INTERNATIONAL STANDARD

ISO 8434-3

Second edition
2005-07-15

Metallic tube connections for fluid power and general use —

Part 3: O-ring face seal connectors

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

Partie 3: Connecteurs à joints faciaux toriques

Reference number
ISO 8434-3:2005(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 8434-3 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 8434-3:1995), 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 fittings*

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

— *Part 4: 24° cone connectors with O-ring weld-on nipples* [1)]

— *Part 5: Test methods for threaded hydraulic fluid power connections* [2)]

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

1) ISO 8434-4 will be incorporated into the revision of ISO 8434-1.

2) ISO 8434-5 will be withdrawn once ISO 19879 is published.

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) and conductors (tubes and hoses). Tubes are rigid conductors; hoses are flexible conductors.

This part of ISO 8434 is based on the USA standard ANSI/SAE J1453. The threads for the O-ring face seal connection are unified inch threads to ISO 263. The inch threads were not changed to metric threads to ISO 261 to allow connectors complying with this 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 are dimensioned to be used with ISO standard metric wrenches.

Metallic tube connections for fluid power and general use —

Part 3:
O-ring face seal connectors

1 Scope

This part of ISO 8434 specifies the general and dimensional requirements for the design and performance of O-ring face seal connectors made of steel for tube outside diameters or hose inside diameters of 6 mm through 38 mm, inclusive. These connectors are for use in fluid power and general applications where elastomeric seals can be used to prevent fluid leakage, including leakage caused by variations in assembly procedures. They are intended for the connection of tubes and hose fittings to ports in accordance with ISO 6149-1. (See ISO 12151-1 for related hose fitting specification.)

These connectors provide leakproof, full-flow connections in hydraulic systems operating from a vacuum of 6,5 kPa [0,065 bar [3)]] absolute pressure 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, it is recommended that sufficient testing be conducted and reviewed by both the user and manufacturer to ensure that required performance levels are met.

NOTE For use under conditions outside the pressure and/or temperature limits specified, see 5.3.

Both metric and inch tubing can be accommodated by changing the sleeve (see Annex D). 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 O-ring face seal 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 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

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

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*

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

3) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1N/mm^2.

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

ISO 3601-3:—[4], *Fluid systems — Sealing devices — O-rings — Part 3: Quality acceptance criteria*

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

ISO 5598, *Fluid power systems and components — Vocabulary* [5]

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

ISO 6149-1, *Connections for fluid power and general use — Ports and stud ends with ISO 261 threads and O-ring sealing — Part 1: Ports with O-ring seal in truncated housing* [6]

ISO 6149-2:—[7], *Connections for fluid power and general use — Ports and stud ends with ISO 261 threads and O-ring sealing — Part 2: Heavy-duty (S series) stud ends — Dimensions, design, test methods and requirements*

ISO 8434-1, *Metallic tube connections for fluid power and general use — Part 1: 24° cone connectors* [8]

ISO 8434-2, *Metallic tube connections for fluid power and general use — Part 2: 37° flared fittings*

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

ISO 12151-1, *Connections for hydraulic fluid power and general use — Hose fittings — Part 1: Hose fittings with ISO 8434-3 O-ring face seal ends*

ISO 19879, *Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections* [9]

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598, ISO 8434-1 and ISO 8434-2, and the following apply.

3.1
fluid power
means whereby energy is transmitted, controlled and distributed using a pressurized fluid as the medium

[ISO 5598]

3.2
connector
leakproof device to connect pipelines (conductors) to one another, or to equipment

[ISO 5598]

4) To be published. (Revision of ISO 3601-3:1987)

5) To be published. (Revision of ISO 5598:1985)

6) To be published. (Revision of ISO 6149-1:1993)

7) To be published. (Revision of ISO 6149-2:1993)

8) To be published. (Revision of ISO 8434-1:1994 and ISO 8434-4:1995)

9) To be published. (Revision of ISO 8434-5:1995)

3.3
fastening thread
terminal thread of a complete connector

3.4
run
two principal, axially aligned outlets of a tee or cross

3.5
branch
side outlet of a tee or cross

3.6
chamfer
removal of a conical portion at the entrance of a thread to assist assembly and prevent damage to the start of the thread

3.7
assembly torque
torque to be applied in order to achieve a satisfactory final assembly

3.8
working pressure
pressure at which the apparatus is being operated in a given application

[ISO 5598]

3.9
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).

3.10
nonadjustable stud end
stud end connector that does not require specific orientation through final tightening of the connection, because it is only used on straight connectors

4 Materials

4.1 General

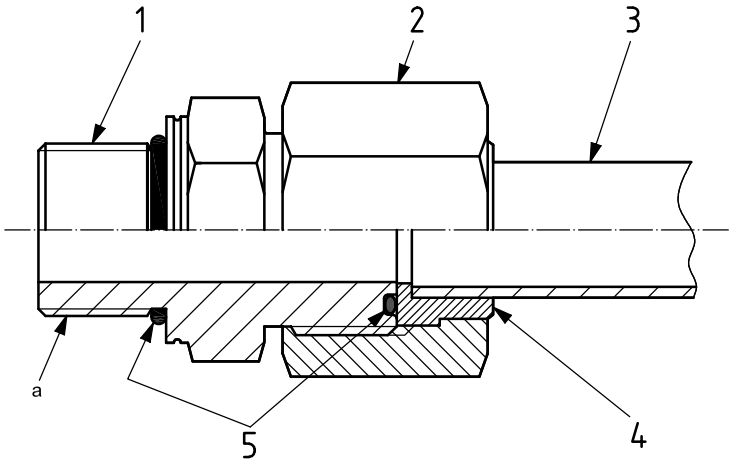
Figure 1 shows the cross-selection and components of a typical O-ring face seal connector.

4.2 Connector bodies

Bodies shall be manufactured from carbon steel that will provide the minimum pressure/temperature requirements 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 that will provide an effective joint. Weld-on sleeves shall be made of materials classified as suitable for welding.

4.3 Nuts

Nuts to be used with carbon steel bodies shall be made of carbon steel, unless otherwise specified. In tube assemblies where sleeves are copper brazed, nuts become annealed, reducing their strength. Nuts for copper brazed assemblies shall be made from suitable, higher strength material to meet the performance requirements in 15.1. High-strength nuts (style B nuts) shall be identified by a turned diameter, d_{14}, as shown in Figure 5.



Key

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

a Stud end in accordance with ISO 6149-2.

Figure 1 — Cross-section and components of typical O-ring face seal connector body

4.4 O-rings

Unless otherwise specified, for use with petroleum-based hydraulic fluids at the pressure and temperature requirements in Clause 5 and Table 1 and for testing, the O-rings shall be made of NBR (nitrile) with a hardness of (90 ± 5) IRHD, measured per ISO 48, and shall conform to the dimensions given in Table 6 and shall meet or exceed the O-ring quality acceptance criteria for grade N of ISO 3601-3:—. In those cases, where the pressure and temperature requirements of this part of ISO 8434 and/or the hydraulic fluid used in the system differ from those specified in Clause 5 and Table 1, the connector manufacturer shall be consulted to ensure that an appropriate O-ring material is selected.

5 Pressure/temperature requirements

5.1 Connectors in conformance with this part of ISO 8434 made of carbon steel shall meet or exceed without leakage the requirements from a vacuum of 6,5 kPa (0,065 bar) absolute pressure to the working pressures given in Table 1 when used at temperatures between −40 °C and +120 °C with petroleum-based hydraulic fluids.

5.2 The connector assembly shall meet or exceed all applicable performance requirements given in Clause 15. Testing shall be conducted at room temperature.

5.3 For applications under conditions other than the temperature and/or pressure limits given in Table 1 and in 5.1 and 5.2, the manufacturer shall be consulted.

Table 1 — Working pressures for O-ring face seal connectors

Tube outside diameter [a]		Thread [b]	Maximum working pressure			
			Connectors with nonadjustable stud ends		Connectors with adjustable stud ends	
mm	in		MPa	(bar)	MPa	(bar)
6	1/4	M12 × 1,5	63	(630)	40	(400)
8	5/16	M14 × 1,5	63	(630)	40	(400)
10	3/8	M16 × 1,5	63	(630)	40	(400)
12	1/2	M18 × 1,5	63	(630)	40	(400)
16	5/8	M22 × 1,5	40	(400)	40	(400)
20	3/4	M27 × 2	40	(400)	40	(400)
22	7/8	M30 × 2 [c]	40	(400)	35	(350)
25	1	M33 × 2	40	(400)	35	(350)
30	1 1/4	M42 × 2	25	(250)	25	(250)
38	1 1/2	M48 × 2	25	(250)	20	(200)

NOTE These pressures were established using connectors made of low carbon steel and tested according to Clause 15.

[a] Metric tubing shall be preferred.

[b] Port in accordance with ISO 6149-1; stud end in accordance with ISO 6149-2.

[c] This size will be included in the revisions of ISO 6149-1 and ISO 6149-2.

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 8434-3, followed by a spaced hyphen, then the connector style letter symbols (see 6.2 and 6.9), followed by a spaced hyphen and, for the ends, the outside diameter of the tube with which they are to be connected, each separated by a multiplication symbol (×). If the style of O-ring groove needs to be included, its letter symbol shall be added after the number for the first outside diameter (see 6.8 for further information). There shall be no spaces on either side of the multiplication symbol. For stud ends (connector ends), the thread designation of the stud end shall be added.

EXAMPLE A straight stud connector (SDS) for use with 12 mm OD tubing with a heavy-duty (S series) M18 × 1,5 stud end, in accordance with ISO 6149-2, is designated as follows:

Connector ISO 8434-3 - SDS-12×12M18

size code

connector style letter symbol

6.2 The letter symbol designation of the connector style shall have two parts: the connection end type immediately followed by the shape of the connector. The letters A and B shall be used to distinguish different styles, where such options exist.

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

6.4 Reducing connectors and reducing 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 larger tube end 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 top to bottom, with larger ends on the left and at the top.

6.8 The style of O-ring groove (see Figure 2) shall be designated as follows.

— If the O-ring groove conforms to styles A (angled groove) or B (half-dovetail groove) (grooves designed to provide improved retention of the O-ring), the code letter A or B shall be added to the designation as specified in 6.1.

— If the O-ring groove conforms to style C, the code letter C shall be added to the designation as specified in 6.1.

— If no preference is stated by either the purchaser or supplier, no code letter related to the O-ring groove shall be added to the designation.

For tee and cross connectors, the O-ring groove style shall be indicated only one time, after the first connection end size. It is assumed that all ends on the connector have the same type of groove.

EXAMPLE A tee connector with three connection ends that connect to a tube with a nominal outside diameter of 12 mm and that have O-ring grooves that provides improved retention of the O-ring would be designated as follows:

ISO 8434-3 -T - 12A×12×12

6.9 The following letter symbols shall be used:

Connection end type	**Letter**
Bulkhead	BH
Swivel	SW
Weld-on	WD
Braze-on	BR
Port	P
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

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 Table 2 or 3.

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

Table 2 — Metric tube sizes

Tube outside diameter mm	**Limits of the outside diameter** 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
22 [a]	21,9	22,1
25	24,9	25,1
30	29,85	30,15
38	37,85	38,15
Metric tubing shall be preferred.		
[a] This size will be included in the revisions of ISO 6149-1 and ISO 6149-2.		

Table 3 — Inch tube sizes

Tube outside diameter		**Limits of the outside diameter** 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
7/8	22,23	22,13	22,33
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
[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 Tables 11 to 15 and 17, 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. The basic forging size may be increased up to the maximum size shown for barstock, but the size selected shall be a metric across-flat size with minus tolerance only.

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 nominal 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 2 through 18 and Tables 6 through 22. They shall be designed so that resistance to flow is reduced to a minimum.

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.

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 specified passage.

9.4 Angular tolerances

Angular tolerances on axis 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 6 to 22 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 6149-2.

9.7 Reducing connectors

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

10 Screw threads

10.1 O-ring face seal ends

The screw threads on the tube connection ends of the connectors shall be ISO inch screw threads in accordance with ISO 263 and Annex A, except for the 1-14 UNS class 2A and 2B threads, whose dimensions are also found in Annex A.

10.2 Stud ends (connection ends)

The screw threads for the stud ends of connectors shall be ISO metric in accordance with ISO 261.

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 connectors, except braze-on type components and weld-on nipples, shall be plated or coated with a suitable material that passes a 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.

Braze-on type connectors, braze sleeves and weld nipples shall be protected from corrosion by an oil film or phosphate coating or by another method that does not negatively affect their ability to be welded or brazed.

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

NOTE Changes in plating can affect assembly torques and require requalification, 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. Covers that contribute to contamination shall not be used.

Braze-on type connectors require protection on the sealing face and threaded end only. 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.

12 Assembly instruction

The assembly of the connectors with the connecting tubes shall be carried out without external loads. For proper method of assembling the adjustable stud end connection, see Annex F.

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;

— details concerning the attachment of the braze sleeve and weld nipple to the 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.

15 Performance and qualification test

15.1 Performance requirements

15.1.1 Special requirements

All components requiring copper brazing for assembly and all nuts supplied as unplated individual items shall be processed through a 1 000 °C minimum annealing process followed by ambient air cooling before burst, cyclic endurance or torque testing.

15.1.2 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 proof pressures given in Table 4.

15.1.3 Burst test

Three of the test assemblies that had been subjected to the proof test in 15.1.2 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 5. The test assemblies shall meet or exceed the minimum required burst pressures given in Table 4.

Table 4 — Test pressures for O-ring face seal connectors

Tube outside diameter	Stud end style															
	Non adjustable								Adjustable							
	Working pressure		Test pressure						Working pressure		Test pressure					
			Proof		Burst		Impulse [a]				Proof		Burst		Impulse [a]	
mm	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)
6	63	(630)	126	(1 260)	252	(2 520)	83,8	(838)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
8	63	(630)	126	(1 260)	252	(2 520)	83,8	(838)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
10	63	(630)	126	(1 260)	252	(2 520)	83,8	(838)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
12	63	(630)	126	(1 260)	252	(2 520)	83,8	(838)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
16	40	(400)	80	(800)	160	(1 600)	53,2	(532)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
20	40	(400)	80	(800)	160	(1 600)	53,2	(532)	40	(400)	80	(800)	160	(1 600)	53,2	(532)
22	40	(400)	80	(800)	160	(1 600)	53,2	(532)	35	(350)	70	(700)	140	(1 400)	46,6	(466)
25	40	(400)	80	(800)	160	(1 600)	53,2	(532)	35	(350)	70	(700)	140	(1 400)	46,6	(466)
30	25	(250)	50	(500)	100	(1 000)	33,2	(332)	25	(250)	50	(500)	100	(1 000)	33,2	(332)
38	25	(250)	50	(500)	100	(1 000)	33,2	(332)	20	(200)	40	(400)	80	(800)	26,6	(266)

[a] Cyclic endurance (impulse) test pressure.

Table 5 — Qualification test torque requirements

Stud end		Face seal end			
Thread	Torque [a] N·m ref.	Tube outside diameter mm	Thread	Torque [b] N·m +10 % 0	Overtorque N·m
M12 × 1,5	35	6	9/16-18 UNF	25	32
M14 × 1,5	45	8	5/8-18 UNF	30	45
M16 × 1,5	55	10	11/16-16 UN	40	54
M18 × 1,5	70	12	13/16-16 UN	55	81
M22 × 1,5	100	16	1-14 UNS	60	136
M27 × 2	170	20	1 3/16-12 UN	90	180
M30 × 2	235	22	1 5/16-12 UN	115	230
M33 × 2	310	25	1 7/16-12 UN	125	270
M42 × 2	330	30	1 11/16-12 UN	170	380
M48 × 2	420	38	2-12 UN	200	450

[a] If these torque values conflict with those in ISO 6149-2, the torque values in ISO 6149-2 shall take precedence.

[b] These torque values may differ from the assembly torques, which are to be supplied by the manufacturer.

15.1.4 Cyclic endurance (impulse test)

The remaining six test assemblies that had been subjected to the proof test in 15.1.2 shall be subjected to the cyclic endurance test procedure specified in ISO 19879. The test shall be conducted at minimum torque values given in Table 5. The test assemblies shall pass a cyclic endurance test for 1 000 000 cycles at the respective impulse pressures given in Table 4.

15.1.5 Vacuum test

For each connector size, two test assemblies in accordance with ISO 19879 shall be subjected to the vacuum test procedure specified in ISO 19879. Connectors shall be capable of withstanding a vacuum of 6,5 kPa (0,065 bar) absolute pressure for 5 min without leakage.

15.1.6 Overtightening test

For each connector size, three samples each of the tube nuts (styles NA or NB, as applicable) and the 90° swivel elbow (SWE) nut shall be subjected to the overtightening test 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 5.

15.1.7 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

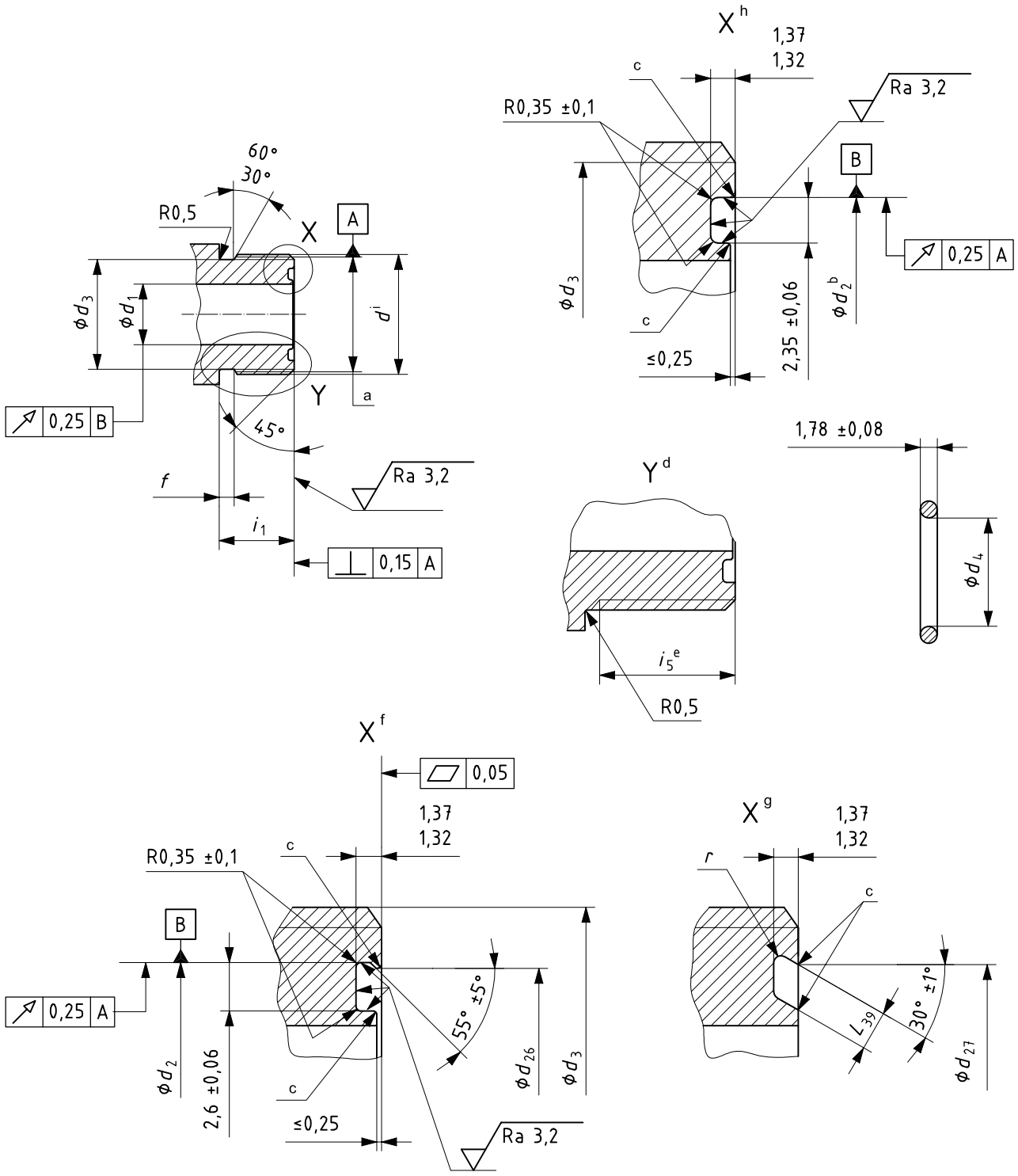
Test data shall be reported in accordance with ISO 19879.

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:

“Dimensions and design for O-ring face seal connectors in accordance with ISO 8434-3, *Metallic tube connections for fluid power and general use — Part 3: O-ring face seal connectors*”.

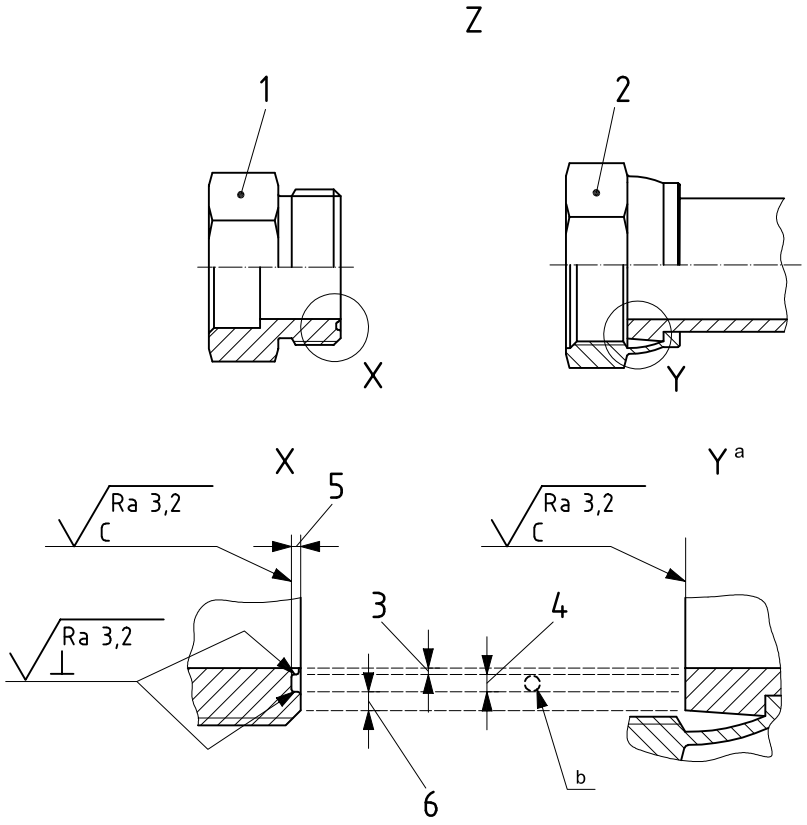
Dimensions in millimetres,
surface roughness in micrometres



a Pitch diameter.
b Groove outside diameter.
c Sharp edge or burr not allowed; break corner 0,15 max.
d Optional construction for shapes and long straights.
e Minimum full thread depth.
f Groove style A – Groove providing improved retention of O-ring – Option 1.
g Groove style A – Groove providing improved retention of O-ring – Option 2.
h Groove style B.
i Screw threads.

Figure 2 — O-ring face seal connections

Surface roughness in micrometres



Key

1 male adapter connector
2 female swivel connector
3 surface A
4 surface B
5 surface C
6 surface D

NOTE 1 Surface roughness: maximum arithmetical average of 3,2 µm on the surfaces.

NOTE 2 Raised extrusions are not permitted on sealing surfaces B and C.

NOTE 3 Annular (circumferential) tool marks up to 3,2 µm Ra maximum are acceptable. Scratches with a width greater than 0,13 mm running perpendicular, radial or spiral to the connector inside diameter on surface B and surface C are not acceptable. Surfaces with no depth or height are acceptable.

NOTE 4 On surfaces A and D, non-continuous surface imperfections are allowed providing they do not inhibit assembly of connectors.

[a] See Table 6 for clarification of the surface location on the female swivel connector that does not have the three distinct surfaces present. The surface inside diameter and outside diameter dimensions represent the total female face area contacted by the O-ring in each male connector O-ring groove.

[b] Area of O-ring placement.

Detail Z — Surface finish acceptance criteria for O-ring face seal connection (typical for all styles)

Figure 2 (*continued*)

Table 6 — Dimensions of O-ring face seal connections

Dimensions in millimetres

Tube outside diameter	d Thread [a]	d_1		d_2		d_3		Option 2				Option 1		
								d_{27}		L_{39}	r	d_{26}	d_2	
		nom.	tol.	nom.	tol.	nom.	tol.	nom.	tol.	± 0,05		± 0,15	nom.	tol.
6	9/16-18 UNF	4,5	± 0,1	11	± 0,08	12,25	± 0,15	10,8	± 0,05	2,25	0,7	10,65	11	± 0,08
8	5/8-18 UNF	5,5	± 0,1	11,85	± 0,08	13,7	± 0,25	11,6	± 0,05	2,2	0,5	11,5	12,07	± 0,08
10	11/16-16 UN	6,5	± 0,2	12,6	± 0,08	15,1	± 0,25	12,4	± 0,05	2,2	0,5	12,25	12,8	± 0,08
12	13/16-16 UN	9,5	± 0,2	15,77	± 0,08	18,25	± 0,25	15,6	± 0,05	2,2	0,5	15,4	15,97	± 0,08
16	1-14 UNS	12,5	± 0,2	19	± 0,08	22,6	± 0,4	18,7	+0,05 −0,10	2,2	0,5	18,5	19,2	± 0,08
20	1 3/16-12 UN	15,5	± 0,2	22,17	± 0,1	27	± 0,4	21,9	+0,05 −0,10	2,2	0,5	21,65	22,37	± 0,1
22	1 5/16-12 UN	18	± 0,2	25,35	± 0,1	30,2	± 0,4	24,95	+0,05 −0,10	2,2	0,5	24,85	25,58	± 0,13
25	1 7/16-12 UN	20,5	± 0,2	26,87	± 0,1	33,35	± 0,4	26,6	+0,05 −0,10	2,2	0,5	26,4	27,1	± 0,13
30	1 11/16-12 UN	26	± 0,3	33,25	± 0,13	39,7	± 0,4	32,95	+0,05 −0,10	2,2	0,5	32,75	33,45	± 0,13
38	2-12 UN	32	± 0,3	41,17	± 0,13	47,65	± 0,4	40,8	+0,05 −0,10	2,2	0,5	40,65	41,37	± 0,13

[a] In accordance with ISO 68-2 and ISO 5864:1993, Class 2A, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.

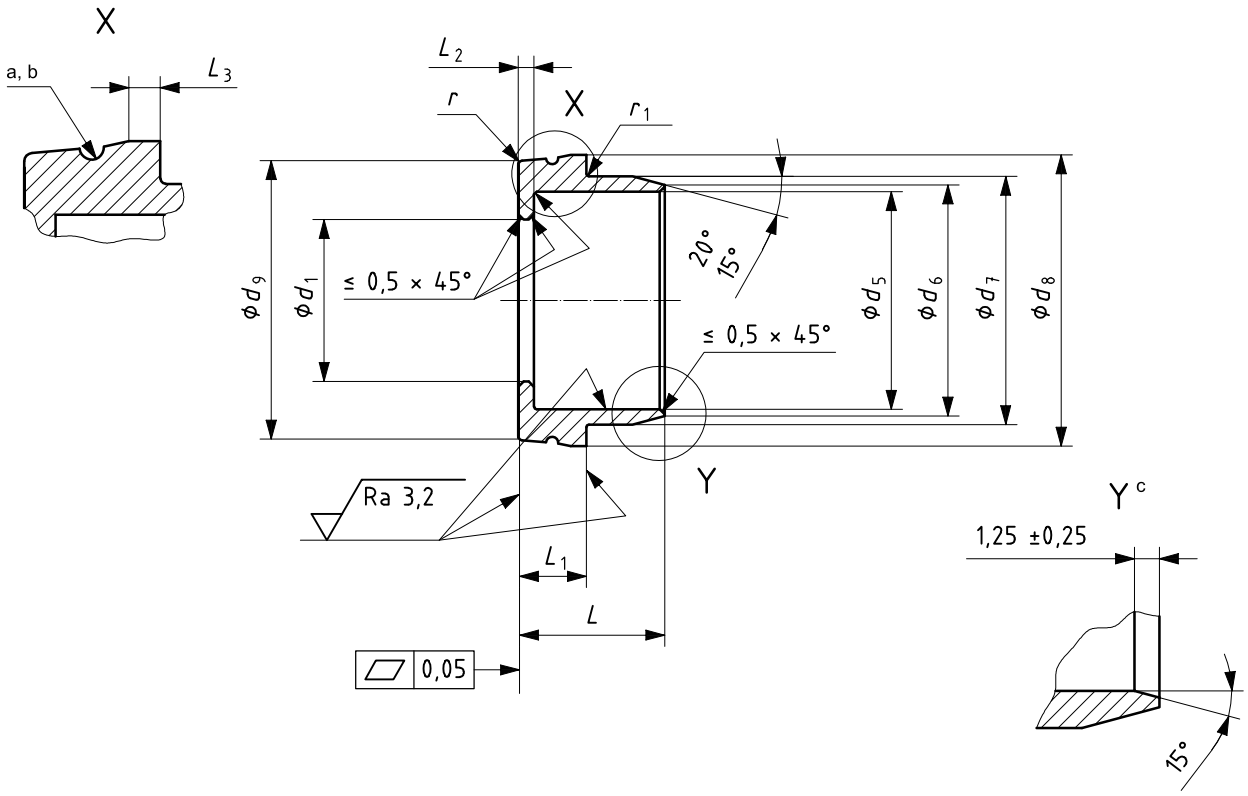
Table 6 (*continued*)

Dimensions in millimetres

Tube outside diameter	d Thread [a]	f		i_1	i_5	O-ring d_4		Surface B	
								Outside diameter	Inside diameter
		nom.	tol.	± 0,4	min.	nom.	tol.	min.	max.
6	9/16-18 UNF	2,4	± 0,3	10	9	7,65	± 0,16	11,08	6,1
8	5/8-18 UNF	2,4	± 0,3	10	9	8,5	± 0,16	11,93	6,95
10	11/16-16 UN	2,8	± 0,4	11	10,5	9,25	± 0,17	12,68	7,7
12	13/16-16 UN	2,8	± 0,4	13	12	12,42	± 0,19	15,85	10,87
16	1-14 UNS	3,1	± 0,4	15,5	14	15,6	± 0,2	19,08	14,1
20	1 3/16-12 UN	3,7	± 0,5	17	15	18,77	± 0,22	22,27	17,25
22	1 5/16-12 UN	3,7	± 0,5	17,5	15,5	21,95	± 0,23	25,45	20,43
25	1 7/16-12 UN	3,7	± 0,5	17,5	15,5	23,52	± 0,24	26,97	21,95
30	1 11/16-12 UN	3,7	± 0,5	17,5	15,5	29,87	± 0,29	33,38	28,3
38	2-12 UN	3,7	± 0,5	17,5	15,5	37,82	± 0,36	41,3	36,22

[a] In accordance with ISO 68-2 and ISO 5864:1993, Class 2A, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.

Dimensions in millimetres,
surface roughness in micrometres



See Annex C for formed tube connections.

Break all corners 0,15 mm maximum unless otherwise specified.

a Identification groove for metric tube sleeve only, centrally located on L_1 surface.

b 1,5 mm wide × 0,5 mm deep maximum; shape optional.

c Optional construction.

Figure 3 — Braze sleeve [BRSL-A (standard) and BRSL-B (option)]

Table 7 — Dimensions of braze sleeves for metric and inch tubing

Dimensions in millimetres

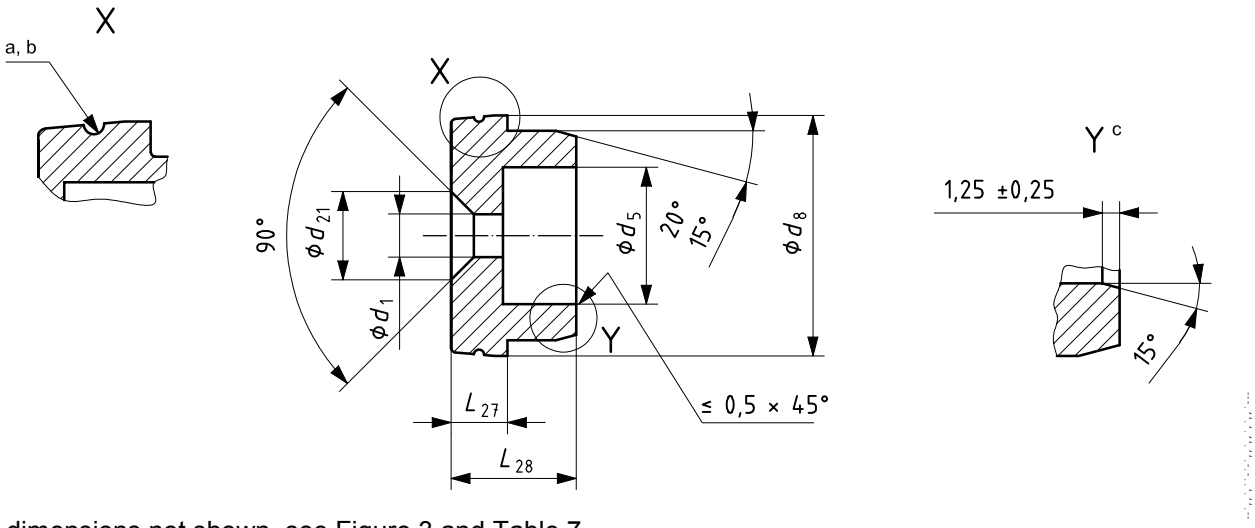
Metric tubing [a]			Inch tubing				d_1	d_6	d_7	d_8	d_9	L	L_1	L_2	L_3	r	r_1
Ordering size code	Tube outside diameter	d_5 [b]	Ordering size code	Tube inside diameter		d_5 [b]											
				in	mm [c]												
Face seal side × tube side		± 0,05	Face seal side × tube side			± 0,05	ref.	0 − 0,3	± 0,1	0 − 0,15	± 0,15	± 0,3	± 0,15	± 0,15	± 0,5	max.	+ 0,15 0
6 × 6	6	6,15	6 × 6,35	1/4	6,35	6,5	4,5	9	10,2	12,75	—	9,5	4	1	—	0,25	0,15
8 × 8	8	8,15	8 × 7,94	5/16	7,94	8,09	5,5	10,5	11,7	14,35	—	9,5	4	1	—	0,25	0,15
10 × 10	10	10,15	10 × 9,52	3/8	9,52	9,68	6,5	11,8	13,25	15,75	—	9,5	4,5	1	—	0,25	0,15
12 × 12	12	12,15	12 × 12,7	1/2	12,7	12,85	9,5	15,1	16,3	18,9	—	9,5	5	1	—	0,25	0,15
16 × 16	16	16,15	16 × 15,88	5/8	15,88	16,03	12,5	19,2	20,75	23,45	22,6	10,5	6	1,5	1,3	0,25	0,25
20 × 20	20	20,18	20 × 19,05	3/4	19,05	19,23	15,5	22,1	23,75	27,85	27	14	6,5	1,5	1,3	0,4	0,25
22 × 22	22	22,18	22 × 22,23	7/8	22,23	22,41	18	25,3	26,9	31	30,15	14	6,5	1,5	1,3	0,4	0,25
25 × 25	25	25,18	25 × 25,4	1	25,4	25,58	20,5	28,1	28,7	34,2	33,35	15,5	7	1,5	1,3	0,4	0,4
30 × 30	30	30,2	30 × 31,75	1 1/4	31,75	31,95	26	34	35,6	40,55	39,7	15,5	7	1,5	1,3	0,4	0,4
38 × 38	38	38,2	38 × 38,1	1 1/2	38,1	38,3	32	42	43,55	48,5	47,65	15,5	7	1,5	1,3	0,4	0,4

[a] Metric tubing shall be preferred.

[b] Actual bore size and depth depend upon joining process. Dimensions given are for silver braze.

[c] Equivalent dimensions in millimetres.

Dimensions in millimetres



For dimensions not shown, see Figure 3 and Table 7.

a Identification groove for metric tube sleeve only, centrally located on L_{27} surface.

b 1,5 mm wide × 0,5 mm deep maximum; shape optional.

c Optional construction.

Figure 4 — Braze-on reducing sleeve (BRRDSLA [standard] and BRRDSLB [optional])

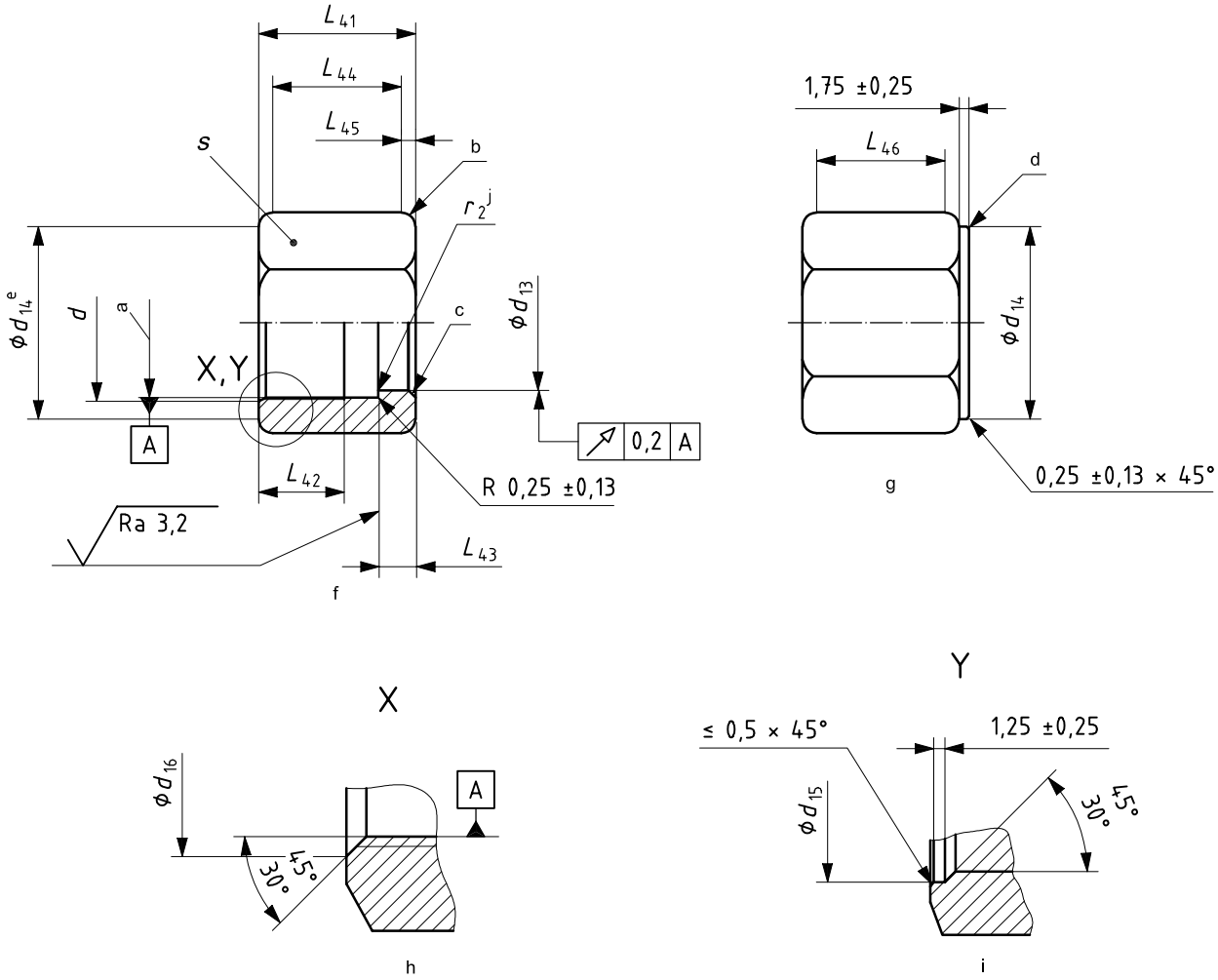
Table 8 — Dimensions of braze-on reducing sleeves

Dimensions in millimetres

Metric nominal tube reduction		Inch nominal tube reduction		d_1	d_8	d_{21}	L_{27}	L_{28}
Ordering size code	d_5[a]	Ordering size code	d_5[a]			0		
Face seal × tube side	ref.	Face seal × tube side	ref.	ref.	ref.	− 0,5	± 0,15	± 0,3
8 × 6	6,15	8 × 6,35	6,5	4,5	14,35	5,5	2	10,5
10 × 6	6,15	10 × 6,35	6,5	4,5	15,75	6,5	2	10,5
10 × 8	8,15	10 × 7,94	8,09	5,5	15,75	6,5	2	10,5
12 × 6	6,15	12 × 6,35	6,5	4,5	18,9	9,5	3,5	12
12 × 8	8,15	12 × 7,94	8,09	5,5	18,9	9,5	3,5	12
12 × 10	10,15	12 × 9,52	9,68	6,5	18,9	9,5	3,5	12
16 × 6	6,15	16 × 6,35	6,5	4,5	23,45	12,5	5	13,5
16 × 8	8,15	16 × 7,94	8,09	5,5	23,45	12,5	5	13,5
16 × 10	10,15	16 × 9,52	9,68	6,5	23,45	12,5	5	13,5
16 × 12	12,15	16 × 12,7	12,85	9,5	23,45	12,5	5	13,5
20 × 6	6,15	20 × 6,35	6,5	4,5	27,85	15,5	6	14,5
20 × 8	8,15	20 × 7,94	8,09	5,5	27,85	15,5	6	14,5
20 × 10	10,15	20 × 9,52	9,68	6,5	27,85	15,5	6	14,5
20 × 12	12,15	20 × 12,7	12,85	9,5	27,85	15,5	6	14,5
20 × 16	16,15	20 × 15,88	16,03	12,5	27,85	15,5	6,5	14,5
22 × 8	8,15	22 × 7,94	8,09	5,5	31	18	6	14,5
22 × 10	10,15	22 × 9,52	9,68	6,5	31	18	6	14,5
22 × 12	12,15	22 × 12,7	12,85	9,5	31	18	6	14,5
22 × 16	16,15	22 × 15,88	16,03	12,5	31	18	5,5	14,5
22 × 20	20,18	22 × 19,05	19,23	15,5	31	18	3	15,5
25 × 12	12,15	25 × 12,7	12,85	9,5	34,2	20,5	6,5	15,5
25 × 16	16,15	25 × 15,88	16,03	12,5	34,2	20,5	7	15,5
25 × 20	20,18	25 × 19,05	19,23	15,5	34,2	20,5	7	17
25 × 22	22,18	25 × 22,22	22,4	18	34,2	20,5	7	17

[a] Actual bore size and depth depends on joining process. Dimensions shown are for silver braze.

Dimensions in millimetres;
surface roughness in micrometres



a Thread minor diameter.

b Chamfer or radius hex corners L_{45} minimum, both ends.

c Corner break, 1 mm max.

d Required identification for style B (high-strength) nut; see 4.3.

e Both sides.

f Tube nut style A (NA) (standard) is not suitable for copper braze assemblies.

g Tube nut style B (NB) (high-strength) is suitable for all assemblies.

h For tube outside diameter $\leqslant$ 12 mm.

i For tube outside diameter $>$ 12 mm.

j Corner break.

Figure 5 — Standard tube nut (NA) and high-strength tube nut (NB)

Table 9 — Dimensions of tube nuts

Dimensions in millimetres

Tube outside diameter and ordering size code	d Thread [a]	Thread minor diameter [b]		d_{13}	d_{14}	d_{15}	d_{16}
		min.	max.	± 0,1	± 0,3	± 0,3	± 0,2
6	9/16-18 UNF	12,9	13,1	10,5	16	—	14,7
8	5/8-18 UNF	14,5	14,7	12	18	—	16,3
10	11/16-16 UN	15,9	16,1	13,55	21	—	17,8
12	13/16-16 UN	19,1	19,3	16,6	23	—	21
16	1-14 UNS	23,6	23,8	21,1	29	26	—
20	1 3/16-12 UN	28,0	28,3	24,15	34,5	31	—
22	1 5/16-12 UN	31,2	31,5	27,3	39,5	34	—
25	1 7/16-12 UN	34,4	34,7	29,1	39,5	37	—
30	1 11/16-12 UN	40,7	41,0	36	48,5	43,5	—
38	2-12 UN	48,7	49,0	44	58	51,5	—

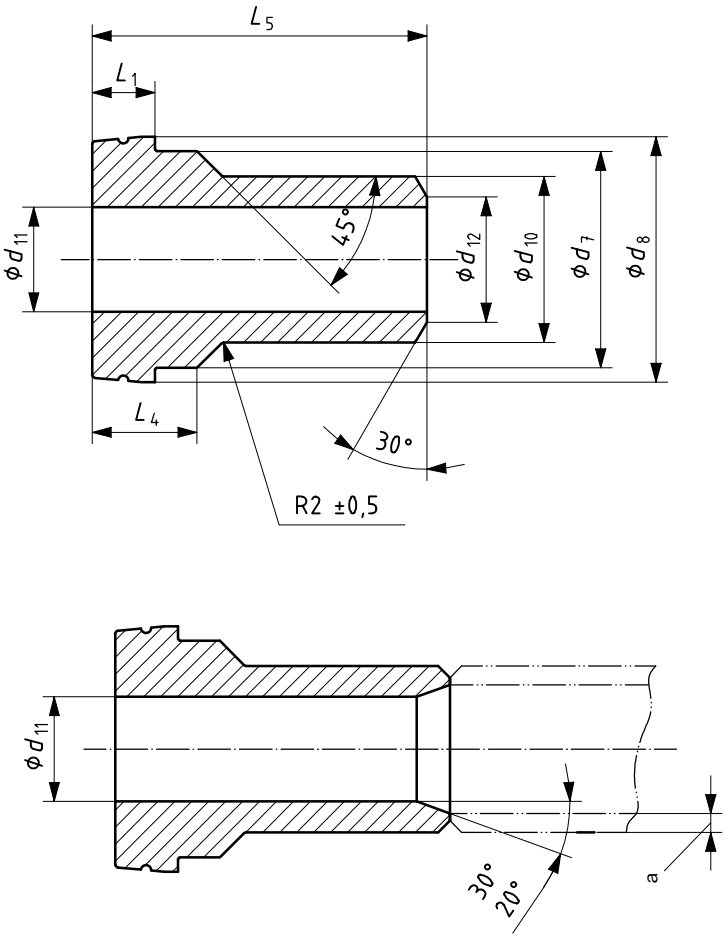
Tube outside diameter and ordering size code	d Thread [a]	L_{41} ± 0,5	L_{42} min.	L_{43} ± 0,25	L_{44} min.	L_{45} min.	L_{46} min.	r_2 0 − 0,15	S [c]
6	9/16-18 UNF	15	9	3	10,5	0,4	8,5	0,15	17
8	5/8-18 UNF	16	9	4	11	0,4	9	0,15	19
10	11/16-16 UN	17	9,5	4	12	0,4	10	0,15	22
12	13/16-16 UN	20	11,5	5	14	0,5	12	0,15	24
16	1-14 UNS	24	13,5	5,5	17	0,5	15	0,25	30
20	1 3/16-12 UN	26,5	14,5	6,5	18,5	0,7	16,5	0,25	36
22	1 5/16-12 UN	26,5	14,5	6,5	18	0,7	16	0,25	41
25	1 7/16-12 UN	27,5	14,5	7	18,5	0,7	16,5	0,4	41
30	1 11/16-12 UN	27,5	14,5	7	17	0,9	15	0,4	50
38	2-12 UN	27,5	14,5	7	15,5	0,9	13,5	0,4	60

[a] In accordance with ISO 68-2 and ISO 5864:1993, Class 2B, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.

[b] Modified diameter, shifted to the high side of the tolerance band in ISO 5864.

[c] In accordance with ISO 4759-1:2000, Grade C.

Dimensions in millimetres



For dimensions not shown, see Figure 3 and Table 7.

[a] Tube wall thickness.

Figure 6 — Weld-on nipple (WDNP)

Table 10 — Dimensions on weld-on nipples for metric and inch tubing

Dimensions in millimetres

Ordering size code	Metric tubing [a]						Ordering size code	Inch tubing												
	Tube		d_{10}	d_{11} [b]		d_{12}		Tube			d_{10}	d_{11} [b]		d_{12}	d_7	d_8	d_9	L_1	L_4	L_5
Face seal × tube side	Outside diameter	Wall thickness [c]	± 0,1	nom.	tol.	± 0,3	Face seal × tube side	inch	mm [b]	Wall thickness [c]	± 0,1	nom.	tol.	± 0,3	± 0,1	ref.	± 0,15	ref.	± 0,5	± 0,3
6 × 6	6	2	6	2	± 0,1	4	6 × 6,35	1/4	6,35	2,11	6,4	2	± 0,1	4	10,2	12,75	—	4	6,5	25
8 × 8	8	2,5	8	3	± 0,1	5	8 × 7,94	5/16	7,94	2,41	7,9	3	± 0,1	5	11,7	14,35	—	4	6,5	25
10 × 10	10	3	10	4	± 0,1	6	10 × 9,52	3/8	9,52	2,77	9,5	4	± 0,1	6	13,25	15,75	—	4,5	7,5	26
12 × 12	12	3,5	12	5	± 0,1	7	12 × 12,7	1/2	12,7	3,76	12,7	5	± 0,1	7	16,3	18,9	—	5	9,5	26
16 × 16	16	3	16	10	± 0,1	12	16 × 15,88	5/8	15,88	3,05	15,9	10	± 0,1	12	20,75	23,45	22,6	6	10	32
20 × 20	20	3,5	20	13	± 0,2	15	20 × 19,05	3/4	19,05	3,76	19	11,5	± 0,2	13,5	23,75	27,85	27	6,5	11,5	37
22 × 22	22	3	22	16	± 0,2	18	22 × 22,23	7/8	22,23	3,05	22,2	16,1	± 0,2	18	26,9	31	30,15	6,5	11,5	37
25 × 25	25	4,5	25	16	± 0,2	18	25 × 25,4	1	25,4	4,76	25,4	16	± 0,2	18	28,7	34,2	33,35	7	13	42
30 × 30	30	4	30	22	± 0,2	24	30 × 31,75	1 ¼	31,75	4,76	31.8	22,2	± 0,2	24	35,6	40,55	39,7	7	13	44
38 × 38	38	5	38	28	± 0,3	30	38 × 38,1	1 ½	38,1	5,59	38,1	27	± 0,3	29	43,55	48,5	47,65	7	13	49

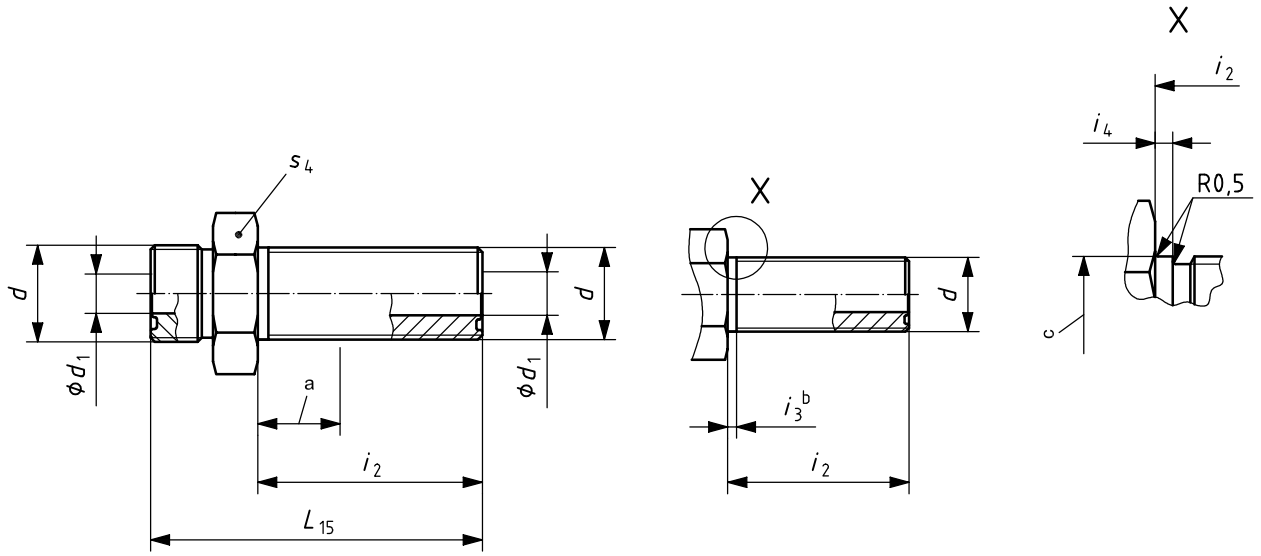
[a] Metric tubing shall be preferred.

[b] Dimension d_{11} shall match the tube inside diameter. These weld nipples are for specific tube outside diameters and wall thicknesses given above. If the inside diameter of a tube is larger than d_{11} + 0,5 mm, the use of style B weld-on nipples is recommended.

[c] For other wall thicknesses, contact the manufacturer.

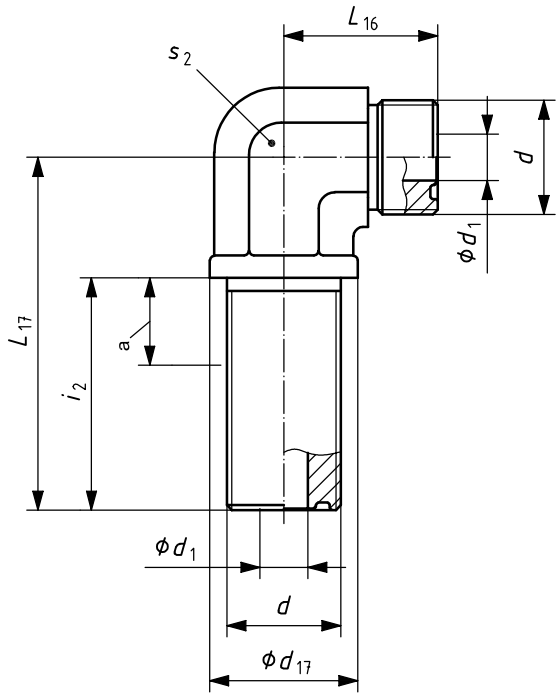
[d] Equivalent dimensions in millimetres.

Dimensions in millimetres

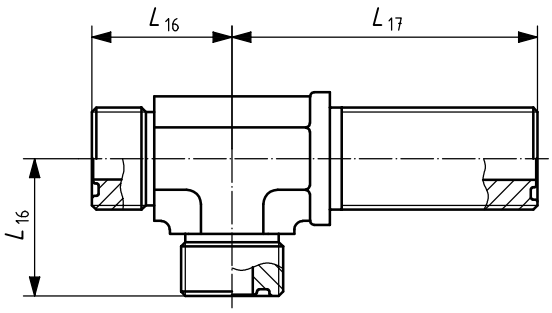


Optional construction

a) Bulkhead (straight) (BHS)



b) 90° bulkhead elbow (BHE)



c) Bulkhead run tee (BHRT)

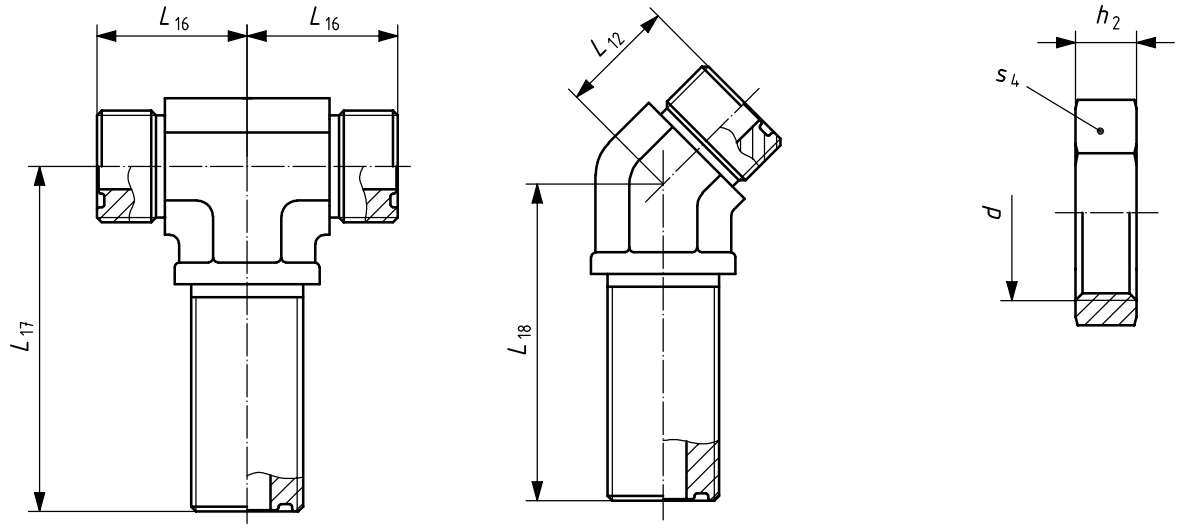
For details not shown here, see Figure 2 and Table 6.

a Maximum bulkhead thickness: 14 mm.

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

c Pilot diameter equal to thread outside diameter.

Figure 7 — Bulkhead connectors (BH) and corresponding bulkhead locknuts (LN)



d) Bulkhead branch tee (BHBT) **e) 45° bulkhead elbow (BHE45)** **f) Bulkhead locknut (BHLN)**

Figure 7 (*continued*)

Table 11 — Dimensions of bulkhead connectors and corresponding bulkhead locknuts

Dimensions in millimetres

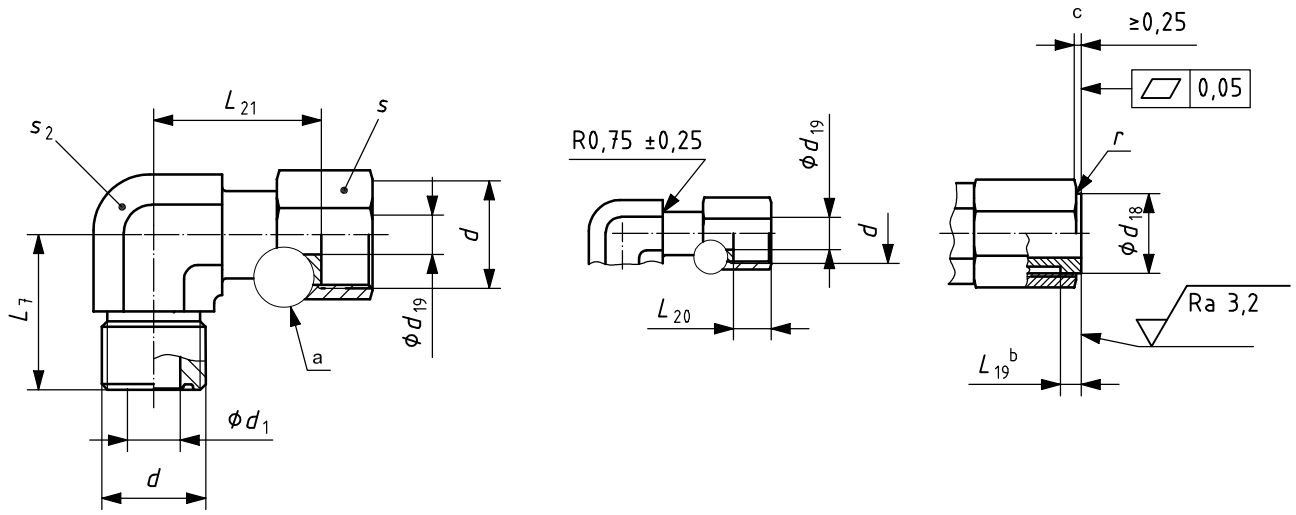
Ordering size code [a]	Tube outside diameter [b]	d Thread [c]	d_1	d_{17}	h_2	i_2	i_3	i_4	L_{12}	L_{15}	L_{16}	L_{17}	L_{18}	s_2		s_4
														Forged connection	Connector machined from barstock	
			ref.	min.	± 0,8	± 0,8	max.	± 0,5	± 1	± 0,8	± 1	± 1	± 1	min.	max.	
6 × 6	6	9/16-18 UNF	4,5	16,5	7	31,5	3	1,5	16	48	22,5	47	44	14	17	22
8 × 8	8	5/8-18 UNF	5,5	19	7	31,5	3	1,5	18	49,5	25	49,5	46	17	22	22
10 × 10	10	11/16-16 UN	6,5	21	8	34	3	1,5	19	53	26	52	48,5	17	27	27
12 × 12	12	13/16-16 UN	9,5	24,5	9	36,5	3	2,5	20,5	58,5	29	55,5	51	19	30	30
16 × 16	16	1-14 UNS	12,5	29	10,5	40,5	4	2,5	23,5	66,5	34,5	63	56,5	24	36	36
20 × 20	20	1 3/16-12 UN	15,5	34	10,5	41,5	4	3	26	69	38,5	67	60,5	27	41	41
22 × 22	22	1 5/16-12 UN	18	38	10,5	42	4	3	30	70	42,5	71	65	36	46	46
25 × 25	25	1 7/16-12 UN	20,5	40,5	10,5	42	4	3	30	70	42,5	71	65	36	46	46
30 × 30	30	1 11/16-12 UN	26	46,5	10,5	42	4	3	32	70	45,5	75,5	67	41	55	50
38 × 38	38	2-12 UN	32	54,5	10,5	42	4	3	37	70	49,5	79,5	67	50	60	60

[a] Add third end size for tees; the ordering sequence is left, then right, then up, then down, omitting ends when not present.

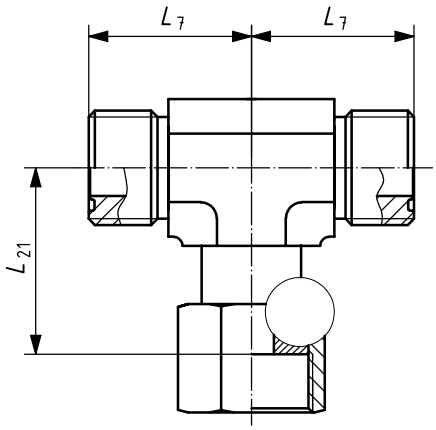
[b] See Table 1 for corresponding inch tube sizes.

[c] Pilot diameter equal to thread outside diameter.

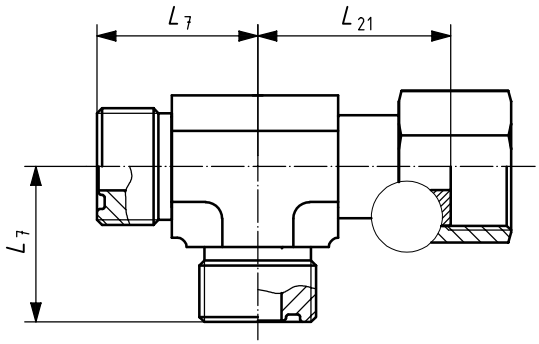
Dimensions in millimetres,
surface roughness in micrometres



a) Swivel elbow (SWE)



b) Swivel branch tee (SWBT)



c) Swivel run tee

a Method of attachment of swivel nut is as chosen by the manufacturer.

b Dimension L_{19} and the overall length of the nut are optional with the manufacturer as long as L_{20} is maintained and the connector's performance requirements are met.

c Nut shown in pulled back position. Pullback not required for hose fittings.

Figure 8 — Swivel connectors

Table 12 — Dimensions of swivel connectors

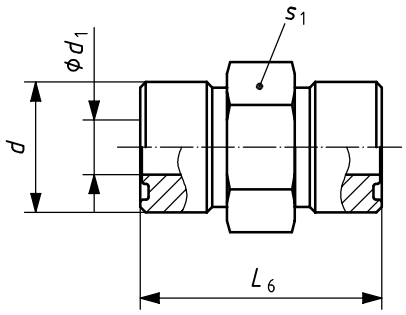
Dimensions in millimetres

Ordering size code [a]	**Tube outside diameter** [b]	d **Thread** [c]	d_1 ref.	d_{18} Seal diameter min.	d_{19} nom.	d_{19} tol.	L_7 ± 1	L_{20} min.	L_{20} max.	L_{21} ± 1,5	r max.	s	s_2 Forged connection min.	s_2 Connection. machined from barstock max.
6 × 6	6	9/16-18 UNF	4,5	12,6	4	± 0,1	21,5	6,6	9	26,5	0,25	17	14	19
8 × 8	8	5/8-18 UNF	5,5	14,1	5,5	± 0,1	23,5	6,6	9	28	0,25	19	17	22
10 × 10	10	11/16-16 UN	6,5	15,6	6,5	± 0,2	25	7	9,5	29	0,25	22	17	27
12 × 12	12	13/16-16 UN	9,5	18,75	9	± 0,2	28	8,6	11,5	38	0,25	24	19	30
16 × 16	16	1-14 UNS	12,5	22,45	11,5	± 0,2	33,5	11,5	13,5	41	0,25	30	24	36
20 × 20	20	1 3/16-12 UN	15,5	26,85	14	± 0,2	37,5	12,6	14,5	46,5	0,4	36	27	41
22 × 22	22	1 5/16-12 UN	18	30	18	± 0,2	41,5	12,5	14,5	52,5	0,4	41	36	46
25 × 25	25	1 7/16-12 UN	20,5	33,2	20	± 0,2	41,5	12,5	14,5	53,5	0,4	41	36	50
30 × 30	30	1 11/16-12 UN	26	39,55	26	± 0,2	44,5	12,5	14,5	58	0,4	50	41	60
38 × 38	38	2-12 UN	32	47,5	32	± 0,3	49	12,5	14,5	61	0,4	60	50	65

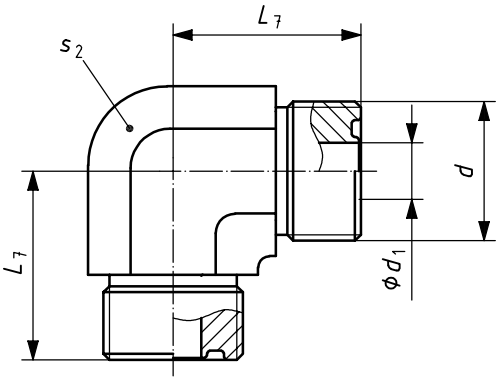
[a] Code given is for elbows. Add the third end size for tees in accordance with 6.6.

[b] See Table 1 for corresponding inch tube sizes.

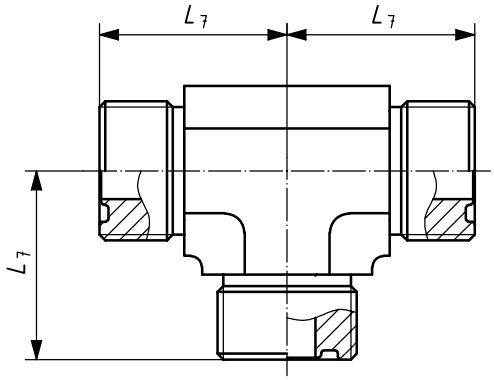
[c] In accordance with ISO 68-2 and ISO 5864:1993, Classes 2A and 2B, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.



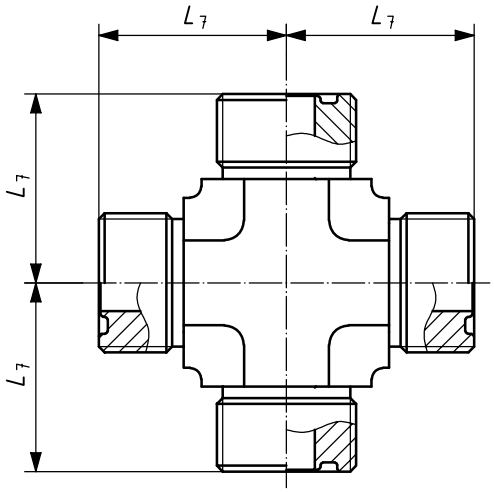
a) Straight (S)



b) 90° elbow (E)



c) Tee (T)



d) Cross (K)

For details not shown here, see Figure 2 and Table 6.

Figure 9 — Union connectors

Table 13 — Dimensions of union connectors

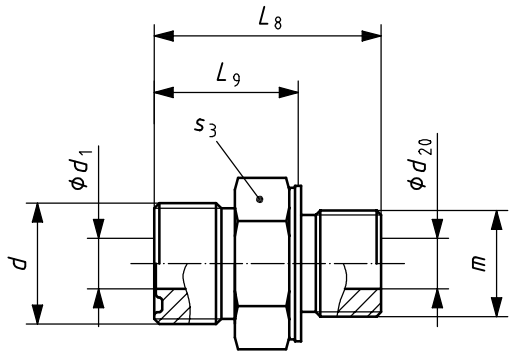
Dimensions in millimetres

Ordering size code [a]	**Tube outside diameter** [b]	d **Thread** [c]	d_1 ref.	L_6 ± 0,8	L_7 ref.	s_1	s_2 Forged connector min.	s_2 Connector machined from barstock max.
6 × 6	6	9/16-18 UNF	4,5	27,5	21,5	17	14	17
8 × 8	8	5/8-18 UNF	5,5	29	23,5	19	17	22
10 × 10	10	11/16-16 UN	6,5	31	25	19	17	27
12 × 12	12	13/16-16 UN	9,5	35,5	28	22	19	30
16 × 16	16	1-14 UNS	12,5	42,5	33,5	27	24	36
20 × 20	20	1 3/16-12 UN	15,5	47	37,5	32	27	41
22 × 22	22	1 5/16-12 UN	18	47,5	41,5	36	36	46
25 × 25	25	1 7/16-12 UN	20,5	49,5	41,5	41	36	46
30 × 30	30	1 11/16-12 UN	26	51,5	44,5	46	41	55
38 × 38	38	2-12 UN	32	53	49	55	50	60

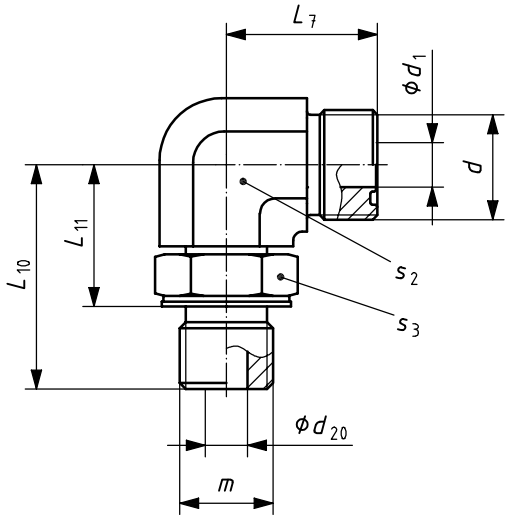
[a] Code given is for straights and elbows. Add third and fourth sizes for tees and crosses in accordance with Clause 6.

[b] See Table 1 for corresponding inch tube sizes.

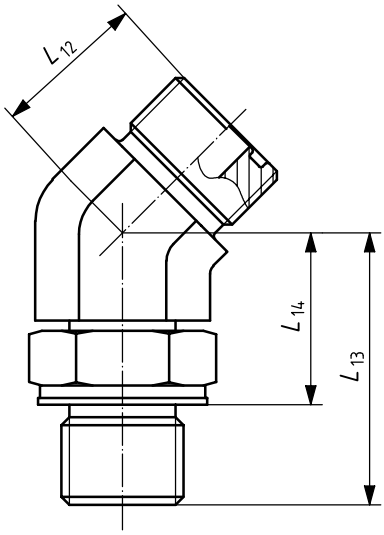
[c] In accordance with ISO 68-2 and ISO 5864:1993, Class 2A, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.



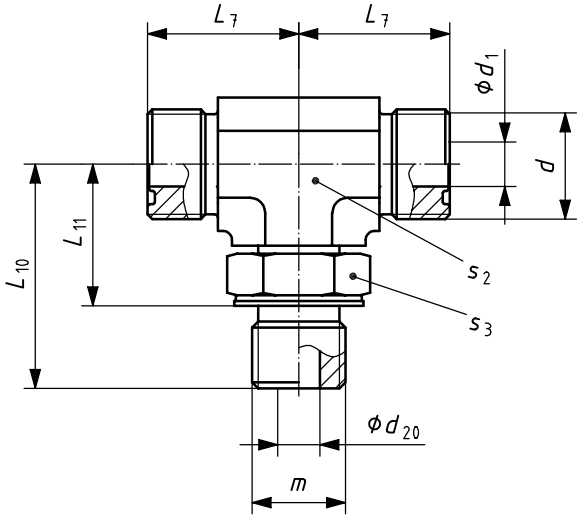
a) Stud (straight) (SDS)



b) 90° adjustable stud elbow (SDE)



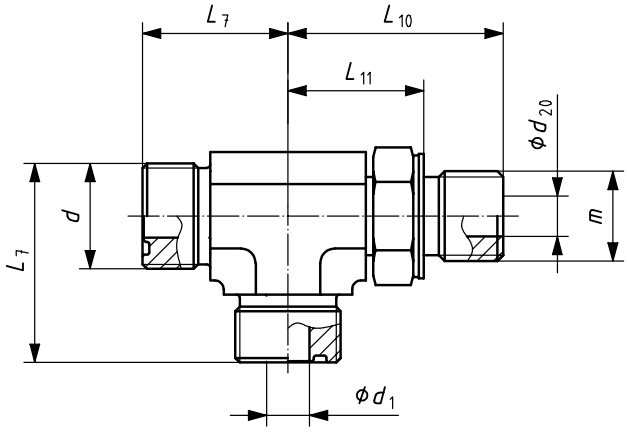
c) 45° adjustable stud elbow (SDE45)



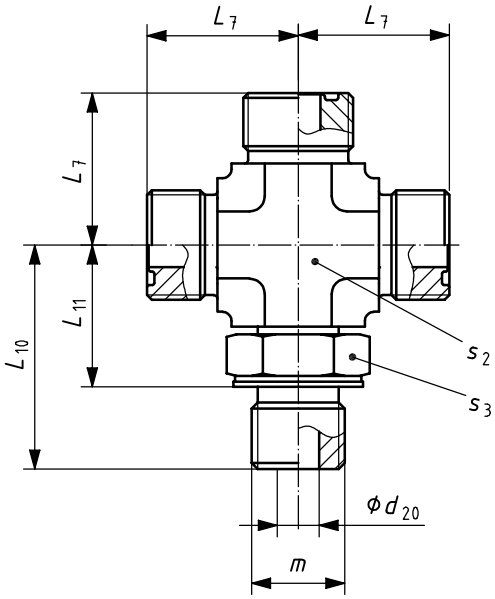
d) Adjustable stud branch tee (SDBT)

For details not shown here, see Figure 2 and Table 6.

Figure 10 — Stud connectors with ISO 6149-2 stud ends



e) Adjustable stud run tee (SDRT)



f) Adjustable stud cross (SDK)

Figure 10 (*continued*)

Table 14 — Dimensions of stud connectors with ISO 6149-2 stud ends

Dimensions in millimetres

Ordering size code [a]	Tube outside diameter [b]	d Thread [c]	m ISO 6149-2 stud end thread	d_1 [d] ref.	d_{20} [d, e] ref.	L_7 ± 1	L_8 ± 0,5	L_9 ref.	L_{10} ± 1	L_{11} ref.	L_{12} ± 1	L_{13} ± 1	L_{14} ref.	s_2 Forged connector min.	s_2 Connector machined from barstock max.	s_3
6 × M12	6	9/16-18 UNF	M12 × 1,5	4,5	4	21,5	28,5	17,5	33	22	16	30	19	14	17	17
8 × M14	8	5/8-18 UNF	M14 × 1,5	5,5	6	23,5	29,5	18,5	35,5	24,5	17,5	31,5	20,5	17	22	19
10 × M16	10	11/16-16 UN	M16 × 1,5	6,5	7	25	33,5	21	37,5	25	19	33,5	21	17	27	22
12 × M18	12	13/16-16 UN	M18 × 1,5	9,5	9	28	38	24	41	27	20,5	37	23	19	30	24
16 × M22	16	1-14 UNS	M22 × 1,5	12,5	12	33,5	42	27	49	34	23,5	44	29	24	36	27
20 × M27	20	1 3/16-12 UN	M27 × 2	15,5	15	37,5	48,5	30	55,5	37	26	50,5	32	27	41	32
22 × M30 [f]	22	1 5/16-12 UN	M30 × 2 [f]	18	17	41,5	50	31,5	59,5	41	30	52,5	34	36	46	36
25 × M33	25	1 7/16-12 UN	M33 × 2	20,5	20	41,5	52	33,5	59,5	41	30	52,5	34	36	46	41
30 × M42	30	1 11/16-12 UN	M42 × 2	26	26	44,5	54,5	35,5	63	44	32	54	35	41	55	50
38 × M48	38	2-12 UN	M48 × 2	32	32	49	57	35,5	71,5	50	37	56,5	35	50	60	55

a Code given is for straights and elbows. For tees, add the third size in accordance with 6.6. For example, a size 6 SDRT with equal size ends will have a size code of 6 × M12 × 6.

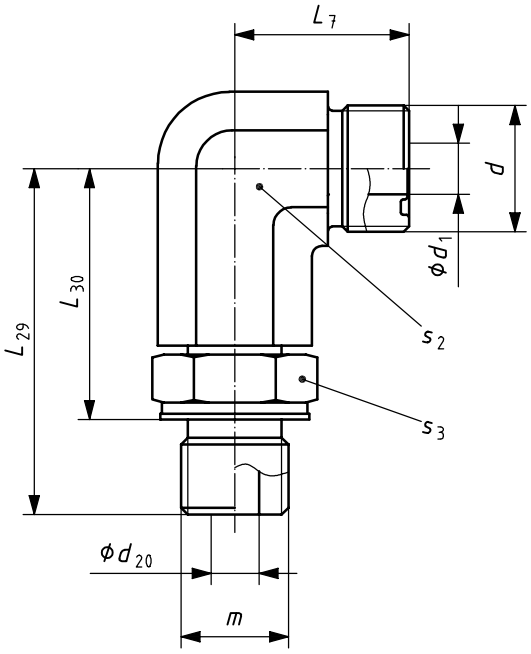
b See Table 1 for corresponding inch tube sizes.

c In accordance with ISO 68-2 and ISO 5864:1993, Class 2A, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.

d For SDS, the smaller of d_1 or d_{20} may go all the way through the connector, or the connector may have a transition area approximately halfway through the hex.

e For tolerances, see ISO 6149-2:—, dimension d_3.

f M30 × 2 port and stud end will be added to the next editions of ISO 6149-1 and ISO 6149-2.



Stud end is in accordance with ISO 6149-2.

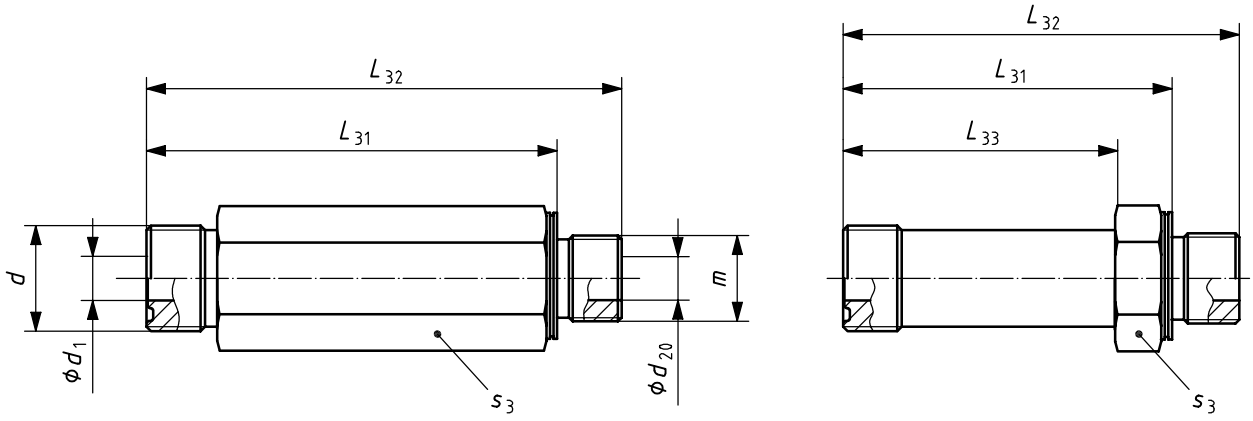
Figure 11 — Long drop elbow stud connector (SDEL) with ISO 6149-2 stud ends

Table 15 — Dimensions of long drop elbow stud connectors with ISO 6149-2 stud ends

Dimensions in millimetres

Ordering size code	**Tube outside diameter**	d **Thread**	m ISO 6149-2 stud end thread	d_1 ref.	d_{20} [a] ref.	L_7 ± 1	L_{29} ± 1	L_{30} ref.	s_2 Forged connector min.	s_2 Connector machined from barstock max.	s_3
6 × M12	6	9/16-18 UNF	M12 × 1,5	4,5	4	21,5	56,5	45,5	14	17	17
8 × M14	8	5/8-18 UNF	M14 × 1,5	5,5	6	23,5	56,5	45,5	17	22	19
10 × M16	10	11/16-16 UN	M16 × 1,5	6,5	7	25	66,5	54	17	27	22
12 × M18	12	13/16-16 UN	M18 × 1,5	9,5	9	28	75	61	19	30	24
16 × M22	16	1-14 UNS	M22 × 1,5	12	12	33,5	88	73	24	36	27
20 × M27	20	1 3/16-12 UN	M27 × 2	15,5	15	37,5	100,5	82,5	27	41	32
22 × M30	22	1 5/16-12 UN	M30 × 2	18	17	41,5	108	89,5	36	46	36
25 × M33	25	1 7/16-12 UN	M33 × 2	20,5	20	41,5	114,5	96	36	46	41
30 × M42	30	1 11/16-12 UN	M42 × 2	26	26	44,5	126,5	107,5	41	55	50
38 × M42	38	2-12 UN	M48 × 2	32	32	49	142	120,5	50	60	55

[a] For tolerances, see ISO 6149-2:—, dimension d_3.



Stud end in accordance with ISO 6149-2.

Figure 12 — Long stud connector (SDSL) with ISO 6149-2 stud ends

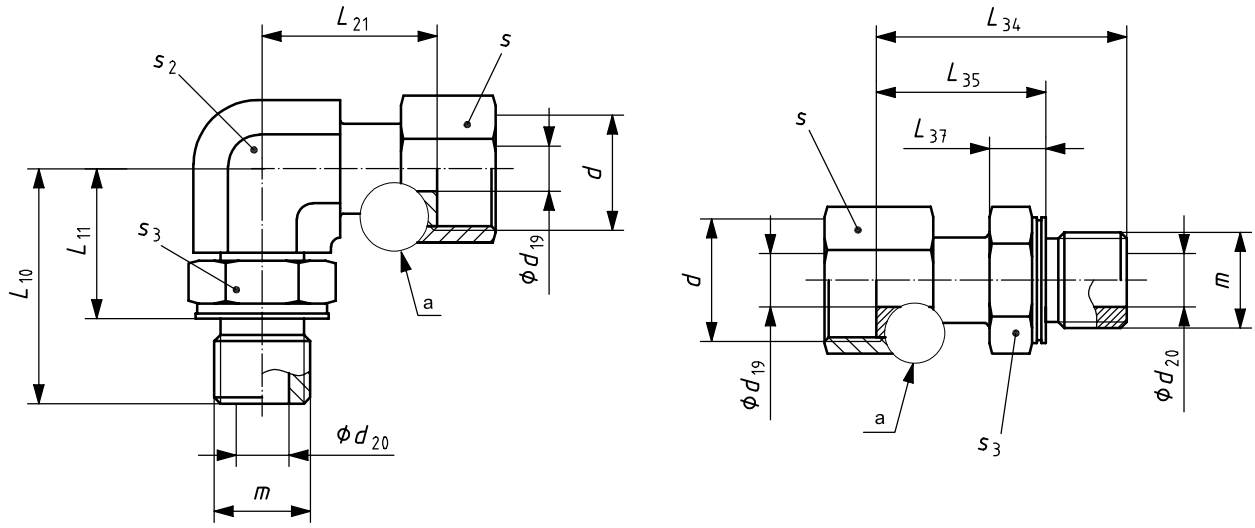
Table 16 — Dimensions for long stud connectors with ISO 6149-2 stud ends

Dimensions in millimetres

Ordering size code	**Tube outside diameter**	d **Thread**	m ISO 6149-2 stud end thread	d_1 [a] ref.	d_{20} [b] ref.	L_{31} ref.	L_{32} ± 0,5	L_{33} ± 0,5	s_3
6 × M12	6	9/16-18 UNF	M12 × 1,5	4,5	4	41,5	52,5	34	17
8 × M14	8	5/8-18 UNF	M14 × 1,5	5,5	6	41,5	52,5	33	19
10 × M16	10	11/16-16 UN	M16 × 1,5	6,5	7	45,5	58	35,5	22
12 × M18	12	13/16-16 UN	M18 × 1,5	9,5	9	54	68	43	24
16 × M22	16	1-14 UNS	M22 × 1,5	12,5	12	63,5	78,5	52	27
20 × M27	20	1 3/16-12 UN	M27 × 2	15,5	15	77	95,5	64	32
22 × M30	22	1 5/16-12 UN	M30 × 2	18	17	81,5	100	67,5	36
25 × M33	25	1 7/16-12 UN	M33 × 2	20,5	20	86,5	105	70,5	41
30 × M42	30	1 11/16-12 UN	M42 × 2	26	26	102,5	121,5	84,5	50
38 × M48	38	2-12 UN	M48 × 2	32	32	115	136,5	97	55

[a] The smaller of d_1 or d_{20} may go all the way through the connector, or the connector may have a transition area approximately halfway through the hex.

[b] For tolerances, see ISO 6149-2:—, dimension d_3.



a) Swivel 90° adjustable stud elbow (SDSWE) [b] **b) Stud straight swivel (SDSWS)** [b]

For dimensions not shown, see ISO 6149-2 or Figure 8 and Table 12.

[a] Method of attachment of swivel nut is optional with the manufacturer.

[b] Face shall be flush or exposed when nut is fully retracted.

Figure 13 — Swivel stud connectors (SDSWE and SDSWS) with ISO 6149-2 stud ends

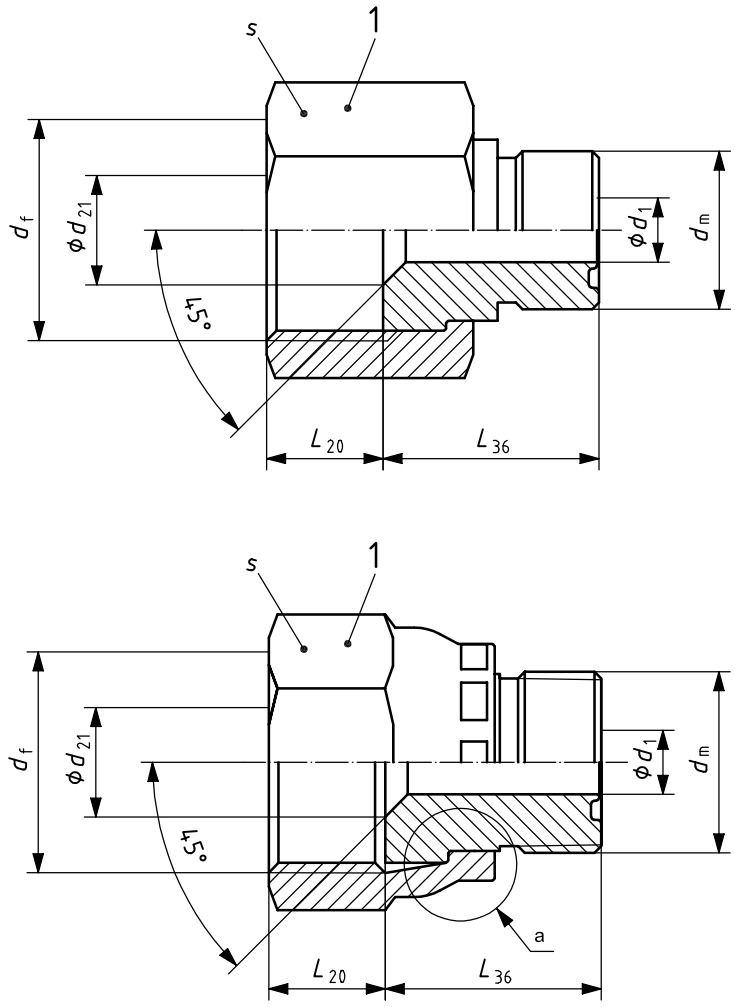
Table 17 — Dimensions of swivel stud connectors with ISO 6149-2 stud ends

Dimensions in millimetres

Ordering size code	**Tube outside diameter**	d **Thread**	m ISO 6149-2 stud end thread	d_{19} [a] ref.	d_{20} [b] ref.	L_{10} ref.	L_{11} ref.	L_{21} ref.	L_{34} ± 0,8	L_{35} ref.	L_{37} min.	s	s_2 Forged connection min.	s_2 Connection machined from barstock max.	s_3
6 × M12	6	9/16-18 UNF	M12 × 1,5	4	4	33	22	26,5	37	26	7,5	17	14	17	17
8 × M14	8	5/8-18 UNF	M14 × 1,5	5,5	6	35,5	24,5	28	38	27	8,5	19	17	22	19
10 × M16	10	11/16-16 UN	M16 × 1,5	6,5	7	37,5	25	29	40,5	28	9	22	17	27	22
12 × M18	12	13/16-12 UN	M18 × 1,5	9	9	41	27	38	49,5	35,5	11	24	19	30	24
16 × M22	16	1-14 UNS	M22 × 1,5	11,5	12	49	34	41	53	38	11,5	30	24	36	27
20 × M27	20	1 3/16-12 UN	M27 × 1,5	14	15	55,5	37	46,5	59,5	41	12	36	27	41	32
22 × M30	22	1 5/16-12 UN	M30 × 2	18	17	59,5	41	53,5	63	44,5	14	41	36	41	36
25 × M33	25	1 7/16-12 UN	M33 × 2	20	20	59,5	41	53,5	67,5	49	16	41	36	46	41
30 × M42	30	1 11/16-12 UN	M42 × 2	26	26	63	44	58	68	49	16	50	41	55	50
38 × M48	38	2-12 UN	M48 × 2	32	32	71,5	50	61	70,5	49	16	60	50	60	55

[a] For SDSWS connectors, the smaller of d_{19} and d_{20} may go all the way through the connector, or the connector may have a transition area approximately halfway through the hex.

[b] For tolerances, see ISO 6149-2:—, dimension d_3.



Key

1 tube nut

For dimensions not shown, see Figure 5 and Table 9.

a Crimp nut design optional.

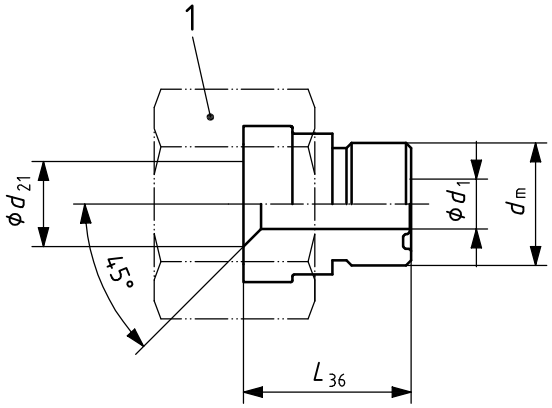
Figure 14 — Reducer with nut (style A) (RDA)

Table 18 — Dimensions for reducers with nuts (style A)

Dimensions in millimetres

Ordering size code Female O-ring face seal × male O-ring face seal	d_f Female thread	d_m Male thread	d_1 ref.	d_{21} ref.	L_{20} ref.	L_{36} ± 0,8	s
8 × 6	5/8-18 UNF	9/16-18 UNF	4,5	6	7,8	17	19
10 × 6 [a]	11/16-16 UN	9/16-18 UNF	4,5	6,5	8,3	19,5	22
10 × 8[a]	11/16-16 UN	5/8-18 UNF	5,5	6,5	8,3	19,5	22
12 × 6	13/16-16 UN	9/16-18 UNF	4,5	9,5	10	22	24
12 × 8	13/16-16 UN	5/8-18 UNF	5,5	9,5	10	22	24
12 × 10 [a]	13/16-16 UN	11/16-16 UN	6,5	9,5	10	22,5	24
16 × 6	1-14 UNS	9/16-18 UNF	4,5	12,5	12,5	23	30
16 × 8	1-14 UNS	5/8-18 UNF	5,5	12,5	12,5	23	30
16 × 10	1-14 UNS	11/16-16 UN	6,5	12,5	12,5	24	30
16 × 12	1-14 UNS	13/16-16 UN	9,5	12,5	12,5	25,5	30
20 × 6	1 3/16-12 UN	9/16-18 UNF	4,5	15,5	13,6	25	36
20 × 8	1 3/16-12 UN	5/8-18 UNF	5,5	15,5	13,6	25	36
20 × 10	1 3/16-12 UN	11/16-16 UN	6,5	15,5	13,6	26	36
20 × 12	1 3/16-12 UN	13/16-16 UN	9,5	15,5	13,6	27,5	36
20 × 16 [a]	1 3/16-12 UN	1-14 UNS	12,5	15,5	13,6	29,5	36
22 × 8	1 5/16-12 UN	5/8-18 UNF	5,5	18	13,5	25	41
22 × 10	1 5/16-12 UN	11/16-16 UN	6,5	18	13,5	26	41
22 × 12	1 5/16-12 UN	13/16-16 UN	9,5	18	13,5	27,5	41
22 × 16	1 5/16-12 UN	1-14 UNS	12,5	18	13,5	29,5	41
22 × 20 [a]	1 5/16-12 UN	1 3/16-12 UN	15,5	18	13,5	32	41
25 × 12	1 7/16-12 UN	13/16-16 UN	9,5	20,5	13,5	29	41
25 × 16	1 7/16-12 UN	1-14 UNS	12,5	20,5	13,5	32	41
25 × 20 [a]	1 7/16-12 UN	1 3/16-12 UN	15,5	20,5	13,5	33	41
25 × 22 [a]	1 7/16-12 UN	1 5/16-12 UN	18	20,5	13,5	33,5	41
30 × 20	1 11/16-12 UN	1 3/16-12 UN	15,5	26	13,5	33,5	50
30 × 22	1 11/16-12 UN	1 5/16-12 UN	18	26	13,5	34	50
30 × 25 [a]	1 11/16-12 UN	1 7/16-12 UN	20,5	26	13,5	38,5	50
38 × 22	2-12 UN	1 5/16-12 UN	18	32	13,5	34	60
38 × 25	2-12 UN	1 7/16-12 UN	20,5	32	13,5	34	60
38 × 30	2-12 UN	1 11/16-12 UN	26	32	13,5	34	60

[a] Crimped nut design.



Key

1 tube nut

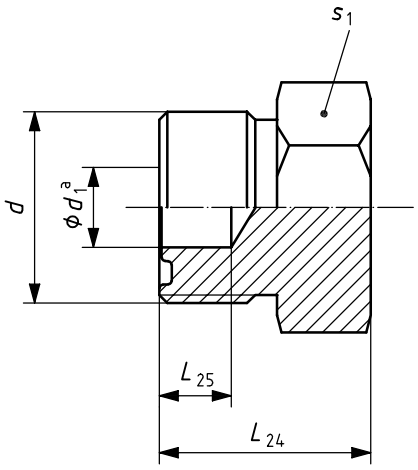
For dimensions not shown, see Figure 5 and Table 9.

Figure 15 — Reducer without nut (style B) (RDB)

Table 19 — Dimensions of reducers without nuts

Dimensions in millimetres

Ordering size code Female O-ring face seal × male O-ring face seal	d_m **Male thread**	d_1 ref.	d_{21} ref.	L_{36} ± 0,8
8 × 6	9/16-18 UNF	5,5	6	17
12 × 6	9/16-18 UNF	4,5	9,5	22
12 × 8	5/8-18 UNF	5,5	9,5	22
16 × 6	9/16-18 UNF	4,5	12,5	23
16 × 8	5/8-18 UNF	5,5	12,5	23
16 × 10	11/16-18 UN	6,5	12,5	24
16 × 12	13/16-16 UN	9,5	12,5	25,5
20 × 6	9/16-18 UNF	4,5	15,5	25
20 × 8	5/8-18 UNF	5,5	15,5	25
20 × 10	11/16-18 UN	6,5	15,5	26
20 × 12	13/16-16 UN	9,5	15,5	27,5
22 × 8	5/8-18 UNF	5,5	18	25
22 × 10	11/16-16 UN	6,5	18	26
22 × 12	13/16-16 UN	9,5	18	27,5
22 × 16	1-14 UNS	12,5	18	29,5
25 × 12	13/16-16 UN	9,5	20,5	29
25 × 16	1-14 UNS	12,5	20,5	32
30 × 20	1 3/16-12 UN	15,5	26	33,5
30 × 22	1 5/16-12 UN	18	26	34
38 × 22	1 5/16-12 UN	18	32	34
38 × 25	1 7/16-12 UN	20,5	32	34
38 × 30	1 11/16-12 UN	26	32	34



For details not shown here, see Figure 2 and Table 6.

a Optional.

Figure 16 — Plug (PL)

Table 20 — Dimensions of plugs

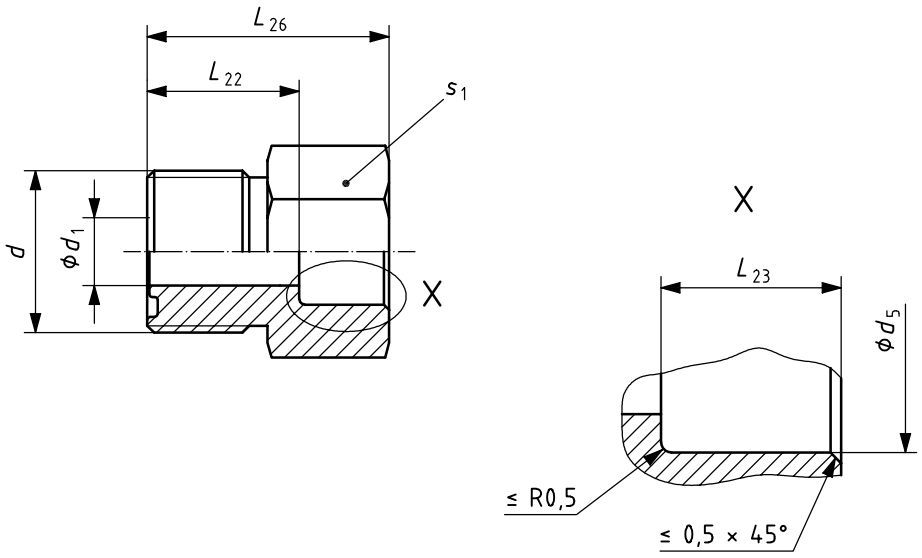
Dimensions in millimetres

Tube outside diameter [a] **and ordering size code**	d **Thread** [b]	d_1 ref.	L_{24} ± 0,8	L_{25} max.	s_1
6	9/16-18 UNF	4,5	16,5	7,1	17
8	5/8-18 UNF	5,5	16,5	7,1	17
10	11/16-16 UN	6,5	19	8,2	19
12	13/16-16 UN	9,5	22	9,8	22
16	1-14 UNS	12,5	26	12,2	27
20	1 3/16-12 UN	15,5	27,5	13,2	32
22	1 5/16-12 UN	18	28	13,2	36
25	1 7/16-12 UN	20,5	28	13,7	41
30	1 11/16-12 UN	26	28	13,7	46
38	2-12 UN	32	28	13,7	55

a See Table 1 for corresponding inch tube sizes.

b In accordance with ISO 68-2 and ISO 5864:1993, Class 2B, and Annex A, except for 1-14 UNS. See Annex A for 1-14 UNS thread dimensions.

Dimensions in millimetres



For dimensions not shown here, see Figure 2 and Table 6.

Figure 17 — Braze-on straight connector (BRS)

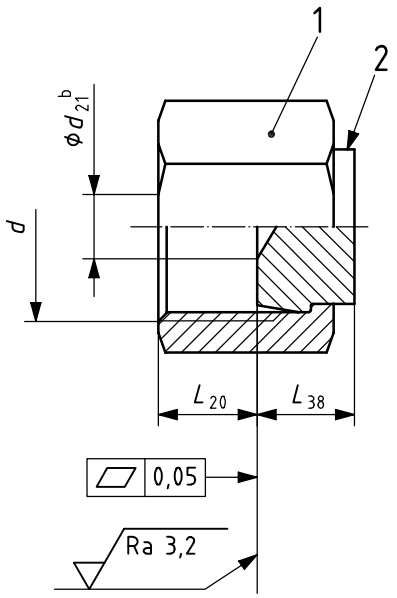
Table 21 — Dimensions of braze-on straight connectors

Dimensions in millimetres

Metric tubing			Inch tubing								
Ordering size code Face seal × tube outside diameter	**Tube outside diameter**	d_5 [a] ref.	**Ordering size code** Face seal × tube outside diameter	**Tube outside diameter**	d_5 [a] ref.	d **Thread**	d_1 ref.	L_{22} ± 0,8	L_{23} ± 0,5	L_{26} ref.	s_1
6 × 6	6	6,15	6 × 6,35	6,35	6,5	9/16-18 UNF	4,5	13,5	8,5	22	17
6 × 8	8	8,15	6 × 7,94	7,94	8,09	9/16-18 UNF	4,5	13,5	8,5	22	17
6 × 10	10	10,15	6 × 9,52	9,52	9,68	9/16-18 UNF	4,5	13,5	8,5	22	17
8 × 6	6	6,15	8 × 6,35	6,35	6,5	5/8-18 UNF	5,5	13,5	8,5	22	17
8 × 8	8	8,15	8 × 7,94	7,94	8,09	5/8-18 UNF	5,5	13,5	8,5	22	17
8 × 10	10	10,15	8 × 9,52	9,52	9,68	5/8-18 UNF	5,5	13,5	8,5	22	17
8 × 12	12	12,15	8 × 12,7	12,7	12,85	5/8-18 UNF	5,5	13,5	8,5	22	19
10 × 6	6	6,15	10 × 6,35	6,35	6,5	11/16-16 UN	4,5	14,5	8,5	23	19
10 × 8	8	8,15	10 × 7,94	7,94	8,09	11/16-16 UN	5,5	14,5	8,5	23	19
10 × 10	10	10,15	10 × 9,52	9,52	9,68	11/16-16 UN	6,5	14,5	8,5	23	19
10 × 12	12	12,15	10 × 12,7	12,7	12,85	11/16-16 UN	6,5	14,5	8,5	23	19
10 × 16	16	16,15	10 × 15,88	15,88	16,03	11/16-16 UN	6,5	14,5	9	23,5	22
12 × 8	8	8,15	12 × 7,94	7,94	8,09	13/16-16 UN	5,5	16	8,5	24,5	22
12 × 10	10	10,15	12 × 9,52	9,52	9,68	13/16-16 UN	6,5	16	8,5	24,5	22
12 × 12	12	12,15	12 × 12,7	12,7	12,85	13/16-16 UN	9,5	16	8,5	24,5	22
12 × 16	16	16,15	12 × 15,88	15,88	16,03	13/16-16 UN	9,5	16	9	25	22
16 × 10	10	10,15	16 × 9,52	9,52	9,68	1-14 UNS	6,5	19	8,5	27,5	27
16 × 12	12	12,15	16 × 12,7	12,7	12,85	1-14 UNS	9,5	19	8,5	27,5	27
16 × 16	16	16,15	16 × 15,88	15,88	16,03	1-14 UNS	12,5	19	9	28	27
16 × 20	20	20,18	16 × 19,05	19,05	19,23	1-14 UNS	12,5	19	12,5	31,5	27
20 × 12	12	12,15	20 × 12,7	12,7	12,85	1 3/16-12 UN	9,5	21	8,5	29,5	32
20 × 16	16	16,15	20 × 15,88	15,88	16,03	1 3/16-12 UN	12,5	21	9	30	32
20 × 20	20	20,18	20 × 19,05	19,05	19,23	1 3/16-12 UN	15,5	21	12,5	33,5	32
20 × 25	25	25,18	20 × 25,4	25,4	25,58	1 3/16-12 UN	15,5	21	14	35	32
22 × 16	16	16,15	22 × 15,88	15,88	16,03	1 5/16-12 UN	12,5	23	9	32	36
22 × 20	20	20,18	22 × 19,05	19,05	19,23	1 5/16-12 UN	18	23	12,5	35,5	36
22 × 22	22	22,18	22 × 22,23	22,23	22,41	1 5/16-12 UN	18	23	12,5	35,5	36
22 × 25	25	25,18	22 × 25,4	25,4	25,58	1 5/16-12 UN	18	23	14	37	36
25 × 16	16	16,15	25 × 15,88	15,88	16,03	1 7/16-12 UN	12,5	24,5	9	33,5	41
25 × 20	20	20,18	25 × 19,05	19,05	19,23	1 7/16-12 UN	15,5	24,5	12,5	37	41
25 × 25	25	25,18	25 × 25,4	25,4	25,58	1 7/16-12 UN	20,5	24,5	14	38,5	41
25 × 30	30	30,2	25 × 31,75	31,75	31,95	1 7/16-12 UN	20,5	24,5	14	38,5	41
30 × 20	20	20,18	30 × 19,05	19,05	19,23	1 11/16-12 UN	15,5	24,5	12,5	37	46
30 × 25	25	25,18	30 × 25,4	25,4	25,58	1 11/16-12 UN	20,5	24,5	14	38,5	46
30 × 30	30	30,2	30 × 31,75	31,75	31,95	1 11/16-12 UN	26	24,5	14	38,5	46
30 × 38	38	38,2	30 × 38,1	38,1	38,3	1 11/16-12 UN	26	24,5	14	38,5	50
38 × 25	25	25,18	38 × 25,4	25,4	25,58	2-12 UN	20,5	24,5	14	38,5	55
38 × 30	30	30,2	38 × 31,75	31,75	31,95	2-12 UN	26	24,5	14	38,5	55
38 × 38	38	38,2	38 × 38,1	38,1	38,3	2-12 UN	32	24,5	14	38,5	55

[a] Dimensions given are for silver brazing. Other dimensions may apply for other joining methods.

Dimensions in millimetres;
surface roughness in micrometres



Key

1 tube nut

2 stake plug [a]

For dimensions not shown, see Figure 5 and Table 9.

[a] Stake plug shall be free to turn.

[b] Optional drill point permitted.

Figure 18 — Cap (CP)

Table 22 — Dimensions of cap assemblies

Dimensions in millimetres

Tube outside diameter and ordering size code	d Thread	d_{21} 0 − 0,5	L_{20} ref.	L_{38} ± 0,5
6	9/16-18 UNF	4,5	7,8	9
8	5/8-18 UNF	5,5	7,8	10
10	11/16-16 UN	6,5	8,3	10,5
12	13/16-16 UN	9,5	10	12
16	1-14 UNS	12,5	12,5	13,5
20	1 3/16-12 UN	15,5	13,6	15
22	1 5/16-12 UN	18	13,5	15
25	1 7/16-12 UN	20,5	13,5	16
30	1 11/16-12 UN	26	13,5	16
38	2-12 UN	32	13,5	16

Annex A
(normative)

Specification for 1-14 UNS inch screw threads — Basic dimensions

Tables A.1 and A.2 provide the dimensions for the 1-14 UNS inch screw thread. Table A.1 gives dimensions for external threads and Table A.2 for internal threads.

Table A.1 — Dimensions of 1-14 UNS, classes 2A and 3A (external) inch screw threads

Thread		Allowance	Major diameter		Pitch diameter		Minor diameter
			max. [a]	min.	max. [a]	min.	max.
Class 2A							
1-14 UNS	in	0,001 7	0,998 3	0,988 0	0,951 9	0,946 3	0,921 0
	mm	0,043	25,356	25,096	24,178	24,037	23,393
Class 3A							
1-14 UNS	in	0	1,000 0	0,989 7	0,953 6	0,949 4	0,922 7
	mm	0	25,400	25,139	24,221	24,115	23,437

[a] For class 2A threads having an additional finish, the maximum major and pitch diameters, after coating, may equal the basic sizes whose values are the same as the maximum values shown for class 3A.

Table A.2 — Dimensions of 1-14 UNS, class 2B (internal) inch screw threads

Thread		Internal — Class 2B				
		Minor diameter		Pitch diameter		Major diameter
		max.	min.	max.	min.	min.
1-14 UNS	in	0,938	0,923	0,960 9	0,953 6	1,000 0
	mm	23,825	23,444	24,407	24,221	25,400

Annex B
(normative)

Reduction factors for reducing connectors

Annex B contains the factors to be used to calculate the lengths of reducing connectors, also known as “jump” connectors.

For any non-standard size connector, be it a connector, 45° or 90° elbow, tee or cross, one end is always standard. Considering this to be the largest end on the connector, it may then be used as a basis of establishing the stock size and length (either overall or end-to-centre) for all other ends, by deducting the factors given in the tables below 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 size difference, or conform to one of the following for any size difference:

— the appropriate end may be countersunk to the larger diameter, or

— 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) for the larger size is held constant.

b) Factors given in Tables B.1, B.3 and B.5 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.

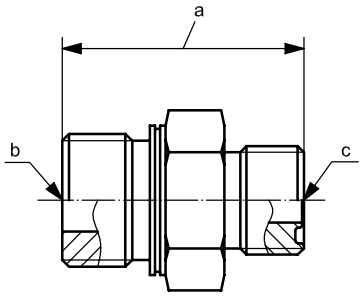
c) The factors given in Tables B.2 and B.4 were derived by subtracting the standard machining length (minimum full thread length) plus an allowance of one-and-one-half thread pitches for imperfect thread length required for the smaller end from the same value required for the larger end and rounding the result down to the nearest 0,5 mm.

The following tolerances apply to reducing connectors:

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

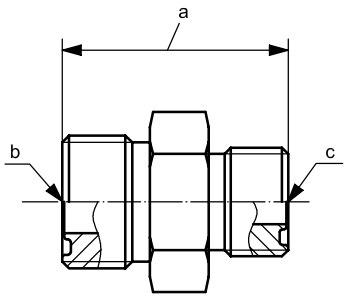
— centreline to end on shaped connectors: ± 1,5 mm.

Figures B.8 and B.12 and accompanying text give examples of how to apply these factors.



a Length to be reduced by factor from Table B.1.
b Standard O-ring stud end.
c Reduced O-ring face seal end.

Figure B.1 — Stud straight with reduced face seal end



a Length to be reduced by factor from Table B.1.
b Standard O-ring face seal end.
c Reduced O-ring face seal end.

Figure B.2 — Reducer union

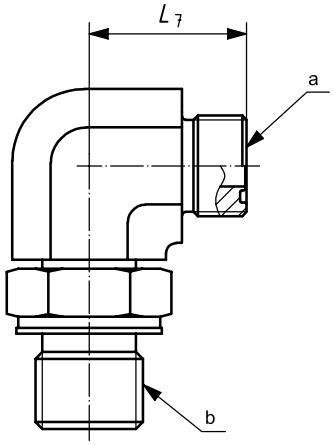
Table B.1 — Reduction factors for straight connectors with reduced face seal ends

Dimensions in millimetres

Nominal tube outside diameter of smaller face seal end	Standard machining size (tube outside diameter or stud size of larger end of connector)								
	Tube outside diameter 8 or M14 × 1,5	Tube outside diameter 10 or M16 × 1,5	Tube outside diameter 12 or M18 × 1,5	Tube outside diameter 16 or M22 × 1,5	Tube outside diameter 20 or M27 × 2	Tube outside diameter 22 or M30 × 2	Tube outside diameter 25 or M33 × 2	Tube outside diameter 30 or M42 × 2	Tube outside diameter 38 or M48 × 2
	Reduction factors								
6	0	1	3	5,5	7	7,5	7,5 [b]	7,5 [b]	7,5 [b]
8		1	3	5,5	7	7,5	7,5 [b]	7,5 [b]	7,5 [b]
10			2	4,5	6	6,5	6,5	6,5 [b]	6,5 [b]
12				2,5	4	4,5	4,5	4,5	4,5 [b]
16			[a]		1,5	2	2	2	2
20						0,5	0,5	0,5	0,5
22							0	0	0
25								0	0
30									0
Minimum stud hex	19	22	24	27	32	36	41	50	55
Minimum union hex	19	19	22	27	32	36	41	46	55

[a] No factor is required when the ends of the connector are the same size. For connectors whose face seal end is larger than the stud end, see Table B.3.

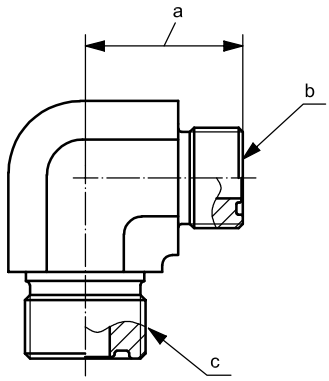
[b] These “multiple jump” connectors are not recommended.



[a] Reduced O-ring face seal end.

[b] Standard O-ring stud end.

Figure B.3 — 90° adjustable stud elbow with reduced face seal end (for shaped connector)



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

b Reduced O-ring face seal end.

c Standard O-ring face seal end.

Figure B.4 — Union elbow with reduced face seal end

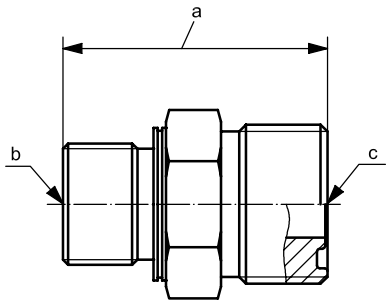
Table B.2 — Factors for face seal ends on shaped connectors with reduced face seal ends

Dimensions in millimetres

Nominal tube outside diameter of smaller face seal end	Standard machining size (tube outside diameter or stud size of larger end of connector)								
	Tube outside diameter 8 or M14 × 1,5	Tube outside diameter 10 or M16 × 1,5	Tube outside diameter 12 or M18 × 1,5	Tube outside diameter 16 or M22 × 1,5	Tube outside diameter 20 or M27 × 2	Tube outside diameter 22 or M30 × 2	Tube outside diameter 25 or M33 × 2	Tube outside diameter 30 or M42 × 2	Tube outside diameter 38 or M48 × 2
	Factors								
6		1,5	3	5,5	7	7,5			
8		1.5	3	5,5	7	7,5		b	
10			1,5	3,5	5	5,5	5,5		
12				2	3,5	4	4	4	
16		a			1,5	2	2	2	2
20						0,5	0,5	0,5	0,5
22							0	0	0
25								0	0
30									0
Minimum hex for forgings	17	17	19	24	27	36	36	41	50

a No factor is required when the ends of the connector are the same size. For connectors whose face seal end is larger than the stud end, see Table B.4.

b These “multiple jump” connectors are not recommended.



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

b Reduced O-ring stud end.

c Standard O-ring face seal end.

Figure B.5 — Straight stud with reduced stud end

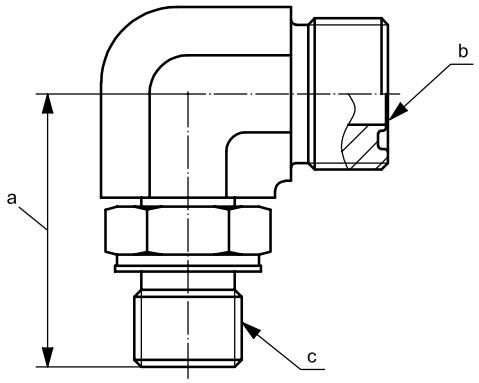
Table B.3 — Factors for straight stud connectors with reduced stud ends

Dimensions in millimetres

Smaller stud end thread	Standard machining size (tube outside diameter of larger end of connector)									
	6	8	10	12	16	20	22	25	30	38
	Factors									
M8 × 1	1,5	1,5	3	4,5 [b]	5,5 [b]	9 [b]	9 [b]	9 [b]	9,5 [b]	12 [b]
M10 × 1	1,5	1,5	3	4,5	5,5 [b]	9 [b]	9 [b]	9 [b]	9,5 [b]	12 [b]
M12 × 1,5		0	1,5	3	4	7,5 [b]	7,5 [b]	7,5 [b]	8 [b]	10,5 [b]
M14 × 1,5			1,5	3	4	7,5	7,5 [b]	7,5 [b]	8 [b]	10,5 [b]
M16 × 1,5				1,5	2,5	6	6	6 [b]	6,5 [b]	9 [b]
M18 × 1,5					1	4,5	4,5	4,5	5 [b]	7,5 [b]
M22 × 1,5			a			3,5	3,5	3,5	4	6,5 [b]
M27 × 2							0	0	0,5	3
M30 × 2								0	0,5	3
M33 × 2									0,5	3
M42 × 2										2,5
Hex	17	19	19	22	27	32	36	41	46	55

a For stud ends larger than the standard for the face seal end, see Table B.1.

b These “multiple jump” connectors are not recommended.



a Length to be reduced by factor from Table B.4.

b Standard O-ring face seal end.

c Reduced O-ring stud end.

Figure B.6 — 90° adjustable stud elbow with reduced stud end

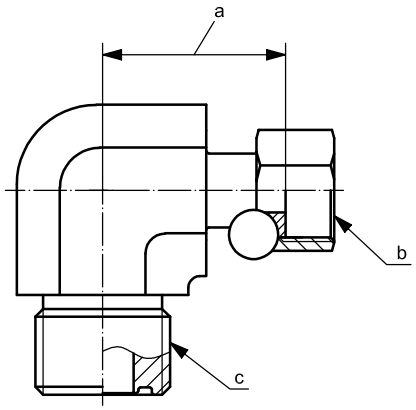
Table B.4 — Factors for 90° adjustable stud elbows with reduced stud ends

Dimensions in millimetres

Smaller stud end thread	Standard machining size (tube OD of larger end of connector)									
	6	8	10	12	16	20	22	25	30	38
	Factors									
M8 × 1	3,5	3,5	5,5							
M10 × 1	3,5	3,5	5,5	8,5						
M12 × 1,5		0	2	5	6,5					
M14 × 1,5			2	5	6,5	13		b		
M16 × 1,5				3	4,5	11	11			
M18 × 1,5					1,5	8	8	8		
M22 × 1,5			a			6,5	6,5	6,5	7,5	
M27 × 2							0	0	1	4,5
M30 × 2								0	1	4,5
M33 × 2									1	4,5
M42 × 2										3,5

a No factor required for connector when the ends of the connector are the same size. For connectors whose face seal end is smaller than the stud end, see Table B.3.

b These “multiple jump” connectors are not recommended.



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

b Reduced O-ring face seal swivel end.

c Standard O-ring face seal end.

Figure B.7 — Swivel elbow with reduced swivel end

Table B.5 — Factors for swivel elbows with reduced swivel ends

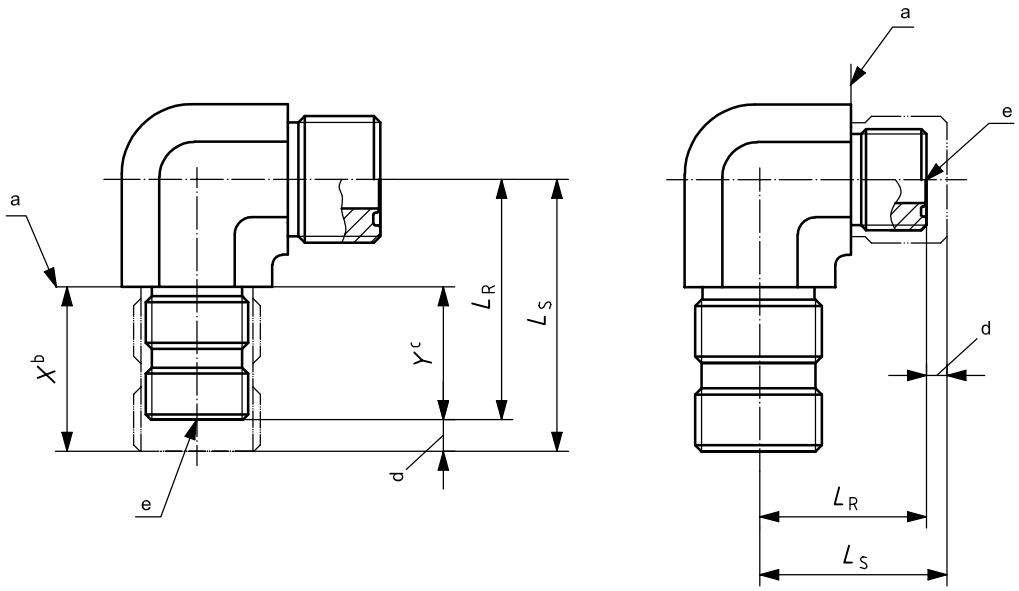
Dimensions in millimetres

Tube outside diameter of smaller face seal end	Standard machining size (tube OD of larger end of connector)								
	8	10	12	16	20	22	25	30	38
	Factors [a]								
6	1	2	5	9	11,5	11,5 [c]	12,5 [c]	12,5 [c]	12,5 [c]
8		1	4	8	10,5	10,5	11,5 [c]	11,5 [c]	11,5 [c]
10			3	7	9,5	9,5	10,5	10,5[c]	10,5 [c]
12				4	6,5	6,5	7,5	7,5	7,5 [c]
16					2,5	2,5	3,5	3,5	3,5
20			b			0	1	1	1
22							1	1	1
25								0	0
30									0

a No factor required for connector when the ends of the connector are the same size. For connectors with the swivel end larger than other end, see Table B.2.

b These “multiple jump” connectors are not recommended.

c Nut overall lengths were used to calculate the factors.



L_S – Standard size $L_R = (L_S$ – Reduction factor)

a Machining start point for both standard and reducing connectors.

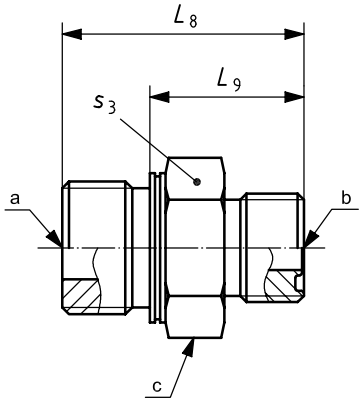
b X = Minimum full thread length plus 1-1/2 pitches for larger end.

c Y = Minimum full thread length plus 1-1/2 pitches for small end.

d Reduction factor.

e Reduced end.

Figure B.8 — Key dimensions of port and tube sides of reducing connectors



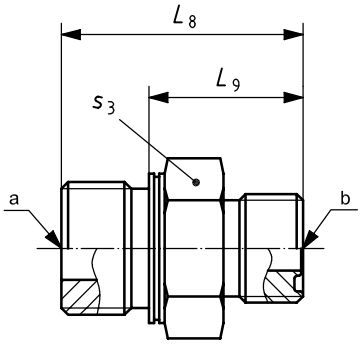
a M18 reduced O-ring stud end.

b 16 mm standard O-ring face seal end.

c Hex.

Figure B.9 — Stud straight connector with reduced stud end

Stud straight in which the stud end is smaller than the standard for the O-ring face seal end size (see Table 14 for basic dimensions) — 16 mm O-ring face seal and size M18 stud end (factors from Table B.3) — Read length L_8 in Table 14 for 16 mm × M22 size, which is 42 mm, and read the nut size from Table 14, which is 27 mm. Note that the hex is determined by the largest end of the connector. All remaining dimensions conform to those of the face seal end size shown in this part of ISO 8434 or the relevant stud end standard, ISO 6149-2. To calculate L_8 shown in Figure B.9, subtract the reduction factor, 1 mm, from Table B.3 from the 42 mm from Table 14. Therefore, the adjusted L_8 equals 41 mm.

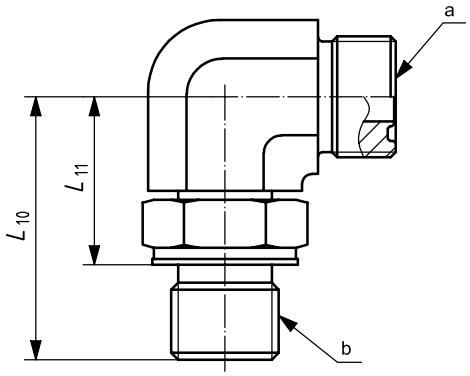


a M22 standard O-ring stud end.

b 12 mm reduced O-ring face seal end.

Figure B.10 — Stud straight connector with reduced face seal end

Stud straight in which the stud end in accordance with ISO 6149-2 is paired with an O-ring face seal end that is reduced from the standard size (see Table 14 for basic dimensions) — M22 stud end with 12 mm O-ring face seal end (factors from Table B.1) — Read dimensions given for 16 × M22 size in Table 14. Because M22 is the larger end (thread size is larger), the connector will be manufactured from 27 mm stock size. From Table 14, L_8 for M22 is 42 mm. Because the tube end is a size 12, using Table B.1, subtract 2,5 mm from 42 mm, which results in dimension L_8 equalling 39,5 mm, and L_9 equals 24,5 mm. All remaining dimensions for the face seal end are in accordance with this part of ISO 8434, and dimensions for the stud end are in accordance with ISO 6149-2.

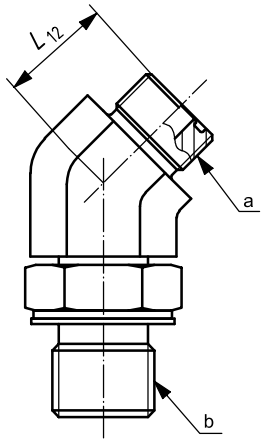


a 16 mm standard O-ring face seal end.

b M18 reduced O-ring stud end.

Figure B.11 — 90° adjustable stud elbow with reduced stud end

90° adjustable stud elbow in which the O-ring face seal end is in accordance with ISO-8434-3 and the stud end is reduced (see Table 14 for basic dimensions) — Size 16 mm O-ring face seal end and M18 stud end (factors from Table B.4) — Read dimension L_{10}, which equals 49 mm, from Table 14 for size 16 × M22. From Table B.4, read the reduction factor of 1,5 mm. Subtract 1,5 mm from 49 mm, resulting in the adjusted drop length L_{10} of 47,5 mm. All remaining dimensions for the face seal end are in accordance with this part of ISO 8434, and the dimensions of the stud end are in accordance with ISO 6149-2.



a 12 mm reduced O-ring face seal end.

b M22 standard O-ring stud end.

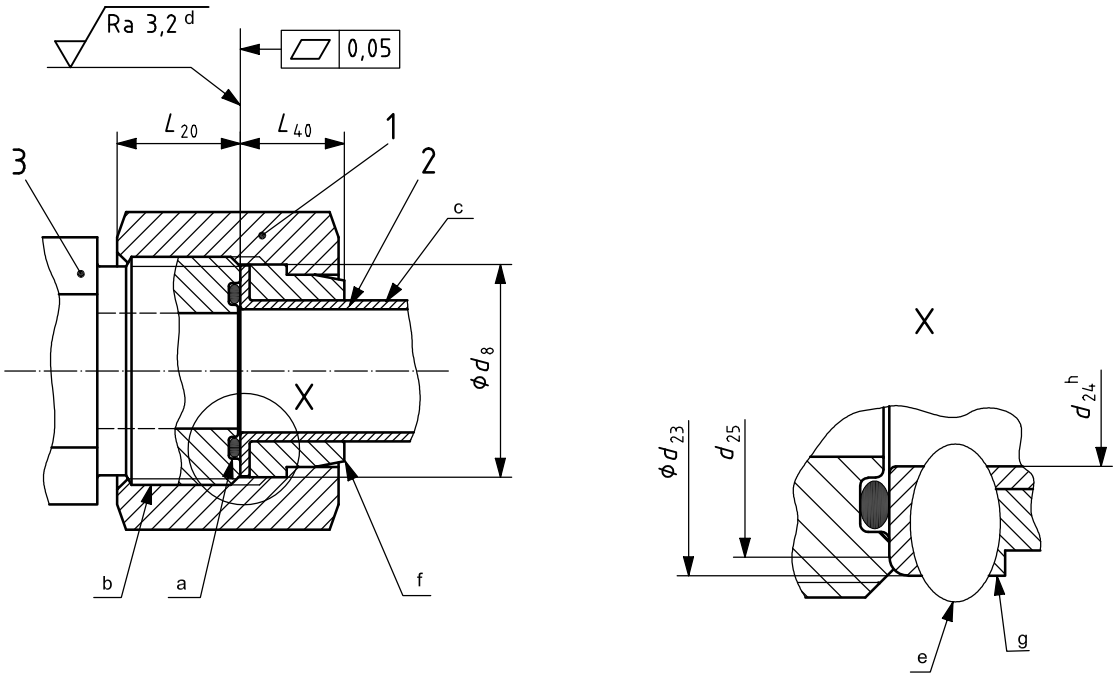
Figure B.12 — 45° adjustable stud elbow with reduced O-ring face seal end

45° adjustable stud elbow in which the stud end in accordance with ISO 6149-2 is paired with an O-ring face seal end that is reduced from the standard size (see Table 14 for basic dimensions) — Size M22 stud end and 12 mm O-ring face seal (factors from Table B.2) — The stud end is the largest end of the connector, and L_{12} for 16 × M22 size (from Table 14) equals 23,5 mm. Read the reduction factor from Table B.2, which is 2,3 mm. The adjusted L_{12} dimension equals 21,2 mm (23,5 mm − 2,3 mm). All remaining dimensions for the face seal end are in accordance with this part of ISO 8434, and the dimensions for the stud end are in accordance with ISO 6149-2.

Annex C
(normative)

Formed tube connection for ISO 8434-3 O-ring face seal connectors

Dimensions in millimetres
Surface roughness in micrometres



Key

1 tube nut NA

2 tube

3 mating male connector

Formed tube end shall provide a sealing surface that can be assembled with a standard ISO 8434-3 connector and nut and meet the performance requirements for a working pressure equivalent to that of the fluid conductor.

a This shall be the only seal point.

b d thread, mating male face seal connector end.

c Circumferential or random grip marks of 0,1 mm maximum depth permissible on surface of tube.

d Tube flatness and smoothness requirements for this surface apply to the area between d_{24} maximum and d_{25} minimum. Areas outside of this shall not protrude beyond the flat surface.

e Tube and sleeve interface to be determined by the manufacturer, provided that appropriate measures are taken to prevent flexural failure at the 90° bend of the tube.

f Tail of the optional sleeve or formed pilot diameter shall be approximately flush with the back of the nut.

g Sleeve optional.

h Dimension d_{24} minimum shall be equal to the connector or tube inside diameter, whichever is smaller. Dimension d_{24} maximum shall be as listed in Table C.1.

Figure C.1 — Formed tube connection for O-ring face seal connector bodies

Table C.1 — Dimensions of formed tube connections for O-ring face seal connectors

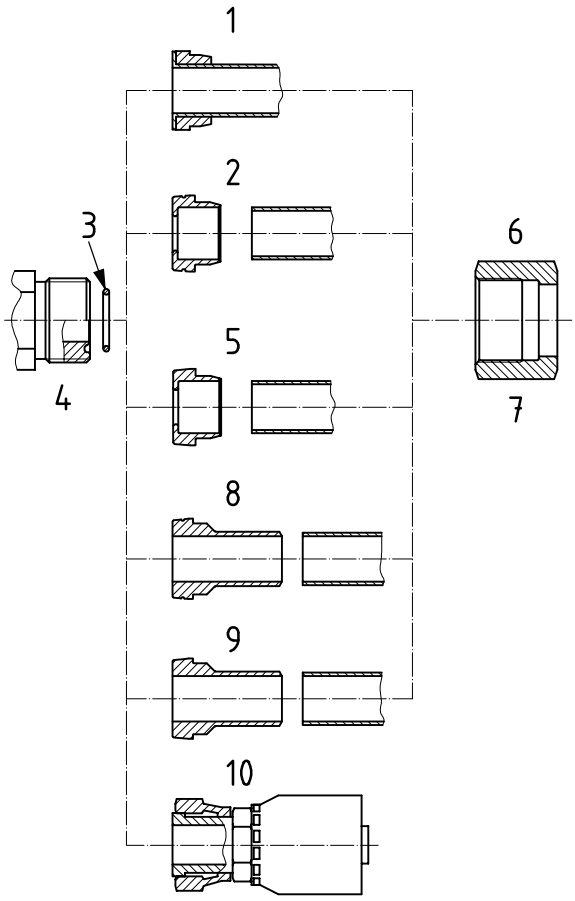
Dimensions in millimetres

Tube outside diameter		Thread	L_{40}		L_{20}		d_{23} (formed outside diameter)		d_{24}	d_{25}
in	mm		min.	max.	min.	max.	min.	max.	max.	min.
1/4	6	9/16-18 UNF	6,6	12,5	6,6	9,0	12,1	12,75	7,3	12,1
5/16	8	5/8-18 UNF	6,6	12,5	6,6	9,0	13,45	14,35	8,4	13,2
3/8	10	11/16-16 UN	7,9	13,0	7,0	9,5	14,85	15,75	8,9	14,3
1/2	12	13/16-16 UN	9,4	17,0	8,6	11,5	18,0	18,9	12,1	17,4
5/8	16	1-14 UNS	10,3	17,0	11,5	13,5	22,2	23,45	15,3	21,2
3/4	20	1 3/16-12 UN	11,9	18,5	12,6	14,5	26,6	27,85	18,5	24,8
7/8	22	1 5/16-12 UN	12,7	19,0	12,5	14,5	29,6	31,0	21,7	27,5
1	25	1 7/16-12 UN	12,7	19,0	12,5	14,5	32,95	34,2	23,2	30,6
1 1/4	30	1 11/16-12 UN	12,7	19,0	12,5	14,5	39,35	40,55	29,5	36,9
1 1/2	38	2-12 UN	12,7	19,0	12,5	14,5	47,25	48,5	37,4	44,9

Annex D
(informative)

O-ring face seal tube and hose connections with metric or inch tubing or swivel hose connector

An example of how metric or inch tubing can be accommodated with the same connector and nut by means of different sleeves is given in Figure D.1.



Key

1 formed tube — inch or metric tubing (see Annex C)
2 braze sleeve for metric tube
3 O-ring
4 male O-ring face seal end
5 braze sleeve for inch tube
6 tube nut
7 tube nut with metric hex
8 weld-on nipples for metric tube
9 weld-in nipples for inch tube
10 swivel hose fitting (see ISO 12151-1)

Table D.1 — O-ring face seal connector bodies with metric or inch tubing using different sleeves

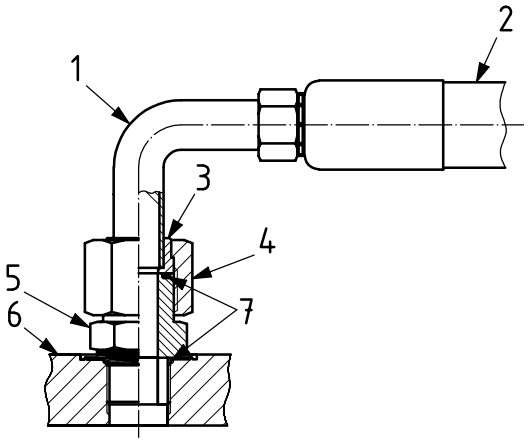
Annex E
(informative)

Typical connections with O-ring face seal connectors

Connectors shown here can be used with tubing or hose as shown in Annex E. See ISO 12151-1 for applicable hose fittings.

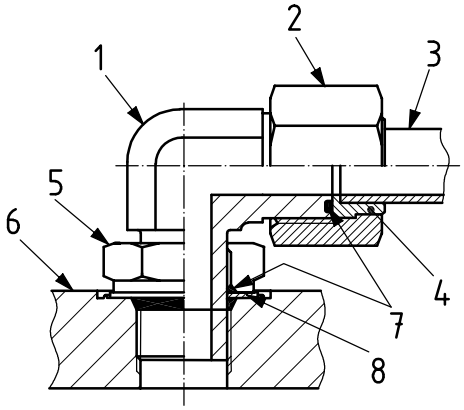
Connectors and adjustable stud ends have lower working pressure ratings than nonadjustable stud ends. To achieve a higher pressure rating for an adjustable connector, a combination of straight stud connector (SDS) and a swivel elbow connector (SWE), as shown in Figure E.1, can be used.

Figures E.1, E.2 and E.3 show typical connections with O-ring face seal connectors.



Key
1 bent tube hose end
2 hose
3 sleeve
4 tube nut
5 straight stud
6 ISO 6149-1 port
7 O-ring

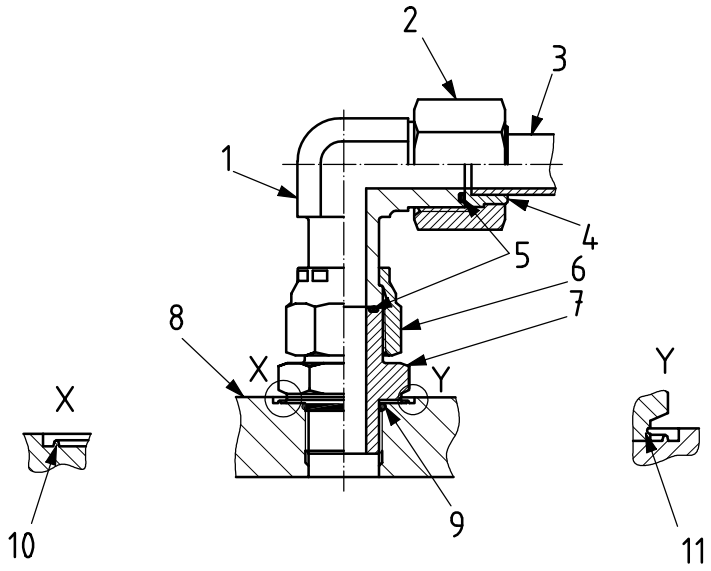
Figure E.1 — Typical connection with O-ring face seal connectors — Non-adjustable style connector



Key

1 adjustable stud elbow
2 tube nut
3 tube
4 sleeve
5 locknut
6 ISO 6149-1 port
7 O-ring
8 back-up washer

Figure E.2 — Typical connection with O-ring face seal connectors — Adjustable style connector



Key

1 swivel elbow
2 tube nut
3 straight tube
4 sleeve
5 O-ring
6 swivel nut
7 straight stud
8 ISO 6149-1 port
9 O-ring
10 optional metric port identification
11 identification for metric stud end

[a] For 6 mm, 8 mm, 10 mm and 12 mm tubes at 63 MPa (630 bar); for 25 mm tube at 40 MPa (400 bar); for 38 mm tube at 25 MPa (250 bar).

Figure E.3 — Typical connection with O-ring face seal connectors — Optional configuration for adjustable style connector for full performance rating [a]

Annex F
(informative)

Assembly instructions for adjustable connectors in ISO 6149-1 ports

Assemble adjustable connectors in ISO 6149-1 ports as follows.

a) **Lubricate** the O-ring by coating it with light oil or petrolatum, and install it in the groove adjacent to the face of the metal back-up washer that is assembled at the extreme end of the groove, as shown in Figure F.1.

b) **Install** the adjustable connector by hand into the port until the back-up washer face bottoms on the port spotface and the O-ring is squeezed into its seal, as shown in Figure F.2.

c) **Position** the adjustable connector by first turning the connector fully into the port and then index by unscrewing the connector no more than one turn to the desired position. See Figure F.3.

d) **Tighten** the locknut to the torque values recommended by the manufacturer while holding the body of the connector with a wrench. See Figure F.4.

Figure F.5 shows the final assembly.

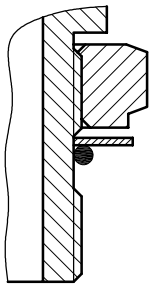


Figure F.1 — Locknut backed off

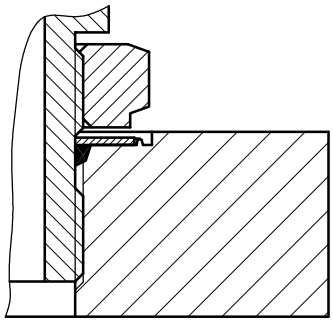


Figure F.2 — Connector installed by hand until back-up washer face contacts port spotface

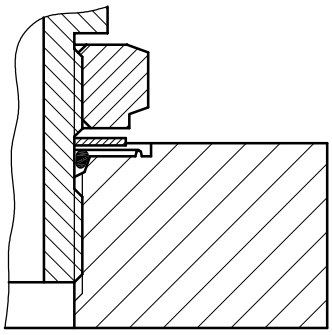


Figure F.3 — Connector backed off for alignment (one turn maximum)

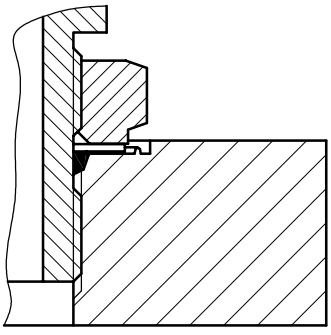
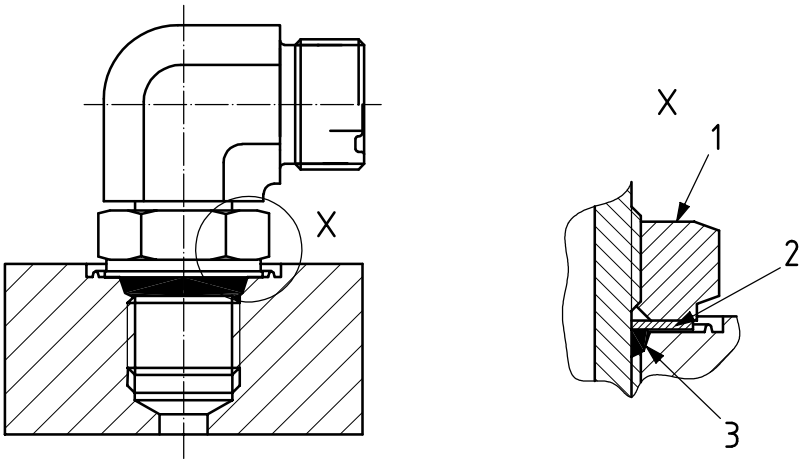


Figure F.4 — Connector locknut tightened to appropriate torque



Key

1 locknut
2 back-up washer
3 O-ring

Figure F.5 — Final assembly of adjustable stud end

ICS 23.100.40

Price based on 63 pages