INTERNATIONAL STANDARD

ISO 8434-3

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Metallic tube connections for fluid power and general use —

Part 3:
O-ring face seal fittings

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

Partie 3: Raccords à joints faciaux toriques

Reference number
ISO 8434-3:1995(E)

Contents

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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.

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.

International Standard ISO 8434-3 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

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

— *Part 1: 24 degree compression fittings*

— *Part 2: 37 degree flared fittings*

— *Part 3: O-ring face seal fittings*

— *Part 4: 24 degree cone connectors with O-ring weld-on nipples*

— *Part 5: Test methods for threaded hydraulic fluid power connections*

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 conforming to ISO 725. The inch threads were not changed to metric threads conforming to ISO 261 to allow fittings complying with this part of ISO 8434 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 programme at considerable cost without providing any functional improvement. The threads are integral to themselves, fittings 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 fittings have adopted the design without noting any problems. All wrench flats are dimensioned to be used with ISO standard metric wrenches.

Annexes A and B form an integral part of this part of ISO 8434. Annexes C and D are for information only.

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

Metallic tube connections for fluid power and general use —

Part 3:
O-ring face seal fittings

1 Scope

This part of ISO 8434 specifies general and dimensional requirements for the design and performance of O-ring face seal fittings made of steel for tube outside diameters or hose inside diameters of 6 mm to 38 mm, inclusive. These fittings 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 for related hose fitting specifications.)

These fittings provide leakproof, full-flow connections in hydraulic systems operating from a vacuum of 6,5 kPa (0,065 bar[1]) absolute pressure to the working pressures shown in table 1. Because many factors influence the pressure at which a system performs satisfactorily, these values should 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.

NOTES

1 For new designs in hydraulic fluid power applications, see the requirements given in 9.6.

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

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

2) To be published. (Revision of ISO 261:1973)

Both metric and inch tubing can be accommodated by changing the sleeve (see annex C). In the past, these fittings 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 fittings.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8434. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8434 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 261:—[2], *ISO general-purpose metric screw threads — General plan.*

ISO 725:1978, *ISO inch screw threads — Basic dimensions.*

ISO 1127:1992, *Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length.*

ISO 3304:1985, *Plain end seamless precision steel tubes — Technical conditions for delivery.*

ISO 3305:1985, *Plain end welded precision steel tubes — Technical conditions for delivery.*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification.*

ISO 3601-3:1987, *Fluid systems — Sealing devices — O-rings — Part 3: Quality acceptance criteria.*

ISO 4759-1:1978, *Tolerances for fasteners — Part 1: Bolts, screws and nuts with thread diameters between 1,6 (inclusive) and 150 mm (inclusive) and product grades A, B and C.*

ISO 5598:1985, *Fluid power systems and components — Vocabulary.*

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

ISO 6149-1:1993, *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.*

ISO 6149-2:1993, *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 6508:1986, *Metallic materials — Hardness test — Rockwell test (scales A - B - C - D - E - F - G - H - K).*

ISO 6803:1994, *Rubber or plastics hoses and hose assemblies — Hydraulic-pressure impulse test without flexing.*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests.*

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

3 Definitions

For the purposes of this part of ISO 8434, the definitions given in ISO 5598 and the following definitions apply.

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

[ISO 5598]

3.2 connection; fitting: Leakproof device to connect pipelines (conductors) to one another, or to equipment.

[ISO 5598]

3.3 fastening thread: Terminal thread of a complete fitting.

3.4 run: Two principal, axially aligned outlets of a tee or cross.

3.5 branch: Side outlet(s) 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: The 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 fitting orientation before final tightening of the locknut to complete the connection. This type of stud end is typically used on shaped fittings (e.g. tees, crosses and elbows).

3.10 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 fittings.

4 Requirements for materials

Figure 1 shows the cross-section and component parts of a typical O-ring face seal fitting.

4.1 Fitting bodies

Bodies shall be manufactured from carbon steel or stainless steels that will provide the minimum pressure/temperature requirements specified in

3) To be published.

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.

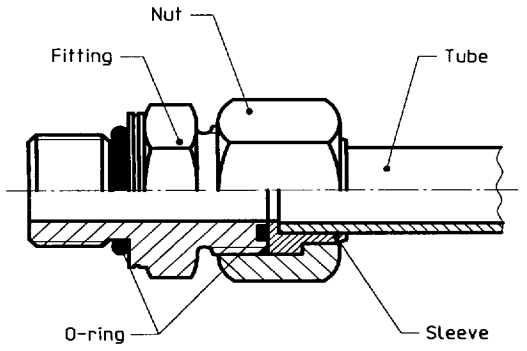


Figure 1 — Cross-section of typical O-ring face seal fitting

4.2 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. 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 given in 15.1.1. High-strength nuts (style B nuts) shall be identified by a turned diameter, d_{14}, as shown in figure 4.

4.3 O-rings

Unless otherwise specified, for use at the pressure and temperature requirements given 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 in accordance with 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.

5 Pressure/temperature requirements

5.1 O-ring face seal fittings complying with this part of ISO 8434 made of carbon steel or stainless steel shall meet or exceed without leakage the requirements of a vacuum of 6,5 kPa (0,065 bar) absolute pressure up to the working pressures given in table 1 when used at temperatures between − 20 °C and + 100 °C.

5.2 The fitting 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 outside the temperature and/or pressure limits given in table 1 and 5.1 and 5.2 , the manufacturer shall be consulted.

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

Tube outside diameter[1]		Port or stud end thread[2]	Working pressure			
			Fittings with non adjustable stud ends		Fittings 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)
25	1	M33 × 2	40	(400)	31,5	(315)
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 fittings made of low-carbon steel and tested in accordance with clause 15.

1) Metric tubing shall be preferred.

2) Port in accordance with ISO 6149-1; stud end in accordance with ISO 6149-2.

6 Designation of fittings

6.1 Fittings shall be designated by an alphanumeric code to facilitate ordering. They shall be designated by ISO 8434-3, followed by a spaced hyphen, then the fitting style letter symbols (see 6.2), followed by a spaced hyphen, and, for the ends, the outside diameter of the tube with which they are to be connected. For stud ends (connector ends), a multiplication sign (×) followed by the thread designation of the stud end shall be added.

EXAMPLE

A straight stud fitting (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:

ISO 8434-3 - SDS - 12 × M18

6.2 The letter symbol designation of the fitting style shall have two parts: the connection end type, immediately followed by the shape of the fitting.

6.3 Tube ends are assumed to be male 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 fittings and reducing elbows shall be designated by specifying the larger tube end first.

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

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

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

6.8 The following letter symbols shall be used:

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

Shape	**Letter**
Straight	S
Elbow	E
45° elbow	E45
Tee	T
Run tee	RT
Branch tee	BT
Cross	K

Component type	**Letter**
Nut	N
Sleeve	SL
Locknut	LN
Plug	PL
Cap	CP
Nipple	NP
Metric	M
Inch	I

7 Requirements for tubes

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

Metric tubing shall be preferred. Tubing shall comply with the relevant dimensions given in table 2 or 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). Stainless steel tubes shall, except for dimensions of inch tubes, comply with ISO 1127.

Table 2 — Metric tube sizes

Tube OD[1] 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
38	37,85	38,15

NOTE — Metric tubing shall be preferred.

1) OD = Outside diameter.

Table 3 — Inch tube sizes

Tube OD		Limits of OD mm	
in	mm [1]	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

1) Equivalent dimension in millimetres.

8 Across-flats dimensions

8.1 The dimensions across flats of elbow, tee and cross fittings shall be as shown in tables 10 to 13 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 $^{0}_{-1}$ 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 4759-1:1978, 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 Fittings

The fittings shall conform to the requirements given in figures 2 to 10 and tables 6 to 14 .

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 fittings 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 tolerances on axis of ends of elbows, tees and crosses shall be ± 2,5° for fittings for tube sizes 10 mm and less, 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 14 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 Ports and stud ends

The dimensions of stud ends shall conform to those given in ISO 6149-2.

For new designs in hydraulic fluid power applications, only, ports and stud ends in accordance with ISO 6149-1 and ISO 6149-2 shall be used.

NOTE 3 For general applications, ports and stud ends in accordance with ISO 6149-3:1993, *Connections for fluid power and general use — Ports and stud ends with ISO 261 threads and O-ring sealing — Part 3: Light-duty (L series) stud ends — Dimensions, design, test methods and requirements*, may be used.

10 Screw threads

10.1 The screw threads on the connection ends of the fittings shall be inch screw threads in accordance with ISO 725, except for the 1-14 UNS class 2A and 2B threads, whose dimensions are found in annex A.

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

11 Manufacture

11.1 Construction

Carbon steel fittings 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 fittings. Fittings 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 $R_a \leqslant 6{,}3\ \mu m$, except where otherwise specified.

11.3 Finish

The external surface and threads on all fittings, 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 shall be considered failure. Fluid passages shall be excluded from the plating and/or coating requirements but shall be protected from rust. Braze-on type fittings, braze sleeves and weld nipples shall be protected from corrosion by an oil film or phosphate coating.

11.4 Fitting protection

By a method agreed between the manufacturer and user, the face of the fittings 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 fitting. Passages shall be securely covered to prevent the entrance of dirt or other contaminants.

Braze-on type fittings require protection on the sealing face and threaded end only. Nuts and sleeves that are furnished separately from the fitting 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 fittings with the connecting tubes shall be carried out without external loads.

The manufacturer shall draw up assembly instructions for the use of the fittings. These instructions shall include at least the following:

— details relating to the material and quality of suitable tubes;

— details concerning the preparation of the selected tube;

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

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

— recommendations regarding the tools to be used for assembly.

13 Procurement information

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

— description of fitting;

— material of fitting;

— material and size of tube;

— fluid to be conveyed;

— working pressure;

— working temperature.

14 Marking of components

Fitting 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

The fittings shall meet or exceed the pressure requirements shown in table 4. 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 before burst, cyclic endurance or torque testing.

15.1.1 Burst-pressure test

For each size, test three samples each of the straight stud (SDS), the 90° straight-thread elbow (SDE) and the 90° swivel elbow (SWE). They shall meet the minimum required burst pressures listed in table 4.

The burst-pressure test shall be conducted at the minimum torque values shown in table 5. For testing only, threads and contact surfaces shall be lubricated with hydraulic oil with a viscosity of VG 32 in accordance with ISO 3448 prior to application of torque. Test blocks for burst testing shall be unplated and hardened to 50 HRC to 55 HRC in accordance with ISO 6508. O-rings shall be made of NBR (nitrile) of (90 ± 5) IRHD, measured in accordance with ISO 48. Adjustable fittings shall be backed out one full turn from finger-tight position to test correctly the worst possible assembly condition. The burst test shall be run at a rate of pressure rise which does not exceed 138 MPa/min (1 380 bar/min).

15.1.2 Cyclic endurance (impulse) test

For each size, test six samples each of the straight stud (SDS), the 90° adjustable stud elbow (SDE) and the 90° swivel elbow (SWE).

All components shall pass a cyclic endurance test for 1 000 000 cycles at the respective impulse pressures given in table 4. The test shall be conducted at minimum torque values shown in table 5. Threads shall be lubricated with hydraulic oil with a viscosity of VG 32 in accordance with ISO 3448 prior to application of torque. O-rings shall be made from NBR (nitrile) with a hardness of (90 ± 5) IRHD, measured in accordance with ISO 48. They shall conform to the dimensions given in table 6 and shall meet or exceed the O-ring quality acceptance criteria for grade N in accordance with ISO 3601-3. The test cycle rate shall be uniform at 0,5 Hz to 1,3 Hz and shall conform to the wave pattern shown in ISO 6803, except that the pressure rise rate shall be adjusted accordingly.

15.1.3 Vacuum requirements

Fittings shall be capable of withstanding a vacuum of 6,5 kPa (0,065 bar) absolute pressure for 5 min without leakage.

For each size, test two samples each of the straight stud (SDS) and the 90° swivel elbow (SWE).

15.1.4 Overtorque test

For each size, test three samples each of the tube nuts (styles NA or NB, as applicable) and the 90° swivel elbow (SWE) nut.

Fitting swivel nuts shall be capable of withstanding the overtorque qualification test with no indication of failure. For testing only, fitting threads and contact surfaces shall be lubricated with VG 32 hydraulic oil prior to application of the overtorque specified in table 5. For torque testing, an unplated steel mandrel hardened to 40 HRC to 45 HRC shall be used. Fittings shall be restrained during test, and the wrench shall be located at the threaded end of the nut hex.

Definitions of failure after torque testing are:

— the nut cannot be removed by hand after breakaway;

— the nut cannot swivel freely by hand;

— the nut will not retract to its original position by hand;

— any visible cracks of severe deformation that would render the nut unusable.

15.1.5 Re-use of test samples

Parts used for cyclic endurance, burst or overtorque 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 shown in annex B.

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 fittings in accordance with ISO 8434-3:1995, *Metallic tube connections for fluid power and general use — Part 3: O-ring face seal fittings.*"

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

Tube OD	Stud end style											
	Non-adjustable						Adjustable					
	Working pressure		Test pressure				Working pressure		Test pressure			
			Burst		Impulse[1]				Burst		Impulse[1]	
mm	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)
6	63	(630)	252	(2 520)	83,8	(838)	40	(400)	160	(1 600)	53,2	(532)
8	63	(630)	252	(2 520)	83,8	(838)	40	(400)	160	(1 600)	53,2	(532)
10	63	(630)	252	(2 520)	83,8	(838)	40	(400)	160	(1 600)	53,2	(532)
12	63	(630)	252	(2 520)	83,8	(838)	40	(400)	160	(1 600)	53,2	(532)
16	40	(400)	160	(1 600)	53,2	(532)	40	(400)	160	(1 600)	53,2	(532)
20	40	(400)	160	(1 600)	53,2	(532)	40	(400)	160	(1 600)	53,2	(532)
25	40	(400)	160	(1 600)	53,2	(532)	31,5	(315)	126	(1 260)	41,9	(419)
30	25	(250)	100	(1 000)	33,2	(332)	25	(250)	100	(1 000)	33,2	(332)
38	25	(250)	100	(1 000)	33,2	(332)	20	(200)	80	(800)	26,6	(266)

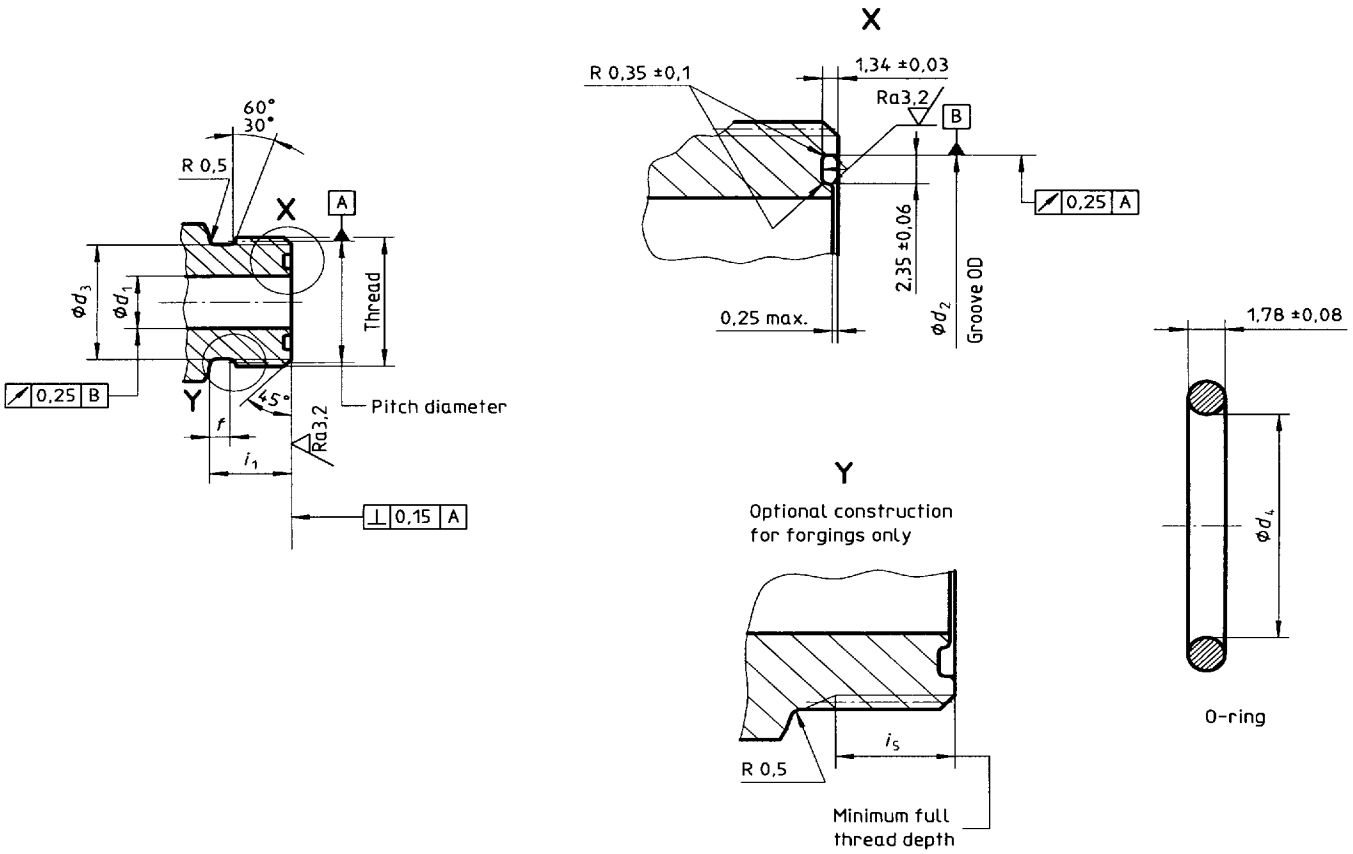
1) Cyclic endurance (impulse) test pressure.

Table 5 — Qualification test torque requirements

Stud end[1]		Face seal end			
Thread	Torque $^{+10}_{0}$ % N·m	Tube OD mm	Thread	Torque $^{+10}_{0}$ % N·m	Overtorque N·m
M12 × 1,5	35	6	9/16-18 UNF	14	32
M14 × 1,5	45	8	9/16-18 UNF	14	32
M16 × 1,5	55	10	11/16-16 UN	24	54
M18 × 1,5	70	12	13/16-16 UN	43	81
M22 × 1,5	100	16	1-14 UNS	60	136
M27 × 2	170	20	1 3/16-12 UN	90	180
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

1) In accordance with ISO 6149-2.

Dimensions in millimetres, surface roughness in micrometres



NOTE — Break all corners to 0,15 max.

Figure 2 — O-ring face seal connection

Table 6 — Dimensions of O-ring face seal connections

Dimensions in millimetres

Tube OD	Thread[1]	d_1		d_2		d_3	f		i_1	i_5	O-ring d_4	
		nom.	tol.	nom.	tol.	± 0,15	nom.	tol.	± 0,4	min.	nom.	tol.
6 and 8	9/16-18 UNF	5	$^{+0,18}_{0}$	11	± 0,08	12,15	2,4	± 0,3	10	9	7,65	± 0,16
10	11/16-16 UN	6,5	$^{+0,22}_{0}$	12,6	± 0,08	15,1	2,8	± 0,4	11	10,5	9,25	± 0,17
12	13/16-16 UN	9,5	$^{+0,22}_{0}$	15,77	± 0,08	18,25	2,8	± 0,4	13	12	12,42	± 0,19
16	1-14 UNS	12,5	$^{+0,27}_{0}$	19	± 0,08	22,75	3,1	± 0,4	15,5	14	15,6	± 0,2
20	1 3/16-12 UN	15,5	$^{+0,27}_{0}$	22,17	± 0,1	27,15	3,7	± 0,5	17	15	18,77	± 0,22
25	1 7/16-12 UN	20,5	$^{+0,33}_{0}$	26,87	± 0,1	33,5	3,7	± 0,5	17,5	15,5	23,52	± 0,24
30	1 11/16-12 UN	26	$^{+0,33}_{0}$	33,25	± 0,13	39,85	3,7	± 0,5	17,5	15,5	29,87	± 0,29
38	2-12 UN	32	$^{+0,39}_{0}$	41,17	± 0,13	47,8	3,7	± 0,5	17,5	15,5	37,82	± 0,36

1) In accordance with ISO 725 and ISO 5864:1993, class 2A, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.

Dimensions in millimetres, surface roughness in micrometres

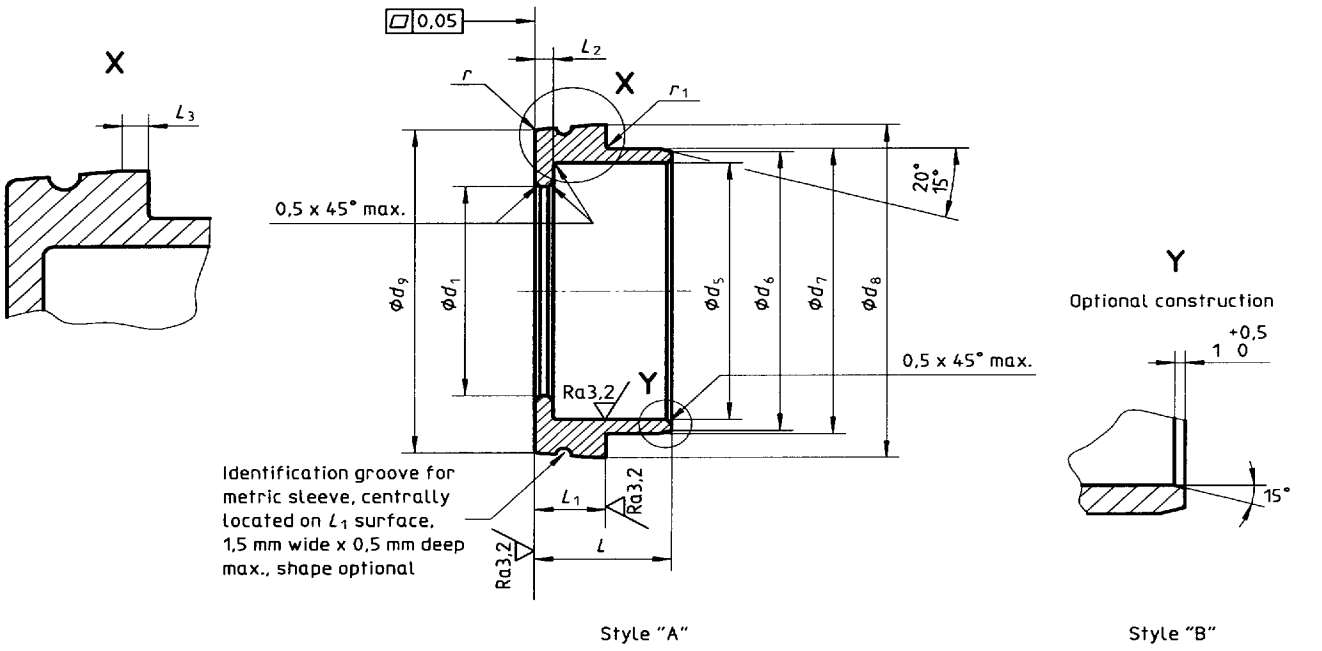


Figure 3 — Braze sleeve [BRSL-A (standard) and BRSL-B (option)]

Table 7 — Dimensions of sleeves for metric and inch tubing

Dimensions in millimetres

Metric tubing 1)		Inch tubing			d_1		d_6	d_7	d_8	d_9	L	L_1	L_2	L_3	r	r_1
Tube OD	d_5 2)	Tube OD		d_5 2)												
	± 0,05	inch	mm 3)	± 0,05	nom.	tol.	$^{0}_{-0,3}$	± 0,1	$^{0}_{-0,15}$	± 0,15	± 0,3	± 0,15	± 0,15	± 0,5	max.	$^{+0,15}_{0}$
6	6,15	1/4	6,35	6,5	5	$^{+0,18}_{0}$	9	10,2	12,75	—	9,5	4	1	—	0,25	0,15
8	8,15	5/16	7,94	8,09	5	$^{+0,22}_{0}$	9	10,2	12,75	—	9,5	4	1	—	0,25	0,15
10	10,15	3/8	9,52	9,68	6,5	$^{+0,22}_{0}$	11,8	13,25	15,75	—	9,5	4,5	1	—	0,25	0,15
12	12,15	1/2	12,7	12,85	9,5	$^{+0,22}_{0}$	15,1	16,3	18,9	—	9,5	5	1	—	0,25	0,15
16	16,15	5/8	15,88	16,03	12,5	$^{+0,27}_{0}$	19,2	20,75	23,45	22,6	10,5	6	1,5	1,3	0,25	0,25
20	20,18	3/4	19,05	19,23	15,5	$^{+0,27}_{0}$	22,1	23,75	27,85	27	14	6,5	1,5	1,3	0,4	0,25
25	25,18	1	25,4	25,58	20,5	$^{+0,33}_{0}$	26,9	28,7	34,2	33,35	15,5	7	1,5	1,3	0,4	0,4
30	30,2	1 1/4	31,75	31,95	26	$^{+0,33}_{0}$	34	35,6	40,55	39,7	15,5	7	1,5	1,3	0,4	0,4
38	38,2	1 1/2	38,1	38,3	32	$^{+0,39}_{0}$	42	43,55	48,5	47,65	15,5	7	1,5	1,3	0,4	0,4

1) Metric tubing shall be preferred.

2) Actual bore size and depth depend upon joining process. Dimensions given are for silver braze.

3) Equivalent dimensions in millimetres.

Dimensions in millimetres, surface roughness in micrometres

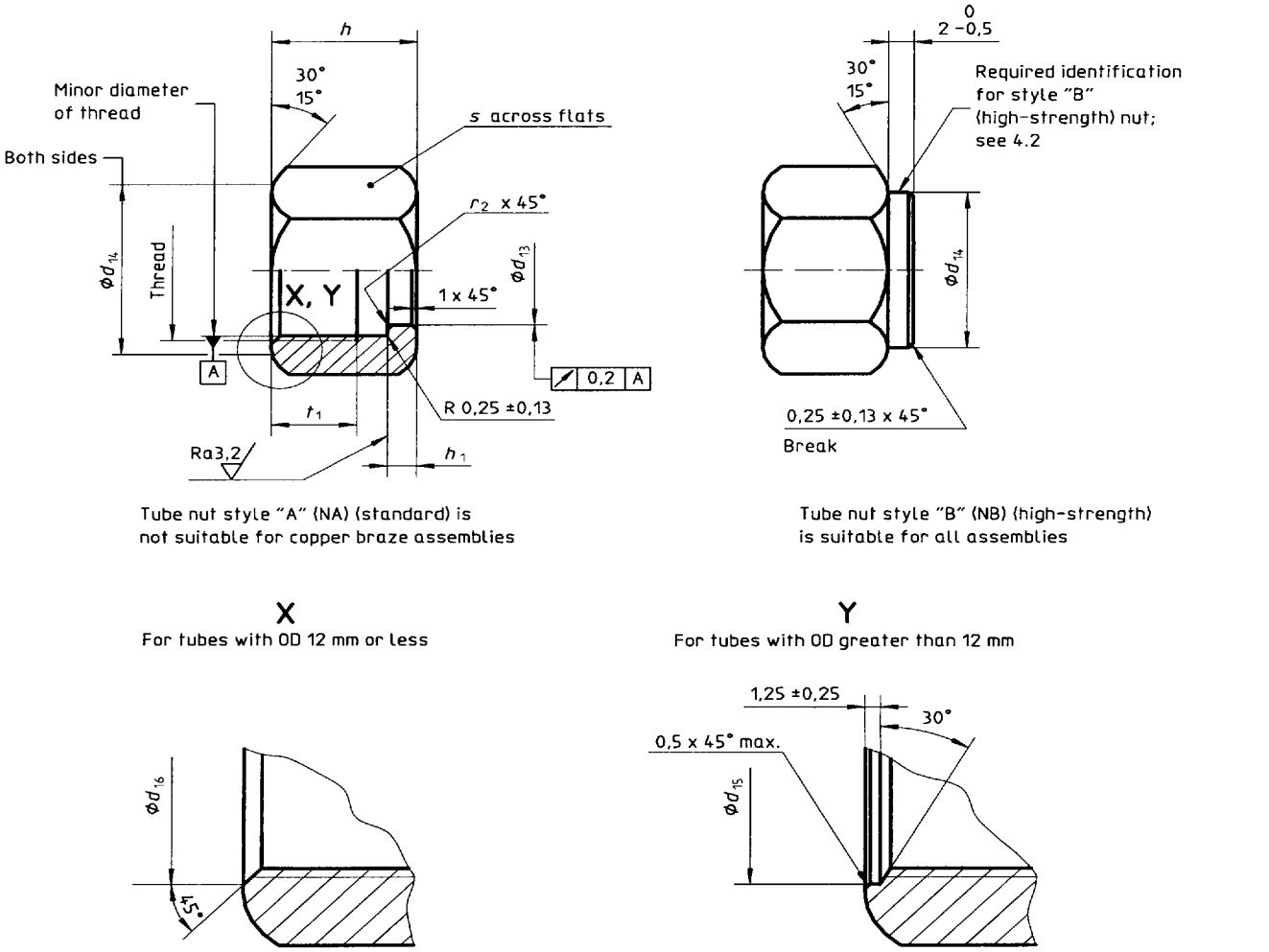


Figure 4 — Standard tube nut (NA) and high-strength tube nut (NB)

Table 8 — Dimensions of tube nuts

Dimensions in millimetres

Tube OD	Thread[1]	Thread minor diameter[2]		d_{13}	d_{14}	d_{15}	d_{16}	h	h_1	r_2	s [3]	t_1
		min.	max.	± 0,1	± 0,3	± 0,3	± 0,2	± 0,5	± 0,15	$^{0}_{-0,15}$		min.
6 and 8	9/16-18 UNF	12,9	13,1	10,5	16	—	14,7	15	3	0,15	17	8,5
10	11/16-16 UN	15,9	16,1	13,55	21	—	17,8	17	4	0,15	22	9,5
12	13/16-16 UN	19,1	19,3	16,6	23	—	21	20	5	0,15	24	11
16	1-14 UNS	23,6	23,8	21,1	29	26	—	24	5,5	0,25	30	13,5
20	1 3/16-12 UN	28,0	28,3	24,15	34,5	31	—	26,5	6,5	0,25	36	14,5
25	1 7/16-12 UN	34,4	34,7	29,1	39,5	37	—	27,5	7	0,4	41	14,5
30	1 11/16-12 UN	40,7	41,0	36	48,5	43,5	—	27,5	7	0,4	50	14,5
38	2-12 UN	48,7	49,0	44	58	51,5	—	27,5	7	0,4	60	14,5

1) In accordance with ISO 725 and ISO 5864:1993, class 2B, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.

2) Modified diameter, shifted to the high side of the tolerance band in ISO 5864.

3) In accordance with ISO 4759-1, tolerance class C.

Dimensions in millimetres, surface roughness in micrometres

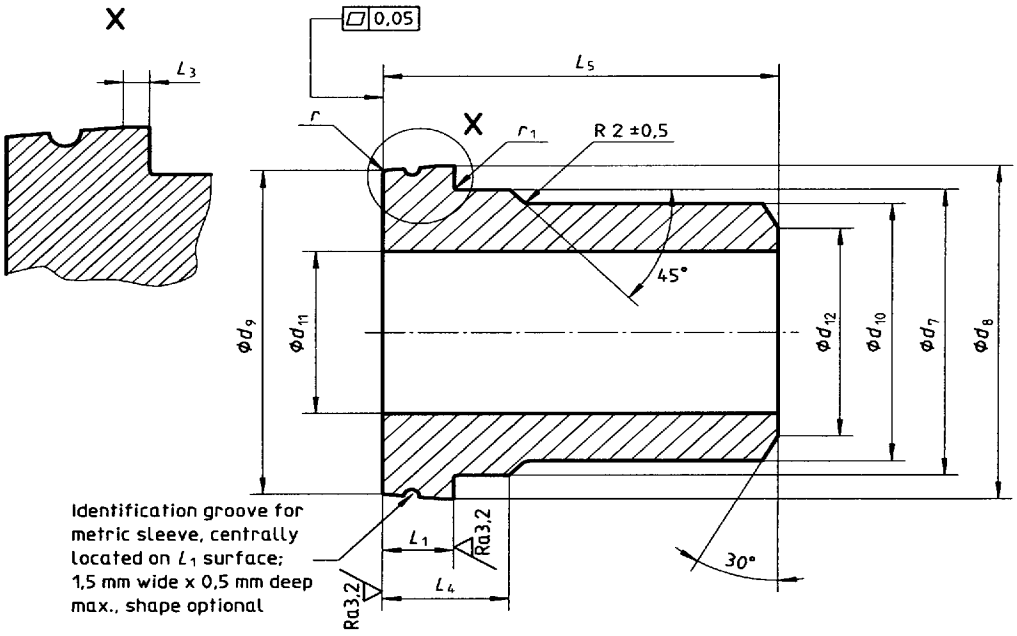


Figure 5 — Weld-on nipple (WDNP)

Table 9 — Dimensions of weld-on nipples for metric and inch tubing

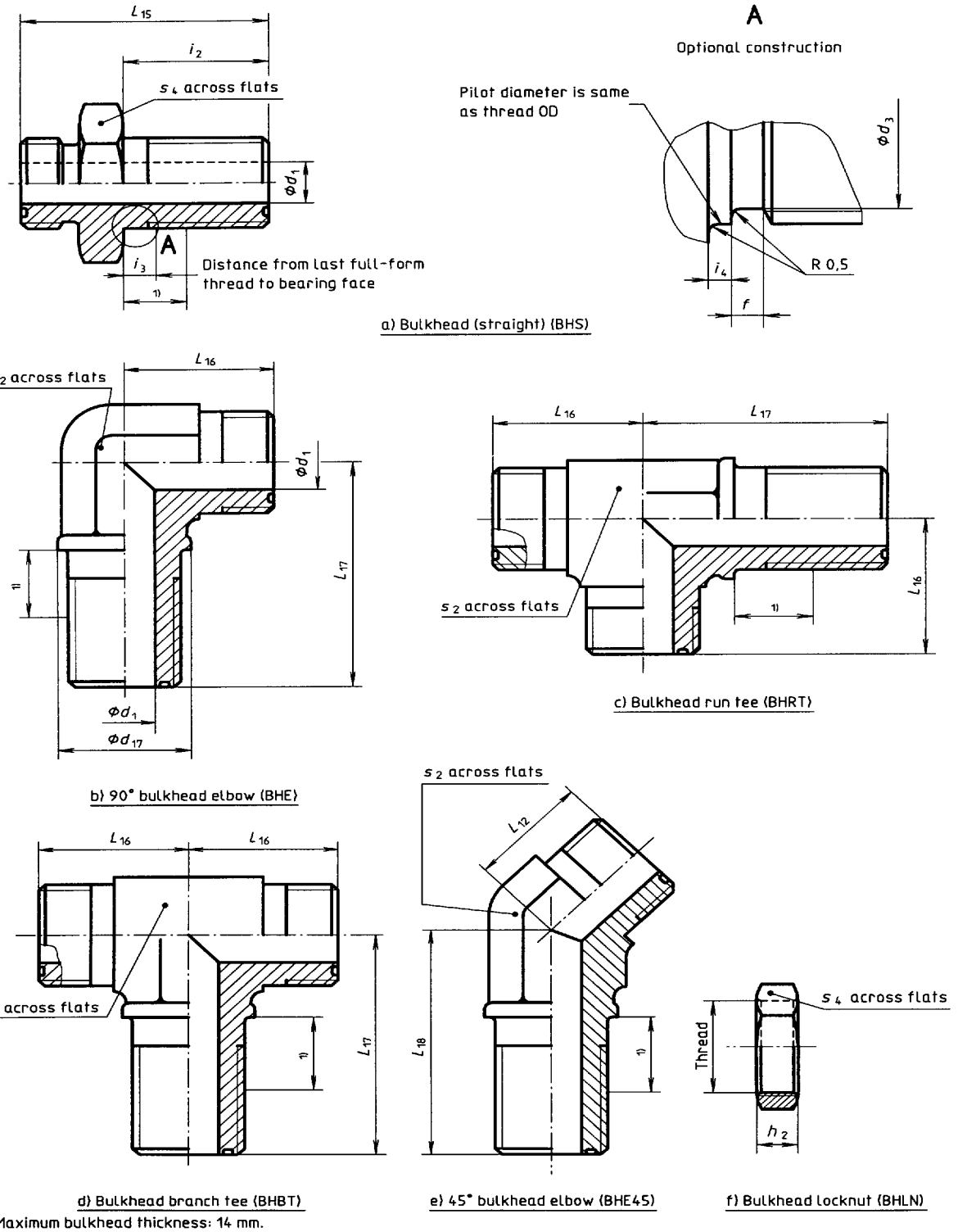
Dimensions in millimetres

Metric tubing[1] Tube OD	d_{10}	d_{11}		d_{12}	Inch tubing Tube OD		d_{10}	d_{11}		d_{12}	d_7	d_8	d_9	L_1	L_3	L_4	L_5	r	r_1
	± 0,1	nom.	tol.	± 0,3	inch	mm [2]	± 0,1	nom.	tol.	± 0,3	± 0,1	$^{0}_{-0,15}$	± 0,15	± 0,15	± 0,15	± 0,5	± 0,3	max.	$^{+0,15}_{0}$
6	6	2	$^{+0,14}_{0}$	4	1/4	6,35	6,4	2	$^{+0,14}_{0}$	4	10,2	12,75	—	4	—	6,5	25	0,25	0,15
8	8	3	$^{+0,14}_{0}$	5	5/16	7,94	7,9	3	$^{+0,14}_{0}$	5	10,2	12,75	—	4	—	6,5	25	0,25	0,15
10	10	4	$^{+0,18}_{0}$	6	3/8	9,52	9,5	4	$^{+0,18}_{0}$	6	13,25	15,75	—	4,5	—	7,5	26	0,25	0,15
12	12	5	$^{+0,18}_{0}$	7	1/2	12,7	12,7	5	$^{+0,18}_{0}$	7	16,3	18,9	—	5	—	9,5	26	0,25	0,15
16	16	10	$^{+0,22}_{0}$	12	5/8	15,88	15,9	10	$^{+0,22}_{0}$	12	20,75	23,45	22,6	6	1,3	10	32	0,25	0,25
20	20	13	$^{+0,27}_{0}$	15	3/4	19,05	19	11,5	$^{+0,27}_{0}$	13,5	23,75	27,85	27	6,5	1,3	11,5	37	0,4	0,25
25	25	16	$^{+0,27}_{0}$	18	1	25,4	25,4	16	$^{+0,27}_{0}$	18	28,7	34,2	33,35	7	1,3	13	42	0,4	0,4
30	30	22	$^{+0,33}_{0}$	24	1 1/4	31,75	31,8	22,2	$^{+0,33}_{0}$	24	35,6	40,55	39,7	7	1,3	13	44	0,4	0,4
38	38	28	$^{+0,33}_{0}$	30	1 1/2	38,1	38,1	27	$^{+0,33}_{0}$	29	43,55	48,5	47,65	7	1,3	13	49	0,4	0,4

1) Metric tubing shall be preferred.

2) Equivalent dimension in millimetres.

Dimensions in millimetres



a) Bulkhead (straight) (BHS)

b) 90° bulkhead elbow (BHE)

c) Bulkhead run tee (BHRT)

d) Bulkhead branch tee (BHBT)

e) 45° bulkhead elbow (BHE45)

f) Bulkhead locknut (BHLN)

NOTE — For details not shown here, see figure 2 and table 6.

Figure 6 — Bulkhead fittings and corresponding bulkhead locknuts

Table 10 — Dimensions of bulkhead fittings and corresponding bulkhead locknuts

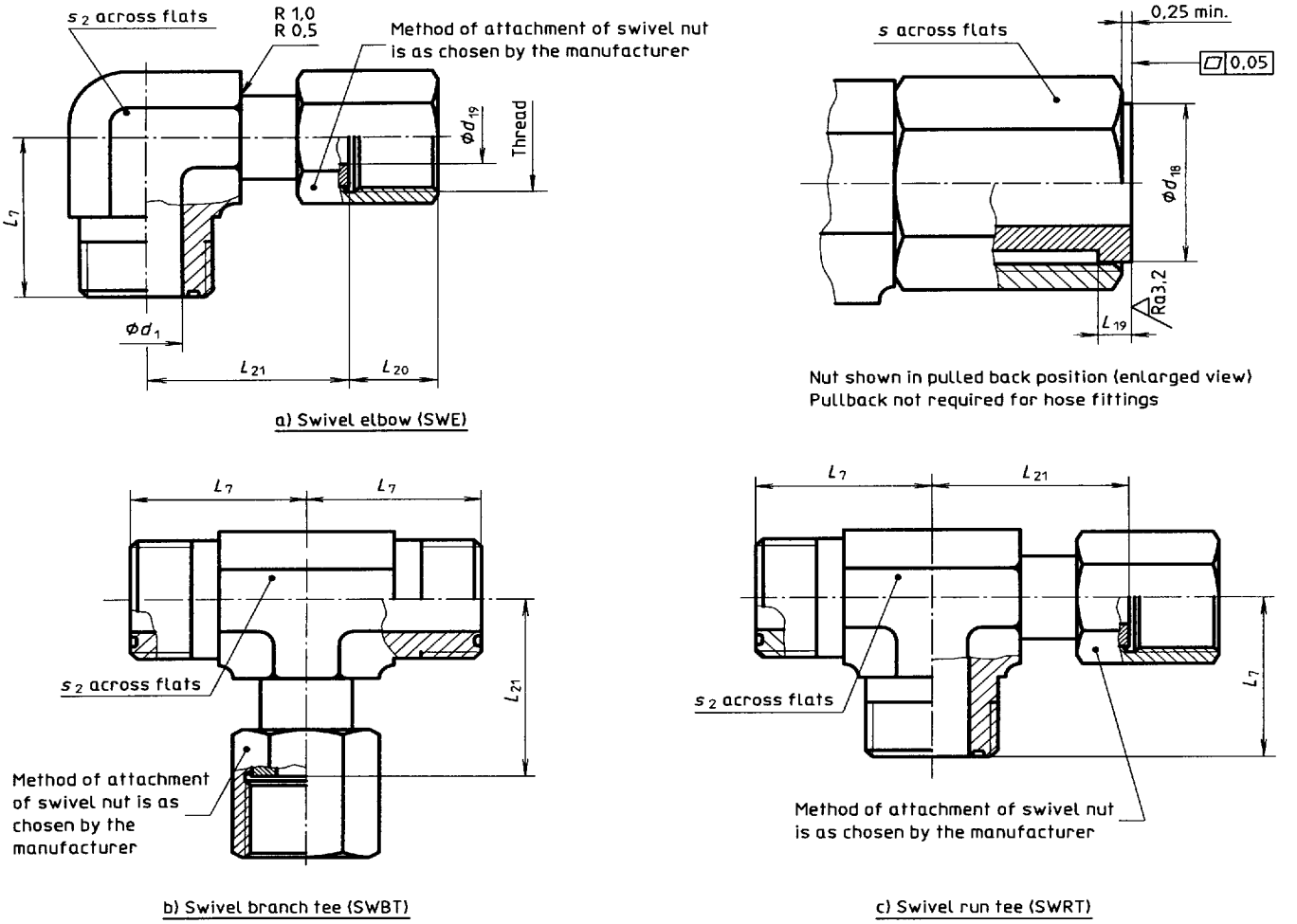
Dimensions in millimetres

Tube OD[1]	Thread[2]	d_1 nom.	d_1 tol.	d_3 ± 0,15	d_{17} min.	f nom.	f tol.	h_2 ± 0,8	i_2 ± 0,8	i_3 max.	i_4 ± 0,5	L_{12} ± 1	L_{15} ± 0,8	L_{16} ± 1	L_{17} ± 1	L_{18} ± 1	s_2 Forged fitting min.	s_2 Fitting machined from barstock max.	s_4
6 and 8	9/16-18 UNF	5	+0,18 0	12,15	17	2,4	± 0,3	7	31,5	3	1,5	16	48	22,5	47	44	14	17	22
10	11/16-16 UN	6,5	+0,22 0	15,1	22	2,8	± 0,4	8	34	3	1,5	19	53	26	52	48,5	17	27	27
12	13/16-16 UN	9,5	+0,22 0	18,25	25,5	2,8	± 0,4	9	36,5	3	2,5	20,5	58,5	29	55,5	51	19	30	30
16	1-14 UNS	12,5	+0,27 0	22,75	30	3,1	± 0,4	10,5	40,5	4	2,5	23,5	66,5	34,5	63	56,5	24	36	36
20	1 3/16-12 UN	15,5	+0,27 0	27,15	35	3,7	± 0,5	10,5	41,5	4	3	26	69	38,5	67	60,5	27	41	41
25	1 7/16-12 UN	20,5	+0,33 0	33,5	41,5	3,7	± 0,5	10,5	42	4	3	30	70	42,5	71	65	36	46	46
30	1 11/16-12 UN	26	+0,33 0	39,85	47,5	3,7	± 0,5	10,5	42	4	3	32	70	45,5	75,5	67	41	55	50
38	2-12 UN	32	+0,39 0	47,8	55,5	3,7	± 0,5	10,5	42	4	3	37	70	49,5	79,5	67	50	60	60

1) See table 1 for corresponding inch tube sizes.

2) In accordance with ISO 725 and ISO 5864:1993, class 2B, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.

Dimensions in millimetres, surface roughness in micrometres



NOTE — For details not shown here, see figure 2 and table 6.

Figure 7 — Swivel fittings

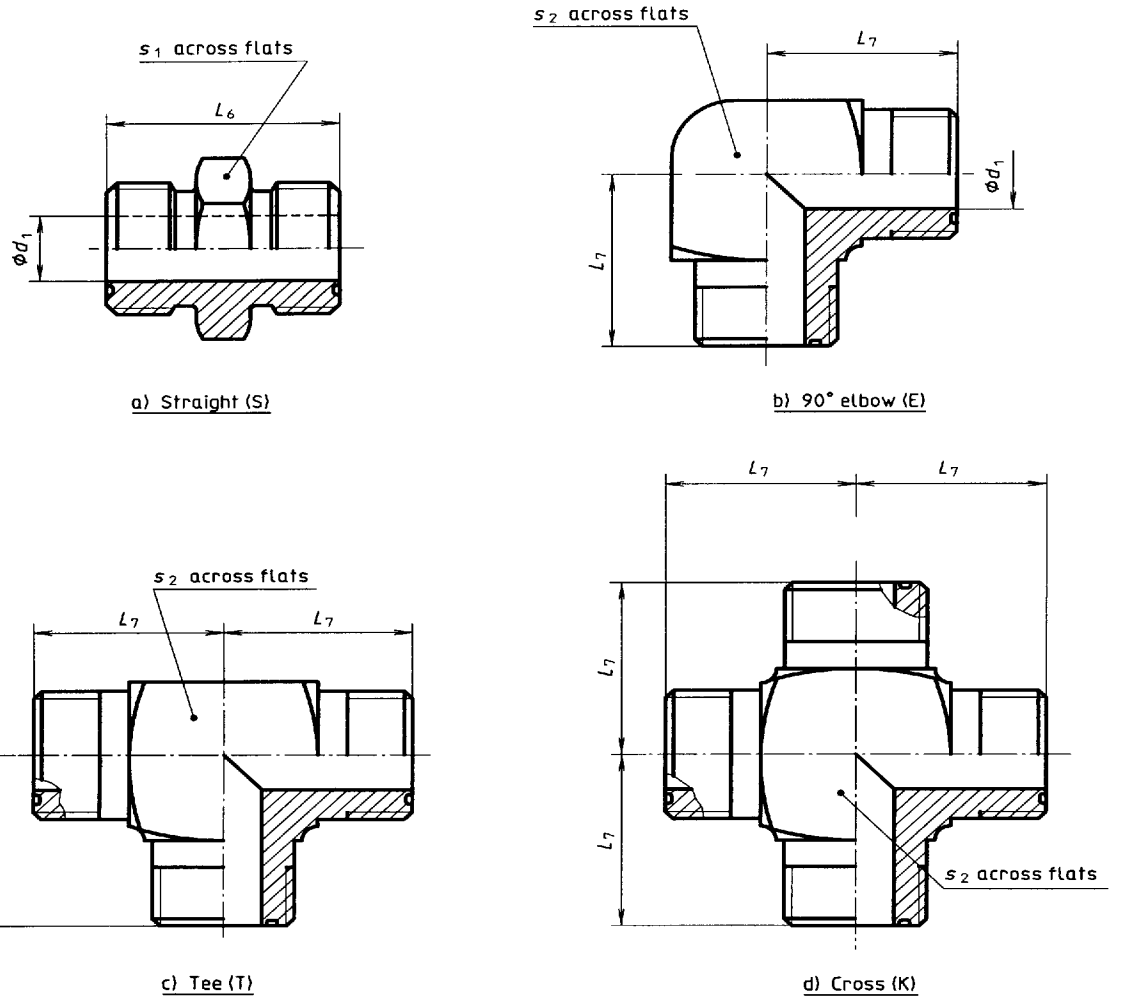
Table 11 — Dimensions of swivel fittings

Dimensions in millimetres

Tube OD[1]	Thread[2]	d_1		d_{18}	d_{19}		L_7	L_{19}	L_{20}	L_{21}	r	s	s_2	
				Minimum seal diameter									Forged fitting	Fitting machined from barstock
		nom.	tol.		nom.	tol	± 1	min.	± 1	± 1,5	max.		min.	max.
6 and 8	9/16-18 UNF	5	$^{+0,18}_{0}$	12,6	4	$^{+0,18}_{0}$	21,5	3,8	8	26,5	0,25	17	14	19
10	11/16-16 UN	6,5	$^{+0,22}_{0}$	15,6	6,5	$^{+0,22}_{0}$	25	4,3	9,5	29	0,25	22	17	27
12	13/16-16 UN	9,5	$^{+0,22}_{0}$	18,75	9	$^{+0,22}_{0}$	28	4,8	11	38	0,25	24	19	30
16	1-14 UNS	12,5	$^{+0,27}_{0}$	22,45	11,5	$^{+0,27}_{0}$	33,5	5,8	13,5	41	0,25	30	24	36
20	1 3/16-12 UN	15,5	$^{+0,27}_{0}$	26,85	14	$^{+0,27}_{0}$	37,5	6,3	14,5	46,5	0,4	36	27	41
25	1 7/16-12 UN	20,5	$^{+0,33}_{0}$	33,2	20	$^{+0,33}_{0}$	41,5	6,8	14,5	53,5	0,4	41	36	50
30	1 11/16-12 UN	26	$^{+0,33}_{0}$	39,55	26	$^{+0,33}_{0}$	44,5	6,8	14,5	58	0,4	50	41	60
38	2-12 UN	32	$^{+0,39}_{0}$	47,5	32	$^{+0,39}_{0}$	49	6,8	14,5	61	0,4	60	50	65

1) See table 1 for corresponding inch tube sizes.

2) In accordance with ISO 725 and ISO 5864:1993, class 2A and 2B, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.



NOTE — For details not shown here, see figure 2 and table 6.

Figure 8 — Straight (S), 90° elbow (E), tee (T) and cross (K) fittings

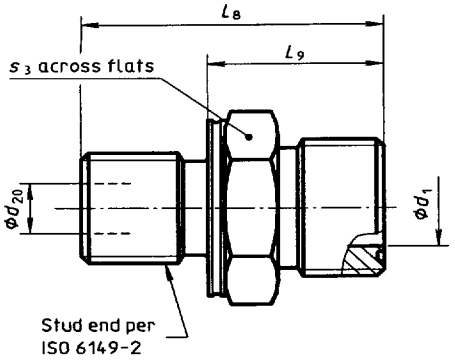
Table 12 — Dimensions of straight, 90° elbow, tee and cross fittings

Dimensions in millimetres

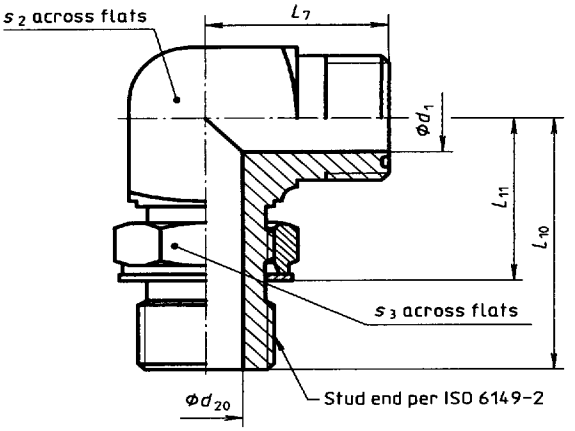
Tube OD[1]	Thread[2]	d_1		L_6	L_7	s_1	s_2	
		nom.	tol.	± 0,8	± 1		Forged fitting min.	Fitting machined from barstock max.
6 and 8	9/16-18 UNF	5	$^{+0,18}_{0}$	27,5	21,5	17	14	17
10	11/16-16 UN	6,5	$^{+0,22}_{0}$	31	25	19	17	27
12	13/16-16 UN	9,5	$^{+0,22}_{0}$	35,5	28	22	19	30
16	1-14 UNS	12,5	$^{+0,27}_{0}$	42,5	33,5	27	24	36
20	1 3/16-12 UN	15,5	$^{+0,27}_{0}$	47	37,5	32	27	41
25	1 7/16-12 UN	20,5	$^{+0,33}_{0}$	49,5	41,5	41	36	46
30	1 11/16-12 UN	26	$^{+0,33}_{0}$	51,5	44,5	46	41	55
38	2-12 UN	32	$^{+0,39}_{0}$	53	49	55	50	60

1) See table 1 for corresponding inch tube sizes.

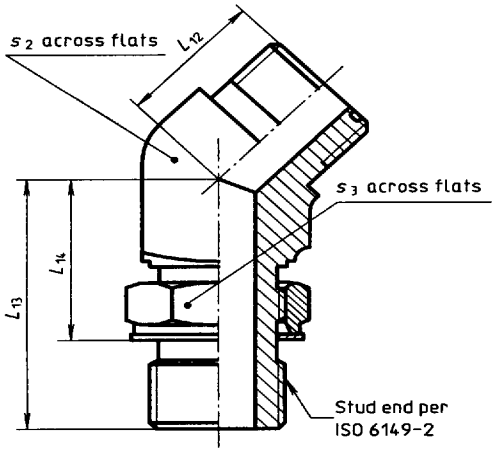
2) In accordance with ISO 725 and ISO 5864:1993, class 2A, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.



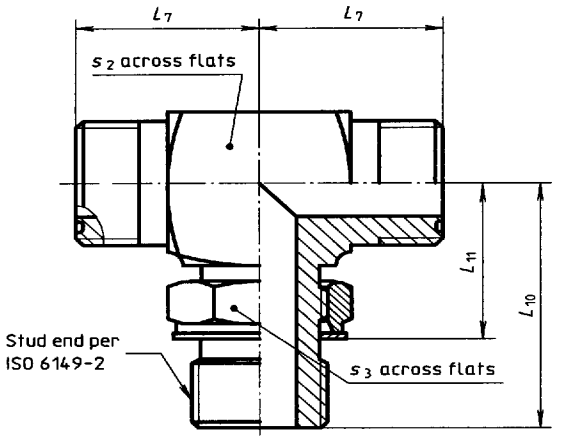
a) Stud (straight) (SDS)



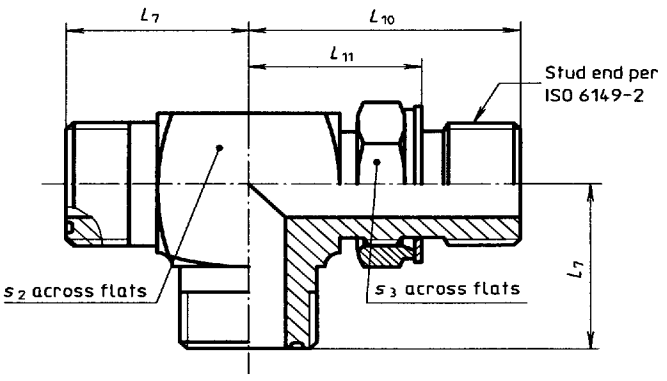
b) 90° adjustable stud elbow (SDE)



c) 45° adjustable stud elbow (SDE45)



d) Adjustable stud branch tee (SDBT)



e) Adjustable stud run tee (SDRT)

NOTE — For details not shown here, see figure 2 and table 6.

Figure 9 — Stud fittings with ISO 6149-2 stud ends

Table 13 — Dimensions of stud fittings with ISO 6149-2 stud ends

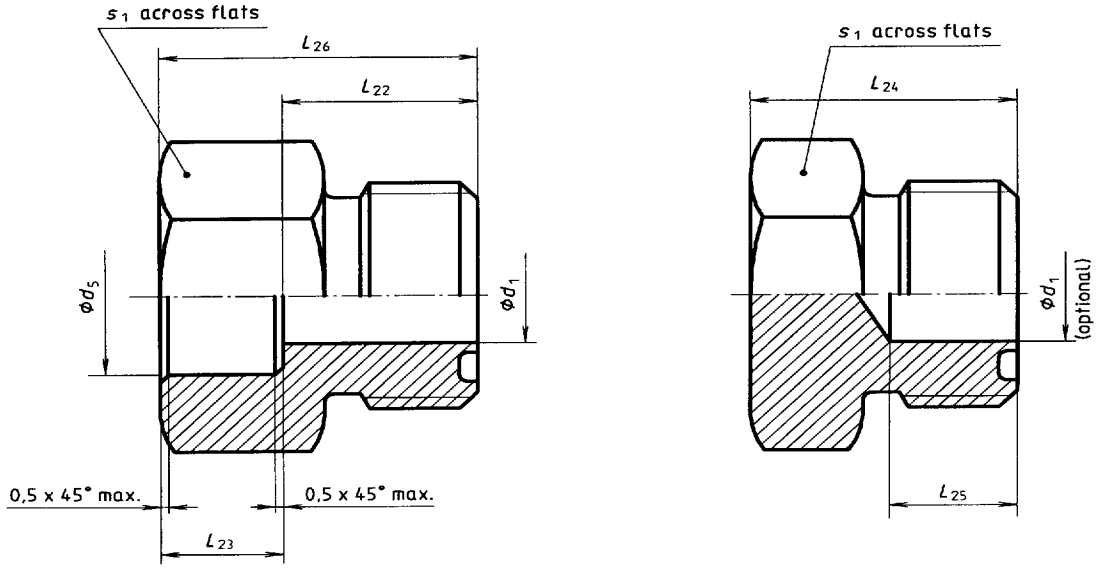
Dimensions in millimetres

Tube OD[1)]	Thread[2)]	ISO 6149-2 stud end thread	d_1		d_{20}		L_7	L_8	L_9	L_{10}	L_{11}	L_{12}	L_{13}	L_{14}	s_2		s_3
															Forged fitting	Fitting machined from barstock	
			nom.	tol.	nom.	tol.	± 1	± 0,5	ref.	± 1	ref.	± 1	± 1	ref.	min.	max.	
6	9/16-18 UNF	M12 × 1,5	5	$^{+0,18}_{0}$	4	$^{+0,18}_{0}$	21,5	28,5	17,5	33	22	16	30	19	14	17	17
8	9/16-18 UNF	M14 × 1,5	5	$^{+0,18}_{0}$	6	$^{+0,18}_{0}$	24	29,5	18,5	35,5	24,5	18	31,5	20,5	17	17	19
10	11/16-16 UN	M16 × 1,5	6,5	$^{+0,22}_{0}$	7	$^{+0,22}_{0}$	25	33,5	21	37,5	25	19	33,5	21	17	27	22
12	13/16-16 UN	M18 × 1,5	9,5	$^{+0,22}_{0}$	9	$^{+0,22}_{0}$	28	38	24	41	27	20,5	37	23	19	30	24
16	1-14 UNS	M22 × 1,5	12,5	$^{+0,27}_{0}$	12	$^{+0,27}_{0}$	33,5	42	27	49	34	23,5	44	29	24	36	27
20	1 3/16-12 UN	M27 × 2	15,5	$^{+0,27}_{0}$	15	$^{+0,27}_{0}$	37,5	48,5	30	55,5	37	26	50,5	32	27	41	32
25	1 7/16-12 UN	M33 × 2	20,5	$^{+0,33}_{0}$	20	$^{+0,33}_{0}$	41,5	52	33,5	59,5	41	30	52,5	34	36	46	41
30	1 11/16-12 UN	M42 × 2	26	$^{+0,33}_{0}$	26	$^{+0,33}_{0}$	44,5	54,5	35,5	63	44	32	54	35	41	55	50
38	2-12 UN	M48 × 2	32	$^{+0,39}_{0}$	32	$^{+0,39}_{0}$	49	57	35,5	71,5	50	37	56,5	35	50	60	55

1) See table 1 for corresponding inch tube sizes.

2) In accordance with ISO 725 and ISO 5864:1993, class 2A, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.

Dimensions in millimetres



a) Braze straight (BRS)

b) Plug (PL)

NOTE — For details not shown here, see figure 2 and table 6.

Figure 10 — Braze straight (BRS) and plug (PL)

Table 14 — Dimensions of braze straight connectors and plugs

Dimensions in millimetres

Tube OD[1]	Thread[2]	d_1		d_5 [3]	L_{22} [4]	L_{23} [3]	L_{24}	L_{25}	L_{26}	s_1
		nom.	tol.	± 0,05	± 0,8	± 0,5	± 0,8	max.	ref.	
6	9/16-18 UNF	5	$^{+0,18}_{0}$	6,15	13,5	8,5	16,5	7,1	22	17
8	9/16-18 UNF	5	$^{+0,18}_{0}$	8,15	13,5	8,5	16,5	7,1	22	17
10	11/16-16 UN	6,5	$^{+0,22}_{0}$	10,15	14,5	8,5	19	8,2	23	19
12	13/16-16 UN	9,5	$^{+0,22}_{0}$	12,15	16	8,5	22	9,8	24,5	22
16	1-14 UNS	12,5	$^{+0,27}_{0}$	16,15	19	8,5	26	12,2	27,5	27
20	1 3/16-12 UN	15,5	$^{+0,27}_{0}$	20,18	21	12,5	27,5	13,2	33,5	32
25	1 7/16-12 UN	20,5	$^{+0,33}_{0}$	25,18	24,5	14	28	13,7	38,5	41
30	1 11/16-12 UN	26	$^{+0,33}_{0}$	30,2	24,5	14	28	13,7	38,5	46
38	2-12 UN	32	$^{+0,39}_{0}$	38,2	24,5	14	28	13,7	38,5	55

1) See table 1 for corresponding inch tube sizes and d_5 dimensions.

2) In accordance with ISO 725 and ISO 5864:1993, class 2B, except for 1-14 UNS. See annex A for 1-14 UNS thread dimensions.

3) Dimensions given are for silver brazing. Other dimensions may apply for other joining methods.

4) Dimension L_{22} remains constant for jump size fittings.

Annex A
(normative)

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

This annex provides the dimensions for the 1-14 UNS inch screw thread, which is not included in ISO 725. Table A.1 gives dimensions for external threads and table A.2 for internal threads.

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

Thread		Allowance	Major diameter		Pitch diameter		Minor diameter
			max. [1]	min.	max. [1]	min.	max.
Class 2A							
1-14 UNS	inch	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	inch	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

1) 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)

O-ring face seal fitting test data form

Manufacturer ..... Test facility .....

Stud end type ..... Thread .....

Minimum material tensile strength ..... MPa

Working pressure (per table 1) ..... MPa (..... bar)

Impulse pressure (133 % × working pressure) ..... MPa (..... bar)

Impulse cycle rate ..... Hz (Impulse cycle goal is 1 million cycles)

Burst pressure (4 × working pressure) ..... MPa (..... bar)

Qualification test assembly torque (per table 4) ..... N·m

Test results

Cyclic endurance test results: min. number of samples tested = 6

Sample No.	Cycles at failure	Type of failure
1	.....	.....
2	.....	.....
3	.....	.....
4	.....	.....
5	.....	.....
6	.....	.....

Burst test results: min. number of samples tested = 3

Sample No.	Nut hardness	Pressure at failure	Type of failure
1	..... HRB/C	..... MPa	.....
2	..... HRB/C	..... MPa	.....
3	..... HRB/C	..... MPa	.....

Overtorque test results: min. number of samples tested = 6

Nut type	Nut hardness	Torque at failure	Type of failure
1	..... HRB/C	..... N·m	.....
2	..... HRB/C	..... N·m	.....
3	..... HRB/C	..... N·m	.....
4	..... HRB/C	..... N·m	.....
5	..... HRB/C	..... N·m	.....
6	..... HRB/C	..... N·m	.....

Vacuum test results: min. number of samples tested = 4

Sample No.	Temperature	Test pressure	Type of failure
1	..... °C	..... kPa absol.	.....
2	..... °C	..... kPa absol.	.....
3	..... °C	..... kPa absol.	.....
4	..... °C	..... kPa absol.	.....

Conclusions: .....

Dimensions (list any exception): .....

Name (printed/typed) and signature of person certifying report: .....

Date: .....

Annex C
(informative)

O-ring face seal tube connections with metric or inch tubing using different sleeves

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

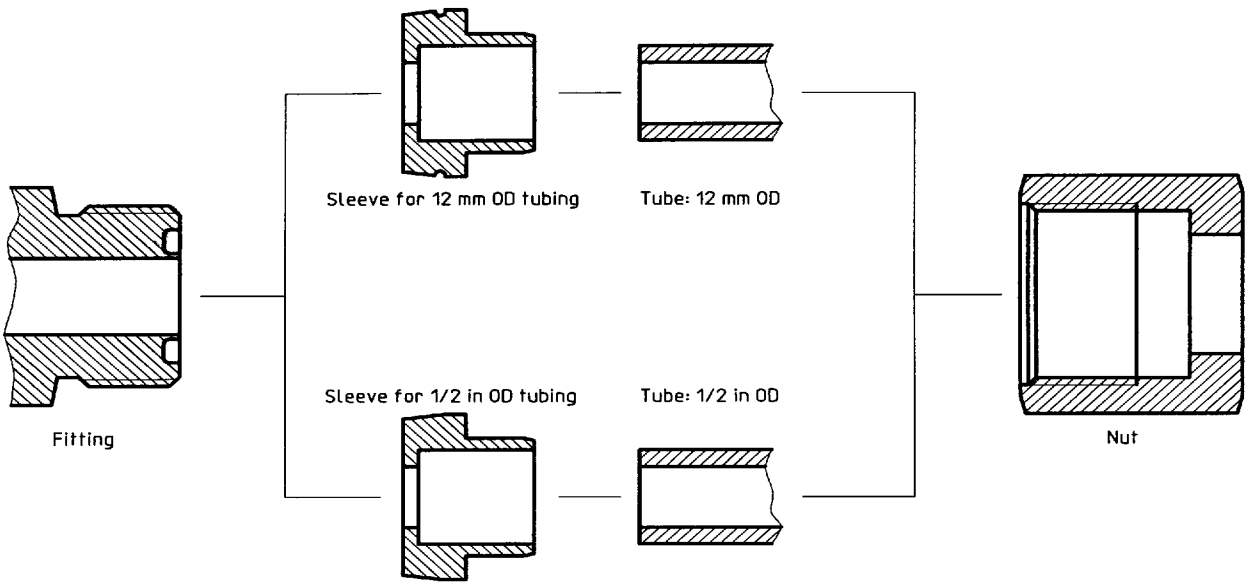


Figure C.1 — O-ring face seal fittings with metric or inch tubing using different sleeves

Annex D
(informative)

Typical connections with O-ring face seal fitting

Figure D.1 shows typical connections with O-ring face seal fittings.

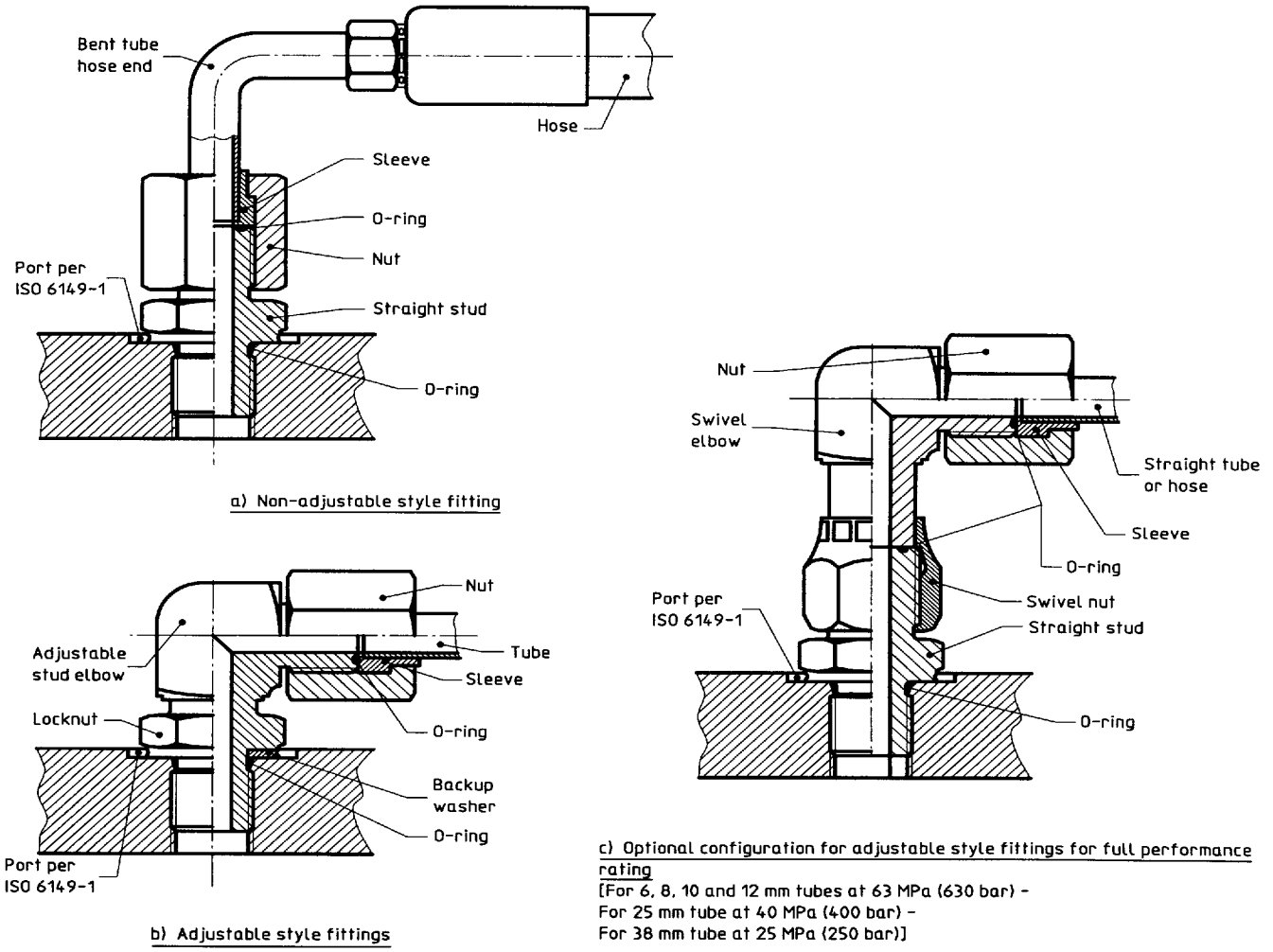


Figure D.1 — Typical connections with O-ring face seal fittings

ICS 23.100.30

Descriptors: hydraulic fluid power, pneumatic fluid power, fluid circuits, pipes (tubes), metal tubes, hoses, pipe joints, pipe fittings, O-ring unions, specifications, materials specifications, manufacturing requirements, dimensions, tests, performance tests, designation, marking.

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