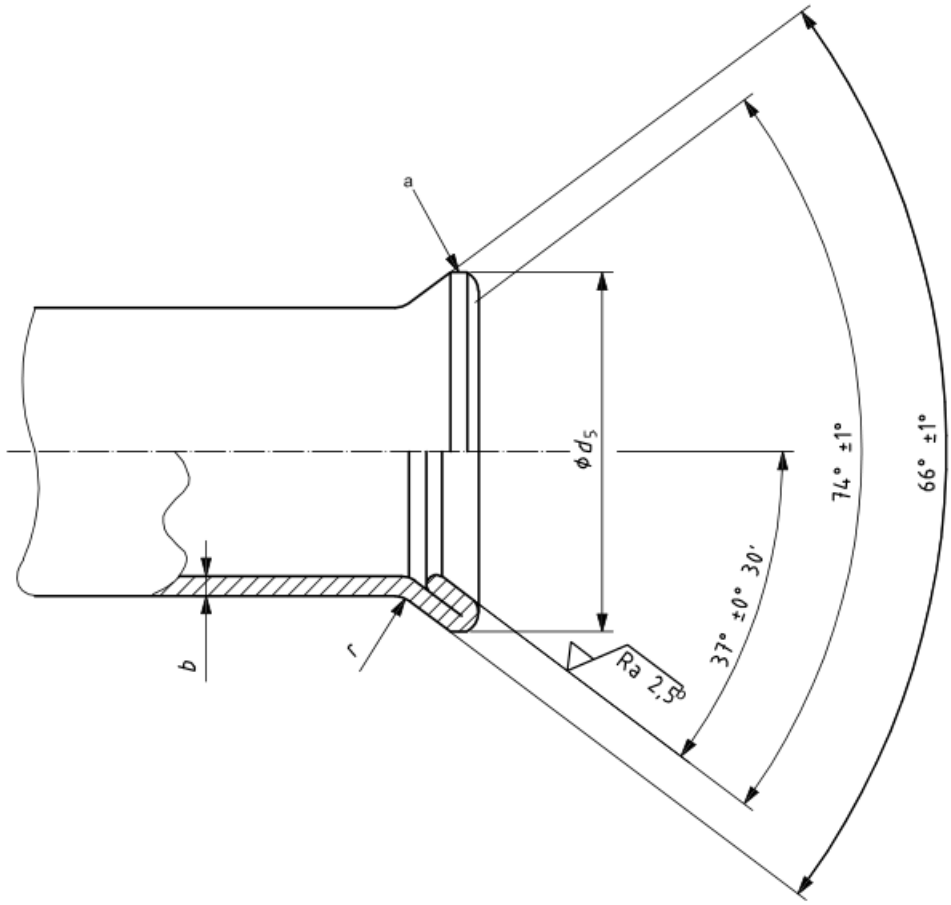
Dimensions in millimètres

Tube OD		b_{max}		d_5		r
Metric mm	Inch in	Metric tube	Inch tube	min.	max.	± 0,5
6	1/4	1,5	1,65	8,6	9,7	0,8
8	5/16	1,5	1,65	10,2	11,3	0,8
10	3/8	1,5	1,65	11,7	12,7	1
12	1/2	2	2,1	16,0	17,3	1,5
16	5/8	2,5	2,41	19,3	20,2	1,5
20	3/4	3	2,76	23,4	24,7	2
25	1	3	3,05	29,7	31	2,3
30/32	1 1/4	3	3,05	37,6	38,9	2,3
38	1 1/2	3	3,05	43,2	45,3	2,8
50	2	3,5	3,4	59,2	61,2	2,8

[a] Metric tubing shall be preferred for new and future designs.

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Dimensions in millimetres
Surface roughness in micrometres



a Slight flat permissible.

b No axial tool marks are allowed on this surface; for spiral tool marks, a surface roughness value $Ra \leqslant 1{,}6$ µm shall be used.

Figure 6 — 37° double flare for tubes

Table 9 — Dimensions of 37° double flare for metric and inch tubes

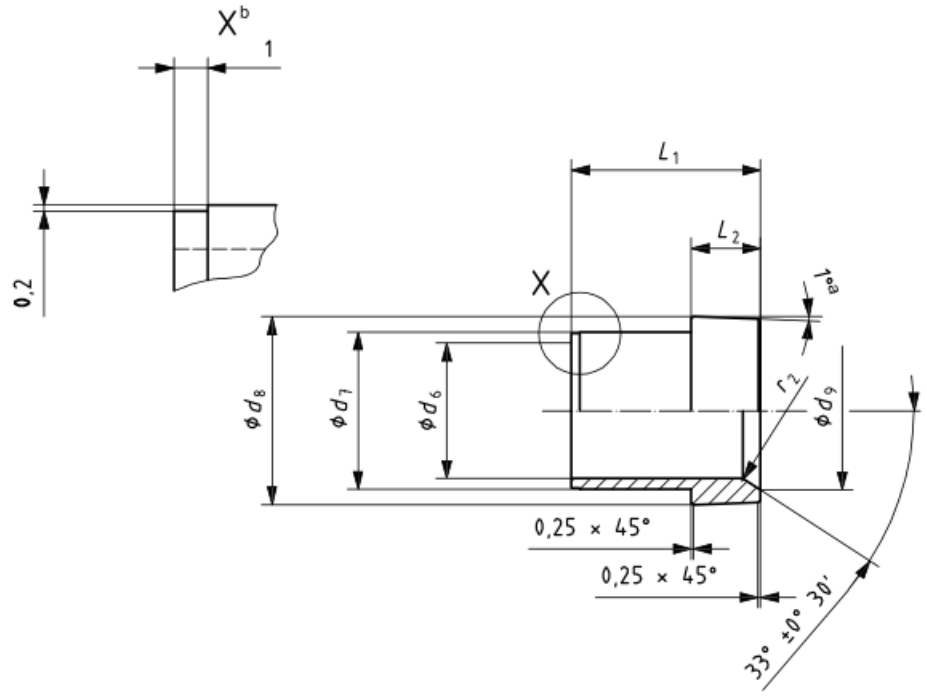
Dimensions in millimetres

Tube OD		b_{max}		d_5		r
Metric [a] mm	Inch in	Metric tube	Inch tube	min.	max.	± 0,5
6	1/4	1	0,88	8,6	9,7	0,8
8	5/16	1	0,88	10,2	11,3	0,8
10	3/8	1,25	1,24	11,7	12,7	1
12	1/2	1,25	1,24	16,0	17,3	1,5
16	5/8	1,5	1,65	19,3	20,2	1,5
20	3/4	1,5	1,65	23,4	24,7	2
25	1	1,5	1,65	34,3	31,0	2,3
30/32	1 1/4	1,5	1,65	37,6	38,9	2,3
38	1 1/2	1,5	1,65	43,2	45,3	2,8
50	2	3,5	3,4	59,2	61,2	2,8

a Metric tubing shall be preferred for new and future designs.

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Dimensions in millimetres
Surface roughness in micrometres



a Optional construction.

b Recommended identification for metric sleeves.

Figure 7 — Sleeves — MSL (for metric tubing) and ISL (for inch tubing)

Table 10 — Dimensions of sleeves for metric and inch tubing

Dimensions in millimetres

Metric tubing [a]		Inch tubing								
Tube OD	d_6	Tube OD		d_6	d_7	d_8	d_9	L_1	L_2	r_2
mm	± 0,05	in	mm [b]	± 0,05	± 0,05	± 0,05	± 0,15	± 1	± 0,5	± 0,3
6	6,18	1/4	6,35	6,55	7,5	9,7	8	10,4	3,6	0,8
8	8,18	5/16	7,94	8,15	9,25	11,25	9,5	11,2	4,1	0,8
10	10,18	3/8	9,52	9,7	10,95	12,7	11,2	12,7	4,3	1,2
12	12,18	1/2	12,7	12,9	14,25	17,3	15	14,2	5,6	1,6
16	16,2	5/8	15,88	16,1	17,45	20,2	17,9	16,8	6,1	1,6
—	—	3/4	19,05	19,25	20,95	24,65	22,4	17,3	6,6	2
20	20,2	—	—	—	21,6	24,65	22,4	17,3	6,6	2
25	25,2	1	25,4	25,6	27,45	31	28,7	19,8	7,1	2,4
30	30,3	—	—	—	32,3	38,9	35,9	23,1	7,9	2,4
32	32,3	1 1/4	31,75	32,05	33,95	38,9	35,9	23,1	7,9	2,4
38	38,4	1 1/2	38,1	38,4	40,85	45,25	41,4	28,4	8,6	2,8
50	50,4	2	50,8	51,2	54,75	61,15	55,8	30,2	10,4	2,8

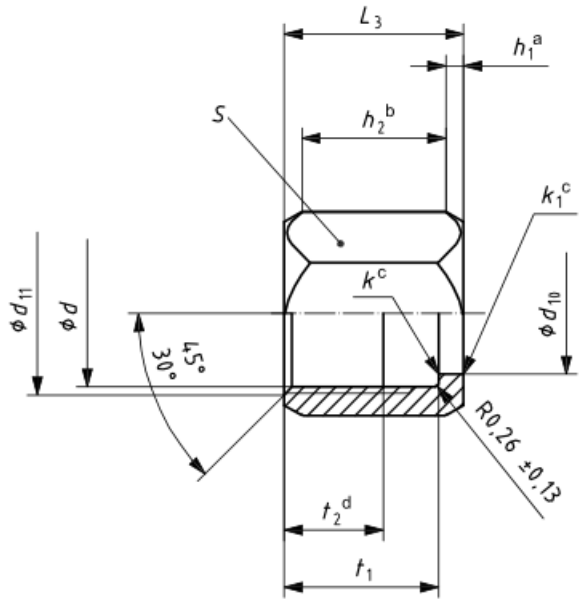
a Metric tubing shall be preferred for new and future designs.

b Equivalent dimensions in millimetres.

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Dimensions in millimetres
Surface roughness in micrometres



[a] Both sides.

[b] Break corners, h_1 minimum both sides.

[c] Break corners.

[d] Full thread length.

Figure 8 — Tube nut (N)

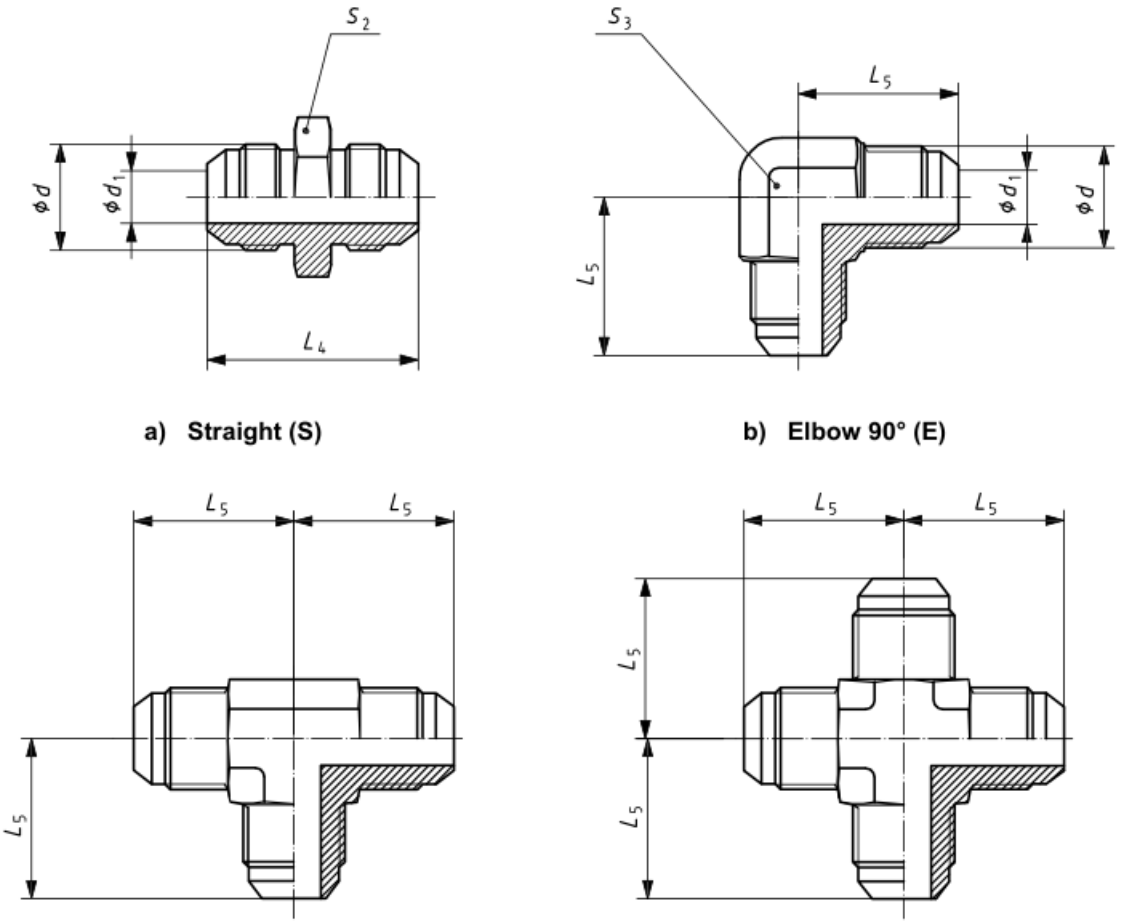
Table 11 — Dimensions of tube nuts

Dimensions in millimetres

Tube OD	Thread [a] d	Thread minor diameter [a]		d_{10}		d_{11}	L_3	h_1	h_2	k	k_1	S	t_1	t_2
		min.	max.	nom.	tol.	± 0,2	± 0,5	min.	min.	± 0,15	max.		± 0,4	min.
6	7/16-20 UNF	9,86	9,99	7,7	+0,10 0	11,5	15,8	0,4	8,5	0,15	0,5	14	12,9	7,5
8	1/2-20 UNF	11,46	11,59	9,45		13	17,3	0,4	9,5	0,15	0,5	17	14,7	8,3
10	9/16-18 UNF	12,90	13,03	11,15		14,6	18,5	0,4	10,5	0,25	0,5	19	15,3	8,3
12	3/4-16 UNF	17,48	17,61	14,45	+0,13 0	19,4	21,6	0,4	12,5	0,25	0,5	22	18,4	9,4
16	7/8-14 UNF	20,42	20,55	17,7		22,6	24,9	0,5	14,5	0,25	1	27	20,8	11,6
3/4 in.	1 1/16-12 UN	24,87	25,00	21,15		27,3	26,2	0,5	14,5	0,25	1	32	22	11,8
20	1 1/16-12 UN	24,87	25,00	21,85		30,5	26,2	0,5	14,5	0,25	1	32	22	11,8
25	1 5/16-12 UN	31,22	31,35	27,6		33,7	28,7	0,7	14,5	0,25	1	41	24,4	14,2
30	1 5/8-12 UN	39,14	39,27	32,5	+0,15 0	41,6	31,2	0,9	14	0,25	1	50	25,8	14,2
32	1 5/8-12 UN	39,14	39,27	34,15		41,6	31,2	0,9	14	0,25	1	50	25,8	14,2
38	1 7/8-12 UN	45,49	45,62	41		48	36,1	0,9	17	0,25	1	60	29,7	16,7
50	2 1/2-12 UN	61,37	61,50	54,95		63,8	44,5	1,2	20,5	0,4	1	75	37,1	21,3

[a] For the general plan of threads, see ISO 263; except that the minimum thread minor diameter is increased by 0,15 for all sizes, refer to the thread minor diameter column in this table, and also see provisions for screw threads in ISO 68-2 and ISO 5864:1993, class 2B.

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a) **Straight (S)**

b) **Elbow 90° (E)**

c) **Tee (T)**

d) **Cross (K)**

NOTE For details not shown here, see Figure 4 and Table 7.

Figure 9 — Union connectors

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Table 12 — Dimensions of union connectors

Dimensions in millimetres

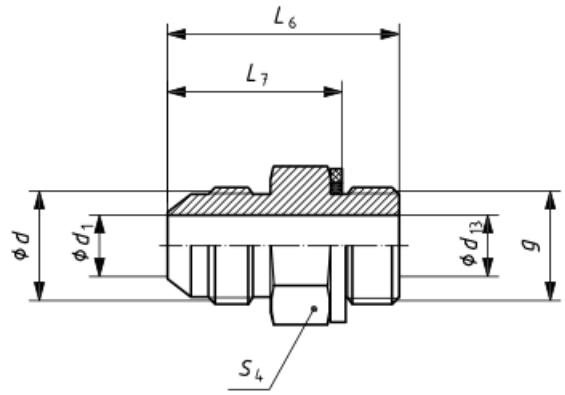
Ordering size code [a]	Tube OD [b]	Thread [c] d	d_1	L_4	L_5	S_2	S_3		
							Forged connector		Connector machined from barstock
			ref.	± 0,8	± 1		nom.	tol.	max.
6 × 6	6	7/16-20 UNF	4,4	35	22,5	12	12	+0/-0,8	14
8 × 8	8	1/2-20 UNF	6	35	24	14	14	+0/-0,8	17
10 × 10	10	9/16-18 UNF	7,5	36	27	17	14	+0/-0,8	22
12 × 12	12	3/4-16 UNF	9,9	41	32	22	19	+0/-0,8	22
16 × 16	16	7/8-14 UNF	12,3	48	37	24	22	+0/-0,8	32
20 × 20	20	1 1/16-12 UN	15,5	55	42	30	27	+0/-1,0	36
25 × 25	25	1 5/16-12 UN	21,5	57	46	36	32	+0/-1,0	41
32 × 32	32	1 5/8-12 UN	27,5	61,5	52,5	46	41	+0/-1,0	55
38 × 38	38	1 7/8-12 UN	33,5	70	59	50	50	+0/-1,0	60
50 × 50	50	2 1/2-12 UN	45	86,5	77,5	65	65	+0/-1,0	80

[a] Code given is for straights and elbows. Add third and fourth sizes for tees and crosses using left, right, up-and-down sequence omitting ends when not present.

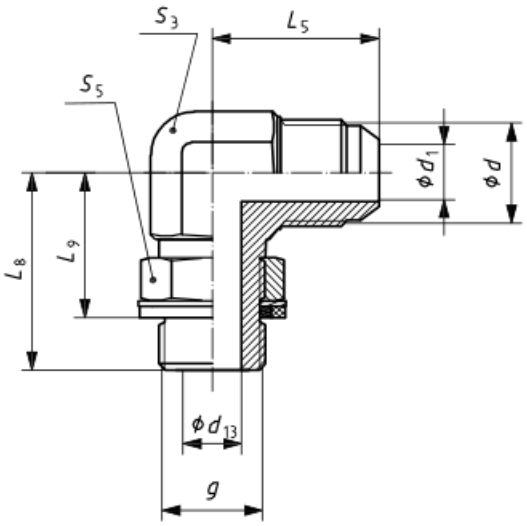
[b] See Table 1 for corresponding inch sizes.

[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

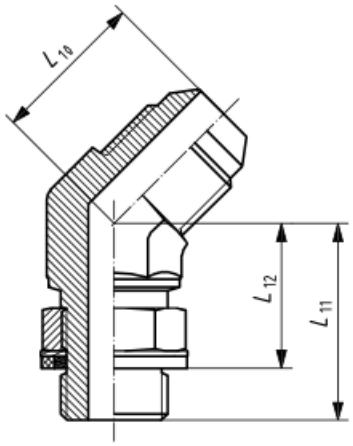
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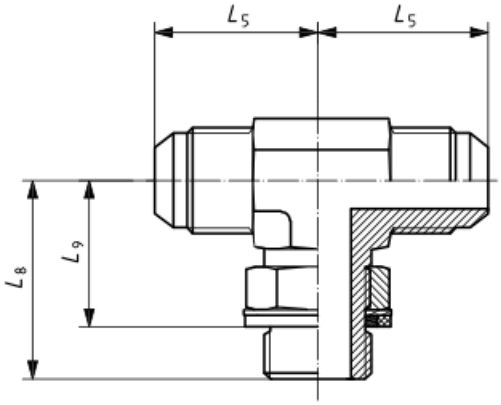
a) Stud (straight) (SDS)



b) 90° adjustable stud elbow (SDE)



c) 45° adjustable stud elbow (SDE45)

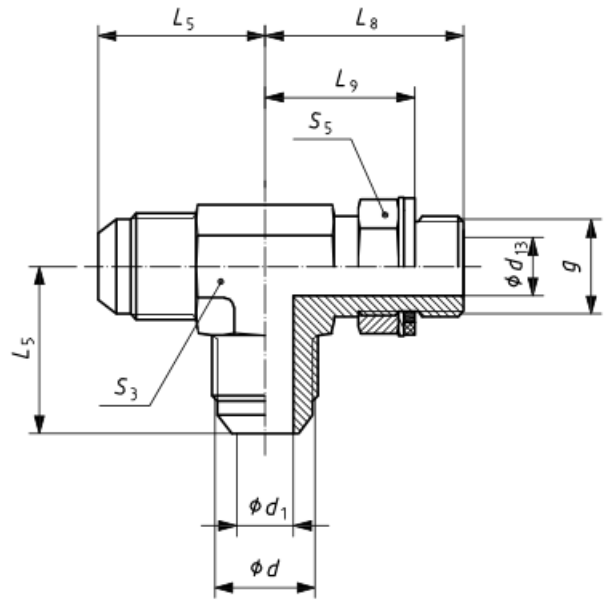


d) Adjustable stud branch tee (SDBT)

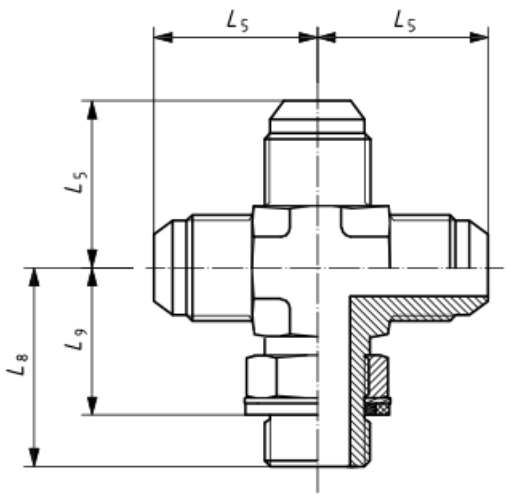
Figure 10 — Stud connectors with ISO 1179-3 stud ends

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e) Adjustable stud run tee (SDRT)



f) Adjustable stud cross (SDK)

NOTE For details not shown here, see Figure 4 and Table 7.

Figure 10 *(continued)*

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Table 13 — Dimensions of stud connectors with ISO 1179-3 stud ends

Dimensions in millimetres

Ordering size code [a]	Tube OD [b]	Thread [c] d	ISO 1179-3 stud end thread g	d_1 [e] ref.	d_{13} [d, e] ref.	L_5 ref.	L_6 ± 0,8	L_7 ref.	L_8 +1	L_9 ref.	L_{10} ± 1	L_{11} ± 1	L_{12} ref.	S_3 ref.	S_4	S_5
6 × G 1/8	6	7/16-20 UNF	G 1/8 – A	4,4	4,4	22,5	29	22,5	26,5	20	18,5	26,5	20	12	14	14
8 × G 1/4	8	1/2-20 UNF	G 1/4 – A	6	7,5	24	32	22,5	32	21,5	19,5	26,5	20	14	19	19
10 × G 1/4	10	9/16-18 UNF	G 1/4 – A	7,5	7,5	27	32	22,5	32	21,5	21	29	19,5	14	19	19
12 × G 3/8	12	3/4-16 UNF	G 3/8 – A	9,9	9,9	32	36	26,5	37	26,5	25	33	23,5	19	22	22
16 × G 1/2	16	7/8-14 UNF	G 1/2 – A	12,3	12,3	37	44	31	43	30	28	38,5	25,5	22	30	27
20 × G 3/4	20	1 1/16-12 UN	G 3/4 – A	15,5	15,5	42	47,5	35	49,5	36,5	32,5	44	31	27	36	36
25 × G 1	25	1 5/16-12 UN	G 1 – A	21,5	21,5	46	53,5	37,5	52	36	37,5	47	31	33	46	41
32 × G 1 1/4	32	1 5/8-12 UN	G 1 1/4 – A	27,5	27,4	52,5	57	41	57	41	40,5	48	32	41	50	50
38 × G 1 1/2	38	1 7/8-12 UN	G 1 1/2 – A	33,5	33,0	59	61	45	60,5	44,5	45	48	32	48	55	55
50 × G 2	50	2 1/2-12 UN	G 2 – A	45	—	77,5	—	45,5	—	—	56,5	47	31	65	70	70

Connectors with stud ends in accordance with ISO 1179 shall not be used for new designs in hydraulic fluid power applications.

[a] Code given is for straights and elbows. Add third and fourth sizes for tees and crosses using left, right, up-and-down sequence omitting ends when not present.

[b] See Table 1 for corresponding inch sizes.

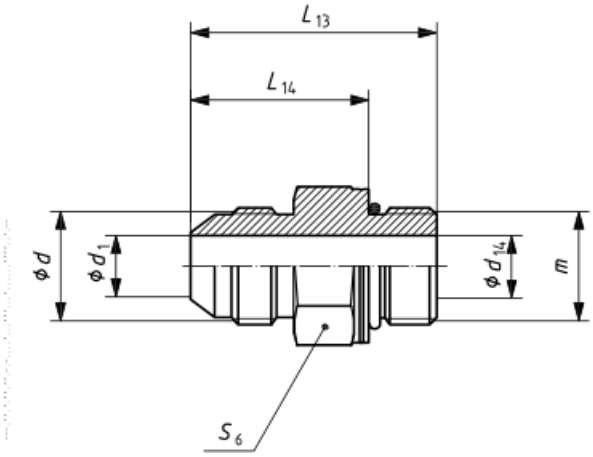
[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

[d] For tolerances, see ISO 1179-3:—, Table 1, dimension d_3.

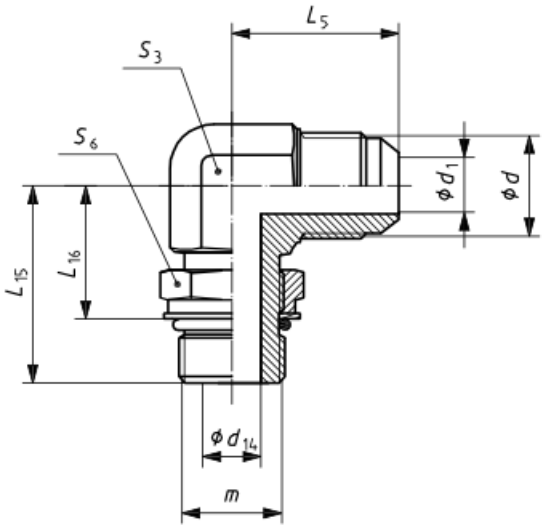
[e] For SDS, the smaller diameter of d_1 or d_{13} may go all the way through the connector, or the connector may have a transition area approximately halfway within the hex.

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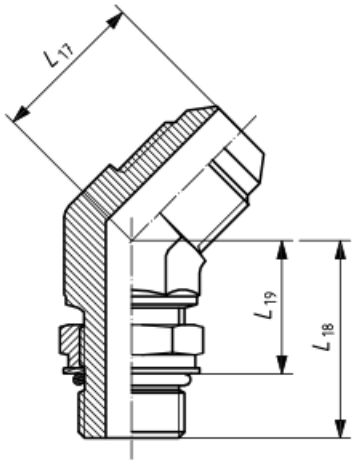
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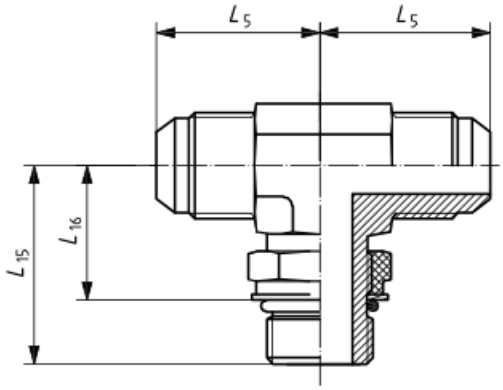
a) Stud (straight) (SDS)



b) 90° adjustable stud elbow (SDE)



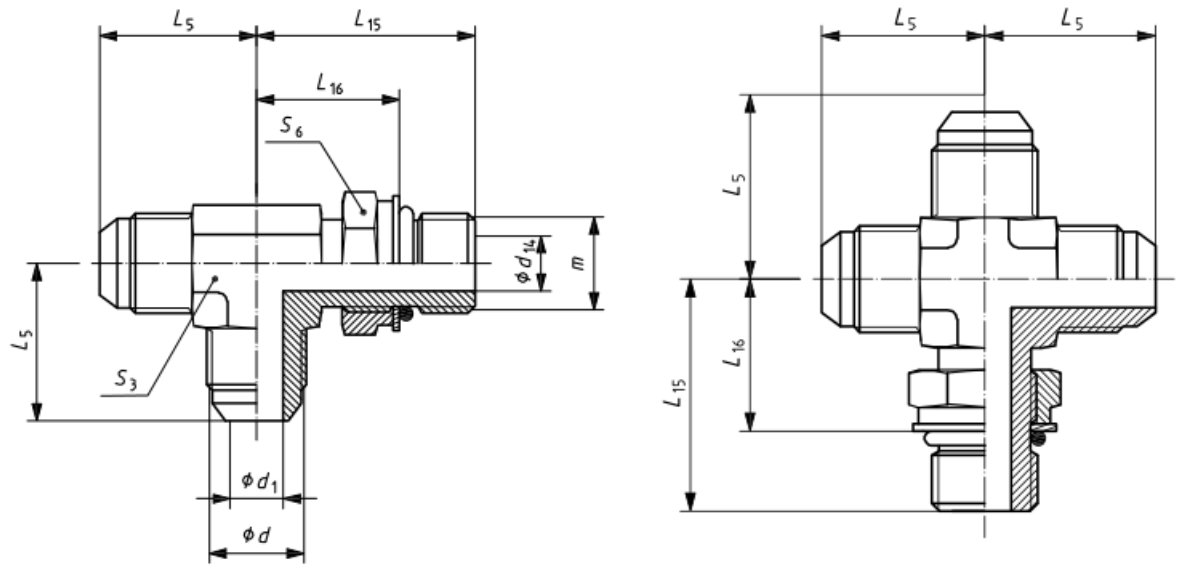
c) 45° adjustable stud elbow (SDE45)



d) Adjustable stud branch tee (SDBT)

Figure 11 — Stud connectors with ISO 6149-3 stud ends

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e) Adjustable stud run tee (SDRT) **f) Adjustable stud cross (SDK)**

NOTE For details not shown here, see Figure 4 and Table 7.

Figure 11 *(continued)*

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Table 14 — Dimensions of stud connectors with ISO 6149-3 stud ends

Dimensions in millimetres

Ordering size code [a]	Tube OD [b]	Thread [c] d	ISO 6149-3 stud end thread m	d_1 [e] ref.	d_{14} [d,e] ref.	L_5 ± 1	L_{13} ± 0,8	L_{14} ref.	L_{15} ± 1	L_{16} ref.	L_{17} ± 1	L_{18} ± 1	L_{19} ref.	S_3 ref.	S_6
6 × M10	6	7/16-20 UNF	M10 × 1	4,4	4,5	22,5	29,5	21	26,6	18	18,5	26,6	18	12	14
8 × M12	8	1/2-20 UNF	M12 × 1,5	6	6,0	24	32	21	31,6	20,5	19,5	29,1	18	14	17
10 × M14	10	9/16-18 UNF	M14 × 1,5	7,5	7,5	27	32	21	34,6	23,5	21	29,1	18	14	19
12 × M16	12	3/4-16 UNF	M16 × 1,5	9,9	9,0	32	35,5	24	38,1	26,5	25	33,1	21,5	19	22
16 × M22	16	7/8-14 UNF	M22 × 1,5	12,3	14,0	37	42,5	29,5	40,8	28,5	28	36,3	23,5	22	27
20 × M27	20	1 1/16-12 UN	M27 × 2	15,5	18,0	42	48,5	32,5	49,8	34	32,5	44,8	29	27	32
25 × M33	25	1 5/1-12 UN	M33 × 2	21,5	23,0	46	50,5	34,5	51,8	36	37,5	44,3	28,5	32	41
32 × M42	32	1 5/8-12 UN	M42 × 2	27,5	30,0	52,5	54	38	56,3	40,5	40,5	45,8	30	41	50
38 × M48	38	1 7/8-12 UN	M48 × 2	33,5	36,0	59	59	41,5	61,3	44	45	47,3	30	50	55
50 × M60	50	2 1/2-12 UN	M60 × 2	45	44,0	77,5	—	—	74,3	57	56,5	45,8	28,5	65	65

[a] Code given is for straights and elbows. Add third and fourth sizes for tees and crosses using left, right, up-and-down sequence omitting ends when not present.

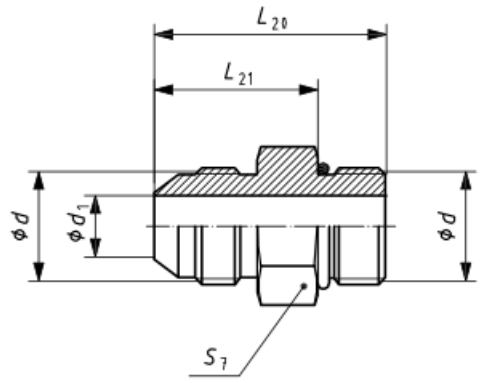
[b] See Table 1 for corresponding inch sizes.

[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

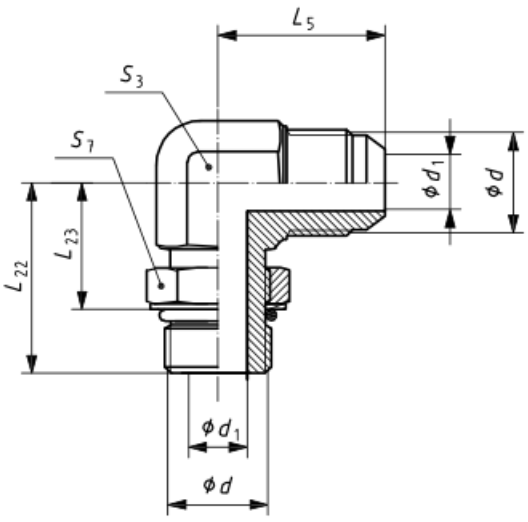
[d] For tolerances, see ISO 1179-3:—, Table 1, dimension d_3.

[e] For SDS, the smaller diameter of d_1 or d_{14} may go all the way through the connector, or the connector may have a transition area approximately halfway within the hex.

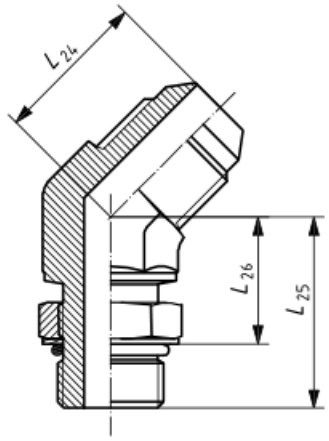
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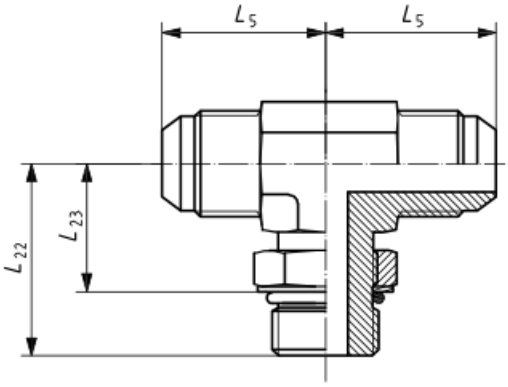
a) Stud (straight) (SDS)



b) 90° adjustable stud elbow (SDE)



c) 45° adjustable stud elbow (SDE45)

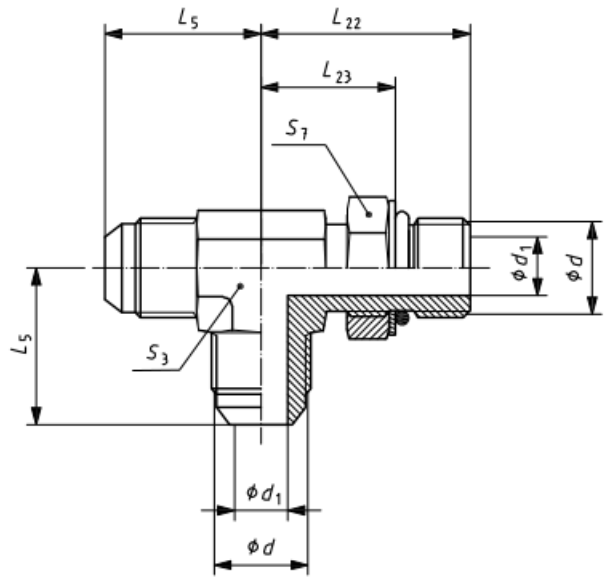


d) Adjustable stud branch tee (SDBT)

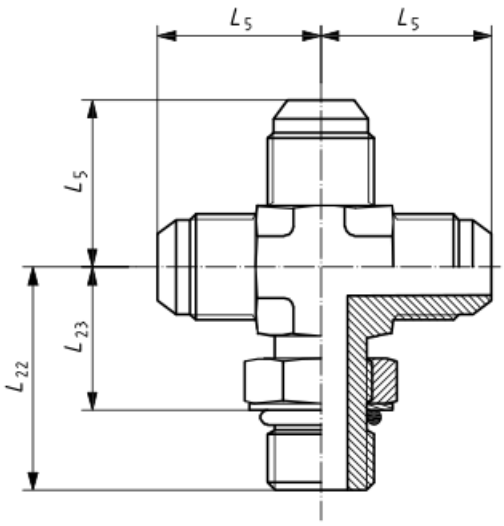
Figure 12 — Stud connector with ISO 11926-3 stud ends

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e) Adjustable stud run tee (SDRT)



f) Adjustable stud cross (SDK)

NOTE For details not shown here, see Figure 4 and Table 7.

Figure 12 — *(continued)*

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Table 15 — Dimensions of stud connectors with ISO 11926-3 stud ends

Dimensions in millimetres

Ordering size code [a]	Tube OD [b]	Thread [c] d	d_1 [d] ref.	L_5 ref.	L_{20} ± 0,8	L_{21} ref.	L_{22} ± 1	L_{23} ref.	L_{24} ± 1	L_{25} ± 1	L_{26} ref.	S_3 ref.	S_7
6 × 6	6	7/16-20 UNF	4,4	22,5	31	22	26	17	18,5	26,5	17,4	12	14
8 × 8	8	1/2-20 UNF	6	24	31	22	28,5	19,4	19,5	26,5	17,4	14	17
10 × 10	10	9/16-18 UNF	7,5	27	33	23	32	22	21	29	19	14	17
12 × 12	12	3/4-16 UNF	9,9	32	37,5	26,5	37	26	25	33	21,9	19	22
16 × 16	16	7/8-14 UNF	12,3	37	43	30,5	43	30	28	38,5	25,8	22	27
20 × 20	20	1 1/16-12 UN	15,5	42	50	35	49,5	34,4	32,5	44	28,9	27	32
25 × 25	25	1 5/16-12 UN	21,5	46	52	36,5	52	36,9	37,5	47	31,9	32	41
32 × 32	32	1 5/8-12 UN	27,5	52,5	55	40	57	41,9	40,5	48,5	33,4	41	50
38 × 38	38	1 7/8-12 UN	33,5	59	60	45	60,5	45,4	45	48,5	33,4	50	55
50 × 50	50	2 1/2-12 UN	45	77,5	70,5	55,5	73,5	58,4	56,5	47	31,9	65	70

Connectors with stud ends in accordance with ISO 11926-3 shall not be used for new designs in fluid power applications.

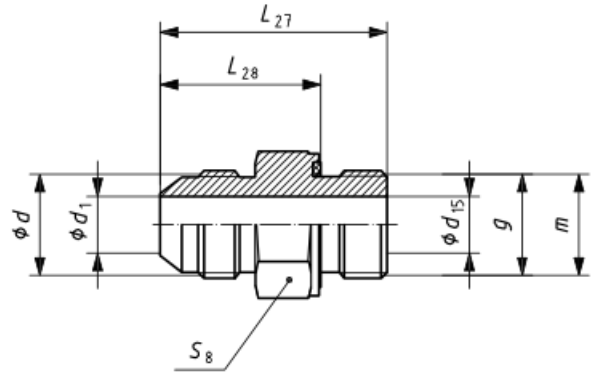
[a] Code given is for straights and elbows. Add third and fourth sizes for tees and crosses using left, right, up-and-down sequence omitting ends when not present.

[b] See Table 1 for corresponding inch sizes.

[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

[d] For tolerances, see ISO 11926-3:1995, Table 1, dimension d_3 .

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NOTE For details not shown here, see Figure 4 and Table 7.

Figure 13 — Stud connector (SDS) with ISO 9974-2 and ISO 1179-2 stud ends

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Table 16 — Dimensions of stud connectors with ISO 9974-2 and ISO 1179-2 stud ends

Dimensions in millimetres

Tube OD [c]	Thread [d]		ISO 9974-2 [a, b]						ISO 1179-2 [a]					
			Ordering size code	ISO 9974-2 stud end thread					Ordering size code [f]	ISO 1179-2 stud end thread				
	d	d_1 [e] ref.		m	d_{15} [e, f] ref.	L_{27} ± 1	L_{28} ± 1	S_8		g	d_{15} [e, f] ref.	L_{27} ± 1	L_{28} ± 1	S_8
6	7/16-20 UNF	4,4	6 × M10	M10 × 1	4	31	23	14	6 × G 1/8	G 1/8 A	4	30	22	16
8	1/2-20 UNF	6	8 × M12	M12 × 1,5	6	33,5	21,5	17	8 × G 1/4	G 1/4 A	7	34,8	22,8	19
10	9/16-18 UNF	7,5	10 × M14	M14 × 1,5	7	33,5	21,5	19	10 × G 1/4	G 1/4 A	7	35,1	23,1	19
12	3/4-16 UNF	9,9	12 × M16	M16 × 1,5	9	37,6	25,6	22	12 × G 3/8	G 3/8 A	9	38,5	26,5	22
16	7/8-14 UNF	12,3	16 × M18	M18 × 1,5	11	41,7	29,7	27	16 × G 1/2	G 1/2 A	14	44,5	30,5	30
20	1 1/16-12 UN	15,5	20 × M22	M22 × 1,5	14	45,5	31,5	32	20 × G 3/4	G 3/4 A	18	50,9	34,9	36
25	1 5/16-12 UN	21,5	25 × M33	M33 × 1,5	23	51,6	33,6	41	25 × G 1	G 1 A	23	54,7	36,7	46
32	1 5/8-12 UN	27,5	32 × M42	M42 × 2	30	54,9	34,9	50	32 × G 1 1/4	G 1 1/4 A	30	60	40	50
38	1 7/8-12 UN	33,5	38 × M48	M48 × 2	36	68,5	46,5	55	38 × G 1 1/2	G 1 1/2 A	36	67,1	45,1	55

[a] For further details on sealing, ISO 9974-2 and ISO 1179-2.

[b] For general applications only. For new designs in hydraulic fluid power applications, stud end dimensions shall be in accordance with ISO 6149-3.

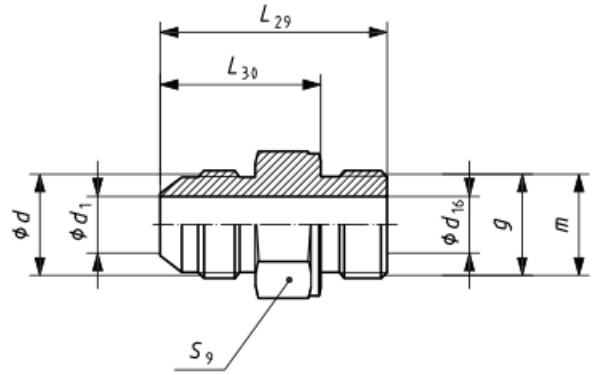
[c] See Table 1 for corresponding inch sizes.

[d] In accordance with ISO 263, ISO 68-2 and ISO 5864.

[e] For SDS, the smaller diameter of d_1 or d_{15} may go all the way through the connector, or the connector may have a transition area approximately halfway within the hex.

[f] For tolerances, see ISO 9974-2:1996, and ISO 1179-2:—, dimension d_3.

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NOTE For details not shown here, see Figure 4 and Table 7.

Figure 14 — Stud connector (SDS) with ISO 9974-3 and ISO 1179-4 stud ends

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Table 17 — Dimensions of stud connectors with ISO 9974-3 and ISO 1179-4 stud ends

Dimensions in millimetres

Tube OD [c]	Thread [d]		ISO 9974-3 [a, b]						ISO 1179-4 [a]					
			Ordering size code	ISO 9974-3 stud end thread					Ordering size code [f]	ISO 1179-5 stud end thread				
	d	d_1 [e] ref.		m	d_{16} [e, f] ref.	L_{29} ± 1	L_{30} ± 1	S_8		g	d_{16} [e, f] ref.	L_{29} ± 1	L_{30} ± 1	S_9
6	7/16-20 UNF	4,4	6 × M10	M10 × 1	4	31	23	14	6 × G 1/8	G 1/8 A	4	30	22	16
8	1/2-20 UNF	6	8 × M12	M12 × 1,5	6	33,5	21,5	17	8 × G 1/4	G 1/4 A	7	34,8	22,8	19
10	9/16-18 UNF	7,5	10 × M14	M14 × 1,5	7	33,5	21,5	19	10 × G 1/4	G 1/4 A	7	35,1	23,1	19
12	3/4-16 UNF	9,9	12 × M16	M16 × 1,5	9	37,6	25,6	22	12 × G 3/8	G 3/8 A	9	38,5	26,5	22
16	7/8-14 UNF	12,3	16 × M18	M18 × 1,5	11	41,7	29,7	27	16 × G 1/2	G 1/2 A	14	44,5	30,5	30
20	1 1/16-12 UN	15,5	20 × M22	M22 × 1.5	14	45,5	31,5	32	20 × G 3/4	G 3/4 A	18	50,9	34,9	36
25	1 5/16-12 UN	21,5	25 × M33	M33 × 1.5	23	51,6	33,6	41	25 × G 1	G 1 A	23	54,7	36,7	46
32	1 5/8-12 UN	27,5	32 × M42	M42 × 2	30	54,9	34,9	50	32 × G 1 1/4	G 1 1/4 A	30	60	40	50
38	1 7/8-12 UN	33,5	38 × M48	M48 × 2	36	68,5	46,5	55	38 × G 1 1/2	G 1 1/2 A	36	67,1	45,1	55

[a] For further details on sealing, see ISO 9974-3 and ISO 1179-4.

[b] For general applications only. For new designs in hydraulic fluid power applications, stud end dimensions shall be in accordance with ISO 6149-3.

[c] See Table 1 for corresponding inch sizes.

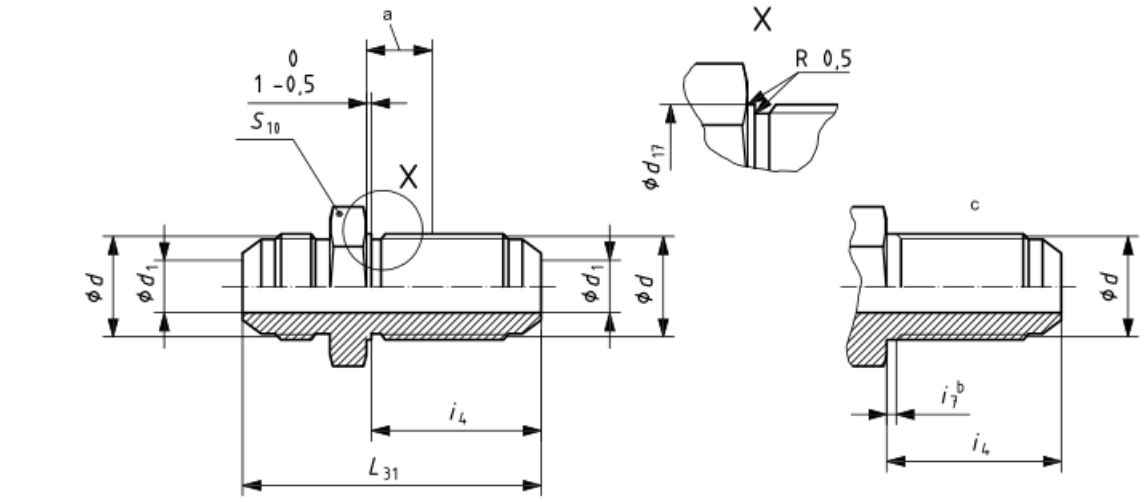
[d] In accordance with ISO 263, ISO 68-2 and ISO 5864.

[e] For SDS, the smaller diameter of d_1 or d_{15} may go all the way through the connector, or the connector may have a transition area approximately halfway within the hex.

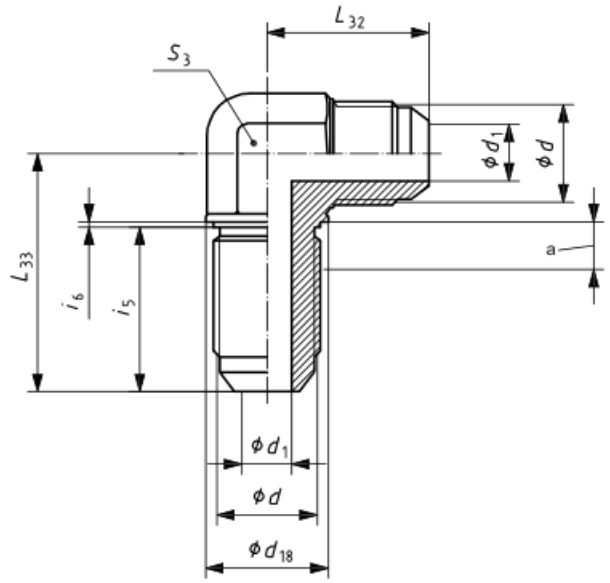
[f] For tolerances, see ISO 9974-3:1996, (dimension d_5), and ISO 1179-4:—, dimension d_3.

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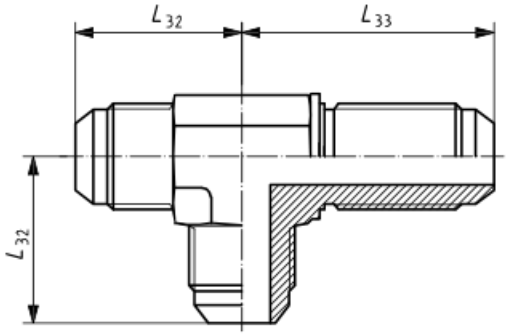
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a) Bulkhead (straight) (BHS)



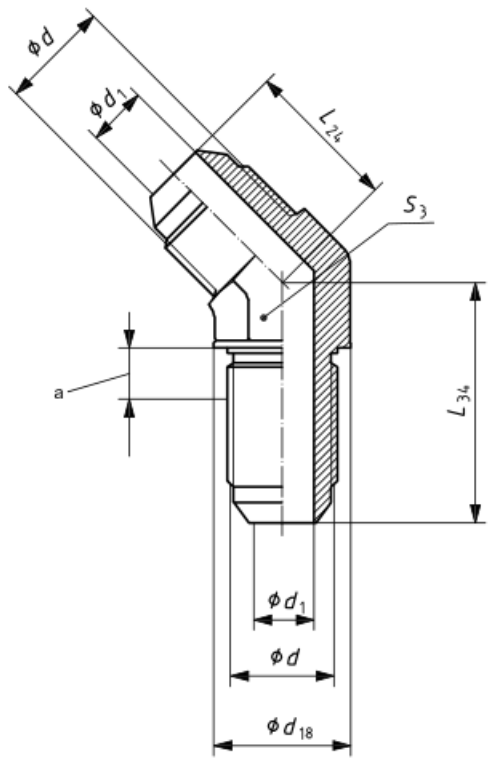
b) 90° bulkhead elbow (BHE)



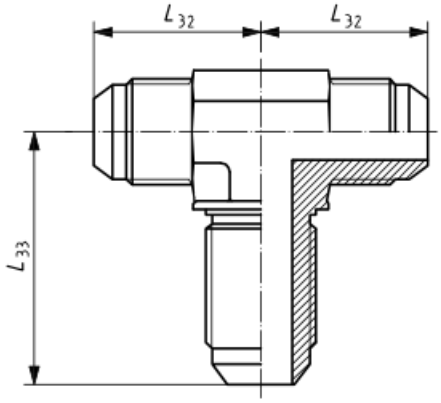
c) Bulkhead run tee (BHRT)

Figure 15 — Bulkhead connectors and corresponding bulkhead locknuts

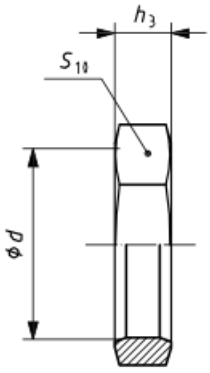
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d) Adjustable stud run tee (SDRT)



e) Bulkhead branch tee (BHBT)



f) Bulkhead locknut (BHLN)

NOTE For details not shown here, see Figure 4 and Table 7.

[a] Maximum bulkhead thickness: 10 mm.

[b] Distance from last full-form thread to bearing face.

[c] Optional construction.

Figure 15 *(continued)*

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Table 18 — Dimensions of bulkhead connectors and corresponding bulkhead locknuts

Dimensions in millimetres

Ordering size code [a]	Tube OD [b]	Thread [c] d	d_1 ref.	d_{17} [d] ref.	d_{18} ± 1	h_3 ± 0,5	i_4 ± 0,5	i_5 ± 0,5	i_6 ± 0,5	i_7 max.	L_{24} ref.	L_{31} ± 0,8	L_{32} ± 1	L_{33} ± 1	L_{34} ± 1	S_3 ref.	S_{10}
6 × 6	6	7/16-20 UNF	4,4	11,1	14,3	7,1	30,5	25,9	2,4	3	18,5	52,5	24,5	40,5	39	12	17
8 × 8	8	1/2-20 UNF	6	12,7	15,9	7,1	30,5	25,9	2,4	3	19,5	52,5	27	43,5	42	14	19
10 × 10	10	9/16-18 UNF	7,5	14,3	17,5	7,1	32,5	27,7	2,4	3	21	55,5	27,5	46	42,5	14	22
12 × 12	12	3/4-16 UNF	9,9	19	22,2	7,9	36,6	31,8	3,2	3	25	62	34,5	53,5	49,5	19	24
16 × 16	16	7/8-4 UNF	12,3	22,2	25,4	9,1	40,1	35,3	3,2	4	28	69,5	39,5	60,5	55	22	30
20 × 20	20	1 1/16-12 UN	15,5	27	30,2	10,4	44,4	39,6	3,2	4	32,5	78,5	45	68	62	27	36
25 × 25	25	1 5/16-12 UN	21,5	33,3	36,5	10,4	44,4	39,6	3,2	4	37,5	80	49,5	71	65	32	41
32 × 32	32	1 5/8-12 UN	27,5	41,3	44,4	10,4	45,7	40,9	3,2	4	40,5	84	55	79	67,5	41	50
38 × 38	38	1 7/8-12 UN	33,5	47,6	50,8	10,4	46	41,1	3,2	4	45	89,5	59,5	87	68	50	55
50 × 50	50	2 1/2-12 UN	45	63,5	66,7	10,4	53,1	48,5	3,2	4	56,5	106,5	73,5	104,5	74	65	70

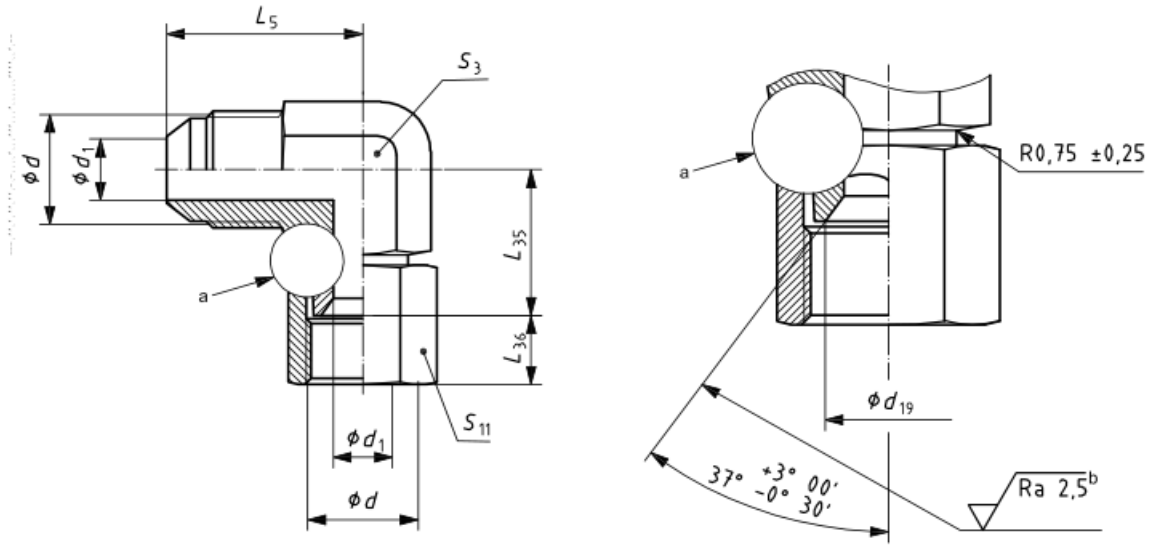
[a] Code given is for straights and elbows. Add third end size for tees using left, right, up-and-down sequence, omitting ends when not present.

[b] See Table 1 for corresponding inch sizes.

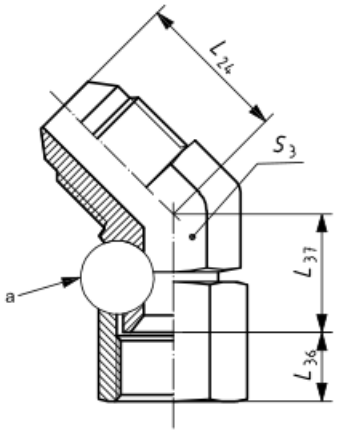
[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

[d] Diameter of bulkhead pilot is the same as major thread diameter. Recommended pilot hole for bulkhead fittings is 0,4 mm over major thread diameter.

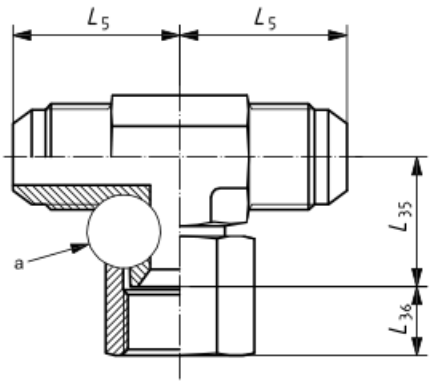
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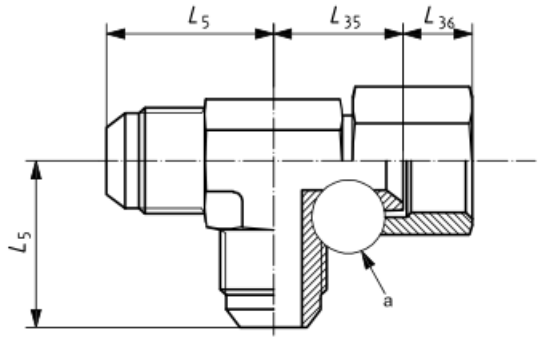
a) Swivel elbow (SWE)



b) 45° swivel elbow (SWE45)



c) Swivel branch tee (SWBT)



d) Swivel run tee (SWRT)

NOTE For details not shown here, see Figure 4 and Table 7.

[a] Method of attachment of swivel nut is at the option of the manufacturer.

[b] No axial tool marks are allowed on this surface; for spiral tool marks, a surface roughness value $Ra \leqslant 1{,}6$ µm shall be used.

Figure 16 — Swivel connector

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Table 19 — Dimensions of swivel connectors

Dimensions in millimetres

Ordering size code [a]	Tube OD [b]	Thread [c] d	d_1 ref.	d_{19} ± 0,25	L_5 ref.	L_{24} ± 1	L_{35} ± 1,5	L_{36} $^{+0,8}_{-0,4}$	L_{37} ± 1,5	S_3 ref.	S_{11}
6 × 6	6	7/16-20 UNF	4,4	7,35	22,5	18,5	16,7	8,7	15,2	12	14
8 × 8	8	1/2-20 UNF	6	8,90	24	19,5	17,4	9,5	15,9	14	17
10 × 10	10	9/16-18 UNF	7,5	10,90	27	21	22,3	9,5	18,9	14	19
12 × 12	12	3/4-16 UNF	9,9	14,35	32	25	24,4	10,7	21,8	19	22
16 × 16	16	7/8-14 UNF	12,3	17,15	37	28	28,4	12,7	23,9	22	27
20 × 20	20	1 1/16-12 UN	15,5	21,45	42	32,5	30,1	14,3	23,8	27	32
25 × 25	25	1 5/16-12 UN	21,5	27,80	46	37,5	35,7	15,1	29,3	32	41
32 × 32	32	1 5/8-12 UN	27,5	35,70	52,5	40,5	42,8	15,9	35,7	41	50
38 × 38	38	1 7/8-12 UN	33,5	41,15	59	45	47,2	18,6	38,6	50	60
50 × 50	50	2 1/2-12 UN	45	56,75	77,5	56,5	62,1	23,8	50,1	65	75

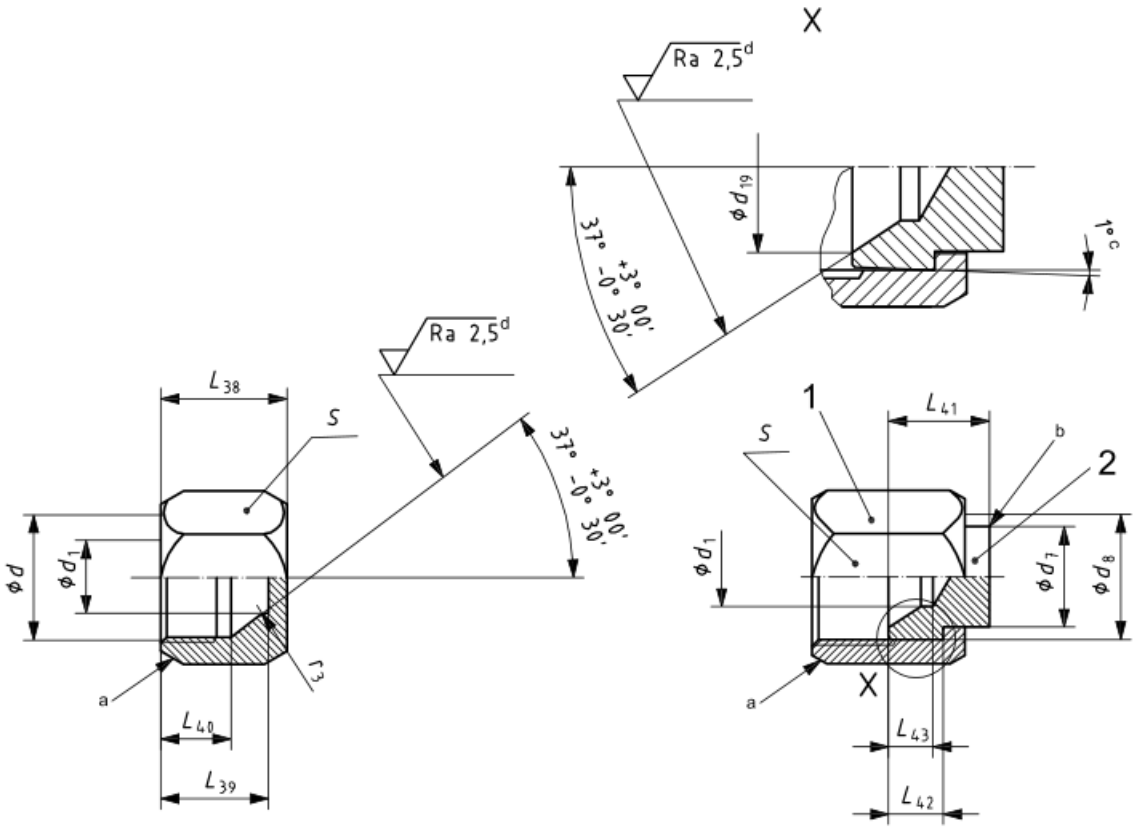
[a] Code given is for straights and elbows. Add third end size for tees using left, right, up-and-down sequence, omitting ends when not present.

[b] See Table 1 for corresponding inch sizes.

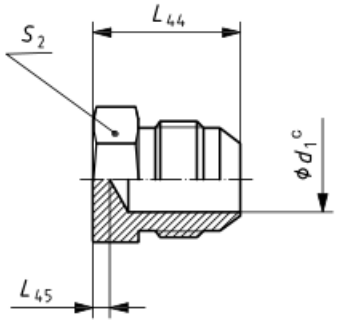
[c] In accordance with ISO 263, ISO 68-2 and ISO 5864.

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a) Cap (CP)



b) Plug (PL)

Key

1 tube nut

2 insert

NOTE For details not shown here, see Figure 4 and Table 7.

a For dimensions, see Figure 8 and Table 11 for details.

b Stake or flare to retain insert.

c Optional construction.

d No axial tool marks are allowed on this surface; for spiral tool marks, a surface roughness value $Ra \leqslant 1{,}6$ µm shall be used.

Figure 17 — Cap and plug

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Table 20 — Dimensions of caps and plugs

Dimensions in millimetres

Ordering size code	Tube OD [a]	Thread [b] d	d_1 ref.	d_7 ref.	d_8 ref.	d_{19} ref.	L_{38} ± 0,3	L_{39} ± 0,3	L_{40} ± 0,13	L_{41} ± 0,4	L_{42} ± 0,4	L_{43} ± 0,4	L_{44} ± 0,8	L_{45} min.	S ref.	S_2 ref.
6 × 6	6	7/16-20 UNF	4,4	7,5	9,65	7,35	15,1	13,5	8,33	8,7	5,2	3,2	20,5	2,8	14	12
8 × 8	8	1/2-20 UNF	6	9,25	11,23	8,9	15,5	13,9	8,74	10,3	5,6	3,6	20,5	3	17	14
10 × 10	10	9/16-8 UNF	7,5	10,95	12,68	10,9	15,9	14,3	8,74	11,9	6,8	4	21,5	3	19	17
12 × 12	12	3/4-16 UNF	9,9	14,25	17,25	14,35	19,0	15,9	9,52	13,5	8	4,4	24	4,1	22	22
16 × 16	16	7/8-14 UNF	12,3	17,45	24,61	17,15	21,4	18,3	11,91	13,5	7,1	4,8	28	4,1	27	24
20 × 20	20	1 1/16-12 UN	15,5	21,6	27,78	21,45	23,0	19,8	12,70	16,7	7,1	8	32,5	4,8	32	30
25 × 25	25	1 5/16-12 UN	21,5	27,45	30,96	27,8	25,8	21,8	14,30	15,9	7,6	5,6	34	4,8	41	36
32 × 32	32	1 5/8-12 UN	27,5	33,95	38,88	35,7	27,0	23,0	14,30	19,1	9,5	7,1	37	5,8	50	46
38 × 38	38	1 7/8-12 UN	33,5	40,85	45,24	41,15	30,2	26,2	16,66	23,8	10,3	9,5	42	5,8	60	50
50 × 50	50	2 1/2-12 UN	45	54,75	61,11	56,75	36,5	32,5	21,03	30,1	14,7	10,3	52	8,4	75	65

[a] See Table 1 for corresponding inch sizes.

[b] In accordance with ISO 263, ISO 68-2 and ISO 5864.

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Annex A
(normative)

Length reduction factors for reducing connectors

Annex A contains the factors to be used to calculate the lengths of reducing connectors, also known as “jump” connectors. Figures A.1 to A.9 illustrate the different types of reducing connectors.

NOTE The reduction factors and associated dimensions given in Tables A.1 to A.3 and A.4 represent factors specified within ANSI/SAE J514 [1]. These factors represent current industry practice.

For any non-standard size connector, be it straight, 45° or 90° elbow, tee or cross connector, one end is always standard. Considering this to be the largest end on the connector, it may then be used as a basis for establishing the stock size and length (either overall or end-to-centre) for all other ends, by deducting the factors given in the below tables equivalent to the reduction in machining requirements from the appropriate standard lengths given for a non-reducing (non-jump) connector.

At the manufacturer’s option, drill-through passages in straight special size (reducing) connectors may conform to the smaller diameter specified for up to two-step tube OD size difference, or conform to one or the other of the following for any size difference:

— the appropriate end may be countersunk to the larger diameter;

— the appropriate end may be drilled to the larger diameter up to the middle of the hex.

The factors that apply to various end configurations and size reductions given in this annex were determined on the following basis.

a) Dimensions of lengths were derived by maintaining the standard hexagon thickness for straight union connectors, and the standard centreline to machining start for shaped connectors. For straight stud connectors, the total width of the hex and the identification collar (ring) — if applicable — for the larger size is held constant.

b) Factors given in Tables A.1, A.3 and A.6 were derived by subtracting the standard machining length required for the smaller end from that required for the larger standard end and rounding the result to one decimal place.

c) The factors given in Tables A.2, A.5 and A.7 were derived by subtracting the standard machining length (minimum full thread length) plus an allowance of one-and-one-half thread pitches for imperfect thread length required for the smaller end from the same value required for the larger end and rounding the result down to the nearest 0,5 mm.

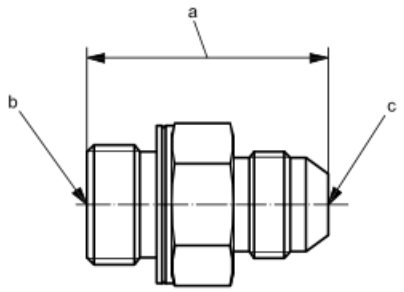
The following tolerances apply to reducing connectors:

— overall length of straight connectors: ± 0,8 mm;

— from centreline to end on shaped connectors: ± 1,5 mm.

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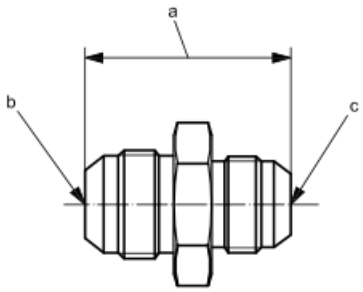


a Length to be reduced by factor from Table A.1.

b Standard stud end.

c Reduced 37° flared end.

Figure A.1 — Stud straight with reduced 37° flared end



a Length to be reduced by factor from Table A.1.

b Standard 37° flared end.

c Reduced 37° flared end.

Figure A.2 — Reducer union

Table A.1 — Factors for straight connectors with reduced 37° flared end

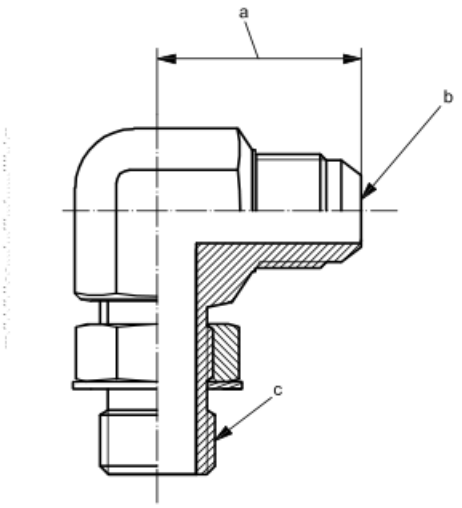
Dimensions in millimetres

Nominal tube OD of smaller 37° flared end	Standard machining size (tube OD or stud size of larger end of connector)								
	Tube OD								
	8 **G1/4 or M12 × 1,5** 1/2-20 UNF	**10** **G1/4 or M14 × 1,5** 9/16-18 UNF	**12** **G3/8 or M16 × 1,5** 3/4-16 UNF	**16** **G1/2 or M22 × 1,5** 7/8-14 UNF	**20** **G3/4 or M27 × 2** 1 1/16-12 UNF	**25** **G1 or M33 × 2** 1 5/16-12 UNF	**32** **G1 1/4 or M42 × 2** 1 5/8-12 UNF	**38** **G1 1/2 or M48 × 2** 1 7/8-12 UNF	**50** **G2 or M60 × 2** 2 1/2-12 UNF
6	0	0,3	2,8	5,3	7,9	9,1	10,4[b]	13,5[b]	19,8[b]
8		0,3	2,8	5,3	7,9	9,1	10,4[b]	13,5[b]	19,8[b]
10			2,5	5,1	7,9	9,1	10,2	13,5[b]	19,8[b]
12				2,5	5,3	6,4	7,6	10,9	17,3[b]
16			[a]		2,8	3,8	5,1	8,4	17,3
20						1,3	2,3	5,6	14,7
22							1,3	17,3	11,9
25								3,3	9,7
30									6,4

a No factor is required when the ends of the connector are the same size. For connectors whose 37° flared end is larger than the stud end, see Table A.3 or A.6.

b These "multiple jump" connectors are not recommended.

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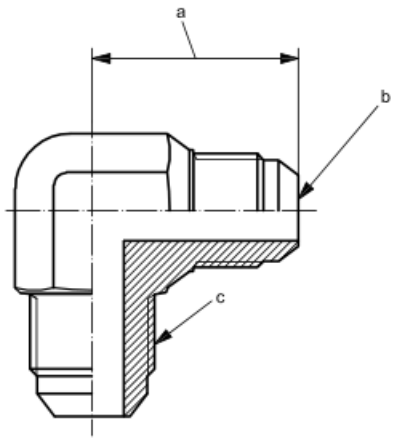


a Length to be reduced by factor from Table A.2.

b Reduced 37° flared end.

c Standard O-ring stud end.

Figure A.3 — 90° adjustable stud elbow with reduced 37° flared end (for shaped connectors)



a Length to be reduced by factor from Table A.2.

b Reduced 37° flared end.

c Standard O-ring stud end.

Figure A.4 — Union elbow with reduced 37° flared end

Table A.2 — Factors for 37° flared end on shaped connectors with reduced 37° flared end

Dimensions in millimetres

Nominal tube OD of smaller 37° flared end	Standard machining size (tube OD or stud size of larger end of connector)								
	Tube OD								
	8 **G1/4 or M12 × 1,5** 1/2-20 UNF	**10** **G1/4 or M14 × 1,5** 9/16-18 UNF	**12** **G3/8 or M16 × 1,5** 3/4-16 UNF	**16** **G1/2 or M22 × 1,5** 7/8-14 UNF	**20** **G3/4 or M27 × 2** 1 1/16-12 UNF	**25** **G1 or M33 × 2** 1 5/16-12 UNF	**32** **G1 1/4 or M42 × 2** 1 5/8-12 UNF	**38** **G1 1/2 or M48 × 2** 1 7/8-12 UNF	**50** **G2 or M60 × 2** 2 1/2-12 UNF
6	0	0,3	3,3	6,1					
8		0,3	3,3	6,1	9,1		b		
10			2,8	5,8	8,9				
12				3,0	6,1	7,4			
16			a		3,0	4,3	5,6		
20						1,3	2,3	5,5	
22							1,3	4,3	10,7
25								3,3	9,7
30									6,4

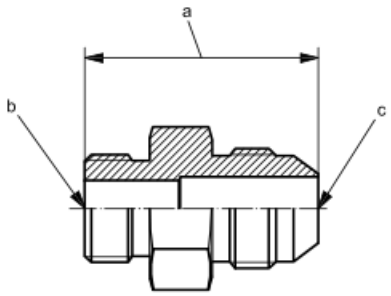
These correction factors also apply to swivel connectors.

a No factor is required when the ends of the connector are the same size. For connectors whose 37° flared end is larger than the stud end, see Tables A.5 and A.7.

b These "multiple jump" connectors are not recommended.

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a Length to be reduced by factor from Table A.3.

b Reduced O-ring stud end.

c Standard 37° flared end.

Figure A.5 — Straight stud with reduced ISO 11926-3 stud end

Table A.3 — Factors for straight stud connectors with reduced ISO 11926-3 stud end

Dimensions in millimetres

Smaller stud end	Standard machining size (tube OD of larger end of connector)								
	8	10	12	16	20	25	32	38	50
6	0	–0,8	+0,3	–1,3 [b]	–3,6 [b]	–3,6 [b]	–3,6 [b]	–3,6 [b]	–3,6 [b]
8		–0,8	+0,3	–1,3	–3,6 [b]	–3,6 [b]	–3,6 [b]	–3,6 [b]	–3,6 [b]
10			–1	+0,3	–2,8	–2,8 [b]	–2,8 [b]	–2,8 [b]	–2,8 [b]
12				–1,5	–0,8	–0,8	–0,8 [b]	–0,8 [b]	–0,8 [b]
16					–2,3	+0,8	+0,8	+0,8 [b]	+0,8 [b]
20						0	+3,3	+3,3	+3,3 [b]
25				[a]			+4,1	+4,1	+4,1
32								+4,1	+4,1
38									+4,1

Connectors involving hex sizes greater than or equal to S_{12} shall include a turned shoulder of diameter d_{21} and length L_{46} as shown in Figure A.6 and given in Table A.4. This turned shoulder permits the reduced straight thread end to seat in a standard port spotface. For some combinations, additional length will be required to accommodate this feature. Therefore, all factors designated as plus in this table should be added to the standard length dimensions to obtain the necessary values.

[a] No factor is required when the ends of the connector are the same size. For stud ends larger than the standard for the 37° flared end, see Table A.1.

[b] These "multiple jump" connectors are not recommended.

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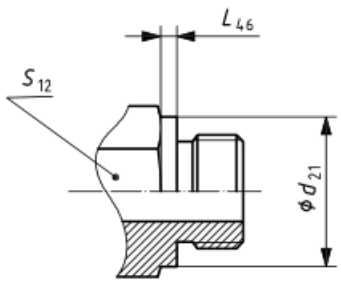


Figure A.6 — Reduced ISO 11926-3 stud end

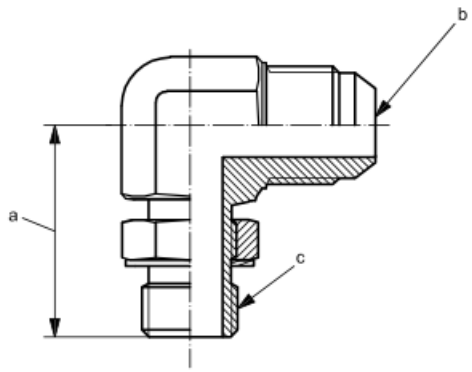
Table A.4 — Dimensions for reduced ISO 11926-3 stud end

Dimensions in millimetres

Nominal tube OD of smaller stud end	d_{21} ± 0,3	L_{46} ± 0,3	S_{12} ref.
6	16	2,3	18
8	17,5	2,3	19
10	19	2,3	21
12	23,9	3,3	25
16	26,9	3,3	29
20	33,3	3,3	35
25	39,6	4,1	42
32	47,7	4,1	50
38	54,1	4,1	56

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a Length to be reduced by factor from Table A.5.

b Standard 37° flared end

c Reduced O-ring stud end

Figure A.7 — 90° adjustable stud elbow with reduced ISO 11926-3 stud end

Table A.5 — Factors for 90° adjustable stud elbow with reduced ISO 11926-3 stud end

Dimensions in millimetres

Nominal tube OD of smaller stud end	Standard machining size (tube OD of larger end of connector)								
	8	10	12	16	20	25	32	38	50
6	0	1,5	4,8	8,9	b				
8		1,5	4,8	8,9					
10			3,3	7,4	11,4	11,4	11,4	11,4	11,4
12				4,1	8,1	8,1	8,1	8,1	8,1
16					4,1	4,1	4,1	4,1	4,1
20						0	0	0	0
25			a				0	0	0
32								0	0
38									0

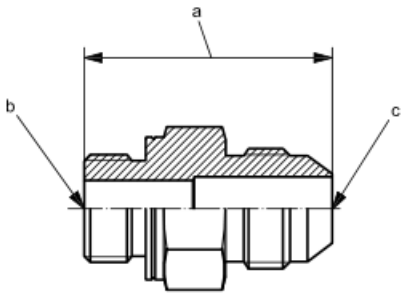
a No factor is required when the ends of the connector are the same size. For stud ends larger than the standard for the 37° flared end, see Table A.2.

b These "multiple jump" connectors are not recommended.

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a Length to be reduced by factor from Table A.6.

b Reduced O-ring stud end.

c Standard 37° flared end.

Figure A.8 — Straight stud with reduced ISO 6149-3 stud end

Table A.6 — Factors for straight stud connectors with reduced ISO 6149-3 stud end

Dimensions in millimetres

Nominal tube OD of smaller stud end	Standard machining size (tube OD of larger end of connector)								
	8 M12 × 1,5	**10** M14 × 1,5	**12** M16 × 1,5	**16** M22 × 1,5	**20** M27 × 2	**25** M33 × 2	**32** M42 × 2	**38** M48 × 2	**50** M60 × 2
6	2,5	2,5							
8		0	0,5						
10			0,5	2,0			b		
12				1,5	4,5				
16					3,0	3,0			
20						0	0		
25			a				0	1,5	
32								1,5	1,5
38									0

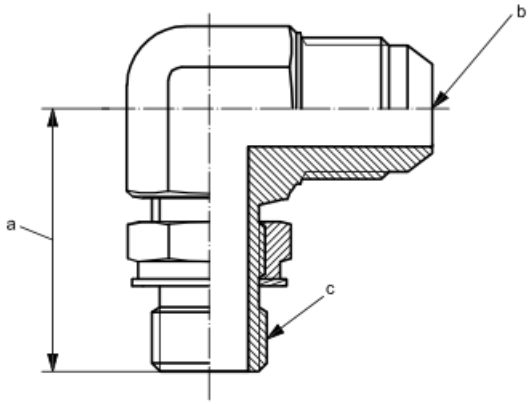
Jump size fittings shall be designed with the metric identification groove specified in ISO 6149-3 for the stud end being machined. This provides clearance for the respective port spotface.

a No factor is required when the ends of the connector are the same size. For stud ends larger than the standard for the 37° flared end, see Table A.1.

b These “multiple jump” connectors are not recommended.

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a Length to be reduced by factor from Table A.7.

b Standard 37° flared end.

c Reduced O-ring stud end.

Figure A.9 — 90° adjustable stud elbow with reduced ISO 6149-3 stud end

Table A.7 — Factors for 90° adjustable stud elbow with reduced ISO 6149-3 stud end

Dimensions in millimetres

Smaller stud end	Standard machining size (tube OD of larger end of connector)								
	8	10	12	16	20	25	32	38	50
6	4,8	4,8							
8		0	0,5						
10			0,5	2,5			b		
12				2,0	7,8				
16					5,8	5,8			
20						0	0		
25			a				0	1,5	
32								1,5	1,5
38									0

a No factor is required when the ends of the connector are the same size. For stud ends larger than the standard for the 37° flared end, see Table A.2.

b These “multiple jump” connectors are not recommended.

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[1] ANSI/SAE J514, *Hydraulic Tube Fittings*

[2] ISO 12151-5, *Connections for hydraulic fluid power and general use — Hose fittings — Part 5: Hose fittings with ISO 8434-2 37° flared ends*

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