

Metallic tube connections for fluid power and general use —

Part 1: 24° compression fittings

The European Standard EN ISO 8434-1:1996 has the status of a British Standard

ICS 23.100.30

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee MCE/18, Fluid power systems and components, upon which the following bodies were represented:

Association of British Mining Equipment Companies
 British Compressed Air Society
 British Fluid Power Association
 British Hydromechanics Research Association
 British Steel Industry
 Department of Trade and Industry (National Engineering Laboratory)
 Ministry of Defence
 University of Bath

The following bodies were also represented in the drafting of the standard through subcommittees and panels.

British Iron and Steel Producers' Association
 Engineering Equipment and Materials Users' Association

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 September 1995

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The following BSI references relate to the work on this standard:
 Committee reference MCE/18
 Draft for comment 89/76134 DC

Amendments issued since publication

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9583	February 1998	Indicated by a sideline in the margin

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National foreword

This British Standard has been prepared by Technical Committee MCE/18 and is the English language version of EN ISO 8434-1:1997 *Metallic tube connections for fluid power and general use — Part 1: 24° compression fittings* published by the European Committee for Standardization (CEN). It is identical with ISO 8434-1:1994 published by the International Organization for Standardization (ISO).

The UK participation in its preparation was entrusted to Technical Committee MCE/18 which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international committee any enquiries on interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

In 1997 the European Committee for Standardization (CEN) accepted ISO 8434-1:1994 as European Standard EN ISO 8434-1:1997. As a consequence of implementing the European Standard this British Standard is renumbered as BS EN ISO 8434-1:1998 and any reference to BS ISO 8434-1:1994 should be read as a reference to BS EN ISO 8434-1:1998.

NOTE International and European Standards, as well as overseas standards, are available from Customer Services, BSI, 389 Chiswick High Road, London W4 4AL.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN ISO title page, page 2, the ISO title page, pages ii to iv, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

ICS 23.100.30

Descriptors: See ISO document

English version

**Metallic tube connections for fluid power and general use —
Part 1: 24° compression fittings**

(ISO 8434-1:1994)

Raccords de tubes métalliques pour
transmissions hydrauliques et pneumatiques et
applications générales —
Partie 1: Raccords à compression à 24°
(ISO 8434-1:1994)

Metallische Rohrverschraubungen für
Fluidtechnik und allgemeine Anwendung —
Teil 1: 24° Schneidringverschraubung
(ISO 8434-1:1994)

This European Standard was approved by CEN on 16 February 1996.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

The text of the International Standard from Technical Committee ISO/TC 131, Fluid power systems, of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee ECISS/TC 29, Steel tubes and fittings for steel tubes, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1998, and conflicting national standards shall be withdrawn at the latest by April 1998.

According to CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 8434-1:1994 has been approved by CEN as a European Standard without any modification.

NOTE Normative references to International Standards are listed in Annex ZA (normative).

INTERNATIONAL
STANDARD

ISO
8434-1

First edition
1994-05-15

**Metallic tube connections for fluid power
and general use —**

Part 1:
24° compression fittings

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

Partie 1: Raccords à compression à 24°



Reference number
ISO 8434-1:1994(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.

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 8434-1 was prepared jointly by Technical Committees ISO/TC 5, *Ferrous metal pipes and metallic fittings* and ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This first edition, together with ISO 8432-2, cancels and replaces ISO 8434:1986, 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 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 connectors.

Annex A forms an integral part of this part of ISO 8434. Annex A is 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), tubes and hoses. Tubes are rigid conductors; hoses are flexible conductors.

1 Scope

This part of ISO 8434 specifies general and dimensional requirements for the design and performance of 24° compression fittings which are suitable for use with ferrous and non-ferrous tubes with outside diameters from 4 mm to 42 mm, inclusive. These fittings are for use in fluid power and general applications within the limits of pressure and temperature specified in this part of ISO 8434.

They are intended for the connection of plain end tubes and hose fittings to ports in accordance with ISO 6149-1, ISO 1179-1 and ISO 9974-1.

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

NOTE 2 For use under conditions outside the, pressure and/or temperature limits specified, see 5.4.

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 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 261:—, *ISO general-purpose metric screw threads — General plan*¹⁾.

ISO 274:1975, *Copper tubes of circular section — Dimensions.*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

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

ISO 1179-1:—, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*²⁾.

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

ISO 1179-3:—, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 3: Light-duty (L series) stud ends with seating by O-ring with retaining ring (types G and H)*²⁾.

ISO 1179-4:—, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 4: Stud ends for general use only with metal-to-metal sealing (type B)*²⁾.

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 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 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 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.*

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

ISO 9974-1:—, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*²⁾.

¹⁾ To be published. (Revision of ISO 261:1973)

²⁾ To be published.

ISO 9974-2:—, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 2: Stud ends with elastomeric sealing (type E)*³⁾.

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

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

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 face-to-face dimension

distance between the two parallel faces of axially aligned outlets of a fitting

3.8 face-to-centre dimension

distance from the face of an outlet to the central axis of an angularly disposed outlet

3.9 assembly torque

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

3.10 working pressure

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

[ISO 5598]

4 Requirements for materials

Figure 1 shows the cross-section and component parts of a typical 24° compression fitting.

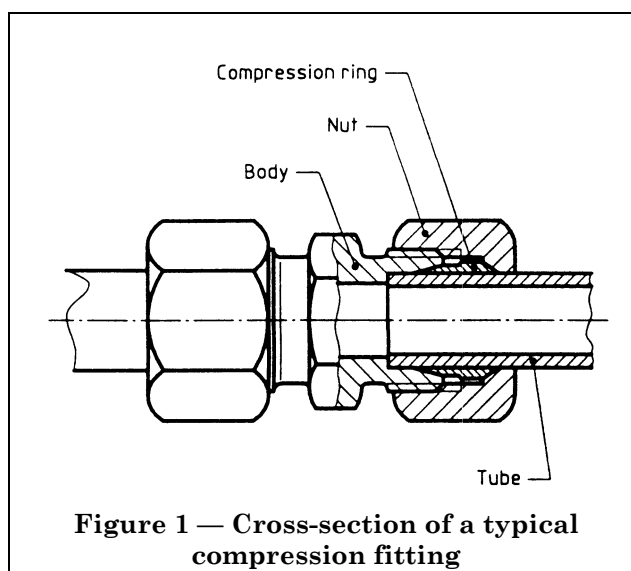


Figure 1 — Cross-section of a typical compression fitting

4.1 Fitting bodies

Bodies shall be manufactured from carbon steel, stainless steels or copper alloys which will provide the minimum requirements for the pressure/temperature ratings specified in clause 5. They shall have characteristics which make them suitable for use with the fluid to be conveyed and to provide an effective joint. Weld fitting types shall be made of materials classified as suitable for welding.

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. Nuts to be used with copper alloy bodies shall be made of a material similar to the bodies.

³⁾ To be published.

4.3 Compression rings

The material of compression rings shall be similar to that of the body and shall be selected by the manufacturer to suit the design and method of manufacture, unless otherwise specified. The ring material shall be compatible with the fluid to be conveyed and provide an effective joint.

5 Pressure/temperature requirements

5.1 Fittings made of carbon steel complying with this part of ISO 8434 shall be suitable for use at the working pressures given in Table 1 when used at fluid temperatures between – 20 °C and + 120 °C.

5.2 Fittings made of stainless steel complying with this part of ISO 8434 shall be suitable for use at the working pressures given in Table 1 when used at temperatures between – 60 °C and + 200 °C. See Table 2 for pressure deratings of fittings made from stainless steel and used at temperatures of + 50 °C and higher.

5.3 Copper alloy fittings shall be suitable for use at the working pressures given in Table 1 when used at temperatures between – 40 °C and + 175 °C.

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

5.5 According to different applications and different pressure ratings, there are three series of fittings. The series are referred to as

LL: extra-light duty

L: light duty

S: heavy duty

Ranges of the tube outside diameters and pressure requirements are shown in Table 1.

5.6 The fitting assembly shall not leak or fail when hydrostatically tested at four times the applicable recommended working pressure specified in Table 1. Testing shall be conducted at room temperature.

5.7 The pressure/temperature requirements given in Table 1 and in 5.1 to 5.6 are for tube and hose connections and fitting bodies only. For port and stud end pressure/temperature requirements, the values specified in the respective port and stud end standards and in Annex A of this part of ISO 8434 shall apply.

Table 1 — Working pressure ratings for 24° compression fittings

Series	Tube outside diameter mm	Working pressure			
		Carbon and stainless steel		Copper alloy	
		MPa	(bar ^a)	MPa	(bar)
LL	4 to 8 incl.	10	(100)	6,3	(63)
L	6 to 15 incl.	25	(250)	16	(160)
	18 to 22 incl. 28 to 42 incl.	16 10	(160) (100)	10 6,3	(100) (63)
S	6 to 12 incl.	63	(630)	40	(400)
	16 to 25 incl.	40	(400)	25	(250)
	30 to 38 incl.	25	(250)	16	(160)

NOTE For higher pressure ratings and for dynamic conditions, the manufacturer shall be consulted.

^a 1 bar = 10⁵ N/m² = 10⁵ Pa = 0,1 MPa

Table 2 — Pressure deratings for fittings made from stainless steel and used at temperatures outside the range given in 5.2

Working pressure for temperature range					
– 35 °C to + 50 °C		+ 100 °C		+ 200 °C	
MPa	(bar)	MPa	(bar)	MPa	(bar)
63	(630)	56,1	(561)	50,4	(504)
40	(400)	35,6	(356)	32	(320)
31,5	(315)	28	(280)	25	(250)
25	(250)	22,3	(223)	20	(200)
16	(160)	14,2	(142)	12,8	(128)
10	(100)	8,9	(89)	8	(80)

NOTE Intermediate values may be interpolated.

6 Designation of fittings

6.1 Fittings shall be designated by an alphanumeric code to facilitate ordering. They shall be designated by ISO 8434-1, 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, preceded by a series letter (see 5.5). For stud ends (connector ends), a multiplication sign followed by the thread designation of the stud end and the sealing type shall be added.

EXAMPLE

A fitting with a heavy-duty stud connection end with a G 3/8 A thread in accordance with ISO 1179-4 to be connected to a 12 mm OD tube is designated as follows:

ISO 8434-1 - SDS - S12 × G 3/8 A, type B

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 an other type of end is involved, it shall be designated.

6.4 Reducing fittings (Figure 2) and reducing elbows (Figure 3) shall be designated by specifying the larger tube end first.

6.5 Stud fittings (Figure 4) shall be designated by specifying the tube end first, then the thread size for the stud end.

6.6 For tee fittings (Figure 5 and Figure 6), 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 If the fitting has a tube union connection, it shall be designated first, then the designation shall proceed clockwise.

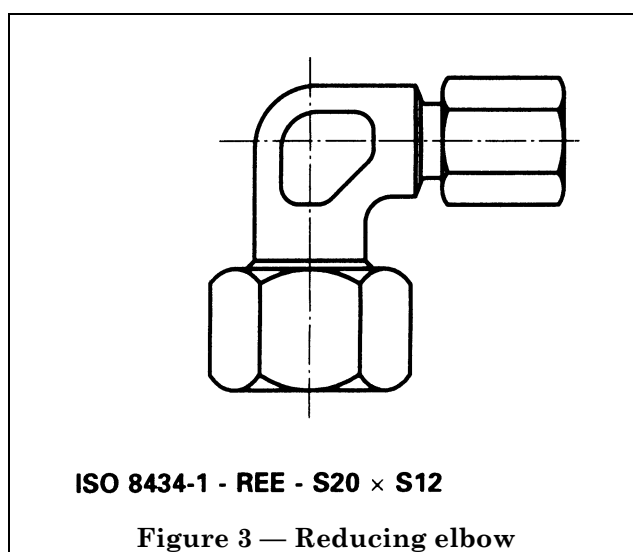
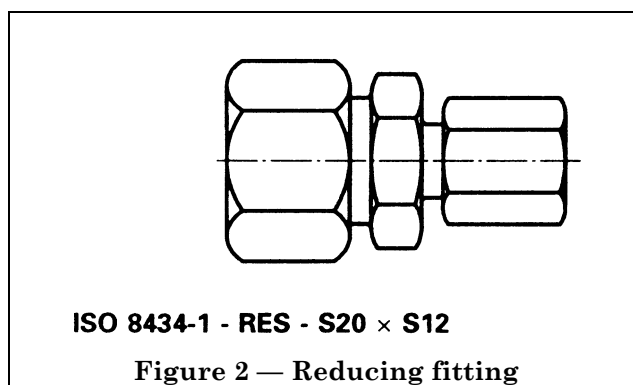
6.9 The following letter symbols shall be used:

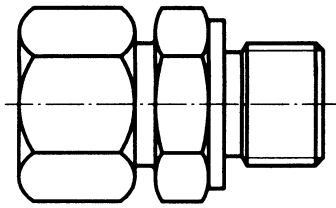
Connection end type	Letter
Bulkhead	BH
Swivel	SW
Weld-on	WD
Braze-on	BR
Port	P
Stud	SD
Reducing	RE

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
Cutting ring	CR
Locknut	LN

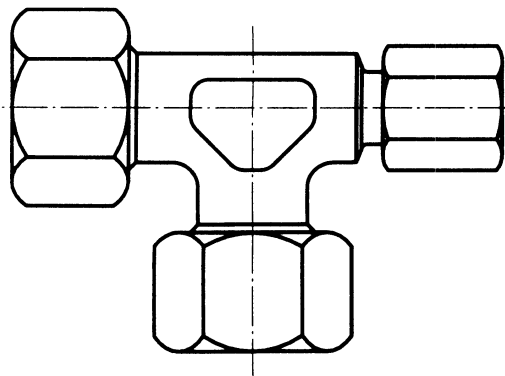
Examples of compression fittings and designations are given in Figure 2 to Figure 6.





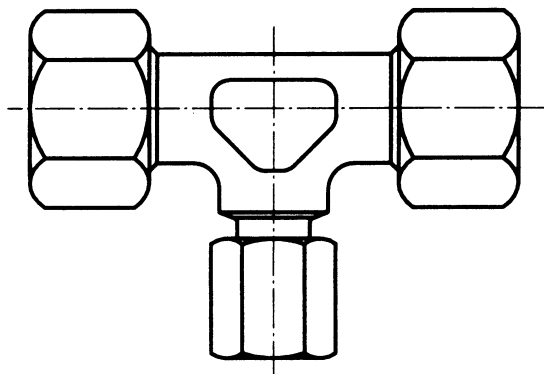
ISO 8434-1 - SDS - S20 × G 3/4 A

Figure 4 — Stud fitting



ISO 8434-1 - RERT - L22 × L12 × L22

Figure 5 — Reducing run tee



ISO 8434-1 - REBT - L22 × L22 × L12

Figure 6 — Reducing branch tee

7 Requirements for tubes

Carbon steel tubes shall comply with delivery condition R37 NBK as specified in ISO 3304 (cold-drawn and normalized) or ISO 3305 (cold-drawn and normalized). Stainless steel tubes shall comply with ISO 1127 (annealed). Copper alloy tubes shall comply with ISO 274 (as-drawn and half-hard).

8 Across-flats dimensions

8.1 The dimensions across flats for nuts and on the bodies of the fittings shall be those given in Table 4 to Table 11 and Table 13 to Table 17. For sizes up to and including 24 mm, tolerances for across-flats dimensions shall be ${}_{-0,8}^0$ mm, and for sizes larger than 24 mm they shall be ${}_{-1}^0$ mm.

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 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 ${}_{-0,4}^0$ mm.

9 Design

9.1 Fittings

The fittings shall conform to the requirements given in Figure 7 to Figure 21 and Table 3 to Table 17. 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 $\pm 0,4$ mm. The sealing seats of fittings shall be concentric with straight thread pitch diameters within 0,25 mm full indicator movement (FIM).

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 $\pm 2,5^\circ$ for fittings for tube sizes 10 mm and less, and $\pm 1,5^\circ$ for all larger sizes.

9.5 Contour details

Details of contour shall be chosen by the manufacturer provided the dimensions given in Table 3 to Table 17 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

These fittings are intended for the connection of plain end tubes and hose fittings to ports in accordance with ISO 6149-1, ISO 1179-1 or ISO 9974-1. For new designs in hydraulic fluid power applications, only ports and stud ends in accordance with the relevant parts of ISO 6149 shall be used. Ports and stud ends in accordance with the relevant parts of ISO 1179 and ISO 9974 shall not be used for new designs in hydraulic fluid power applications.

10 Screw threads

10.1 Compression ends

The screw threads on the compression ends of the fittings shall be ISO metric in accordance with ISO 261.

Threads shall be chamfered at the face of the coupling to an included angle of 45°. The diameter of the chamfer shall be equal to the minor diameter of the thread, with a tolerance of ${}^0_{-0,4}$ mm.

10.2 Stud ends (connection ends)

The thread for stud ends (connection ends) of fittings shall be chosen from ISO 228-1 (Class A) or ISO 261. The dimensions of the stud ends shall comply with the requirements given in Table 7 to Table 9.

NOTE 3 Parallel threads require an undercut with a sealing washer, O-ring or similar device to ensure a leakproof joint, unless the stud end undercut is designed for metal-to-metal sealing.

11 Manufacture

11.1 The fittings shall be free from defects such as cracks and porosity and shall be deburred. Sharp edges shall be removed on the outside. All machined surfaces shall have a surface roughness value of $R_a < 6,3$ μm , except where otherwise noted in the figures.

11.2 Unless otherwise specified, carbon steel coupling bodies, rings and nuts shall be treated or protected to prevent corrosion during storage. The external surface and threads on all fittings except weld components shall be protected with an appropriate coating to pass a minimum 18-h salt spray test in accordance with ISO 9227, unless otherwise agreed 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 or coating requirements but shall be protected from rust. Weld components shall be protected from corrosion by an oil film or phosphate coating.

11.3 Shaped fittings for tubes of outside diameters up to and including 12 mm may be machined from forgings or bars. Shaped fittings for tubes of outside diameter greater than 12 mm shall be made from forgings.

11.4 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;
- instructions regarding the assembly of the coupling, 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 should 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.

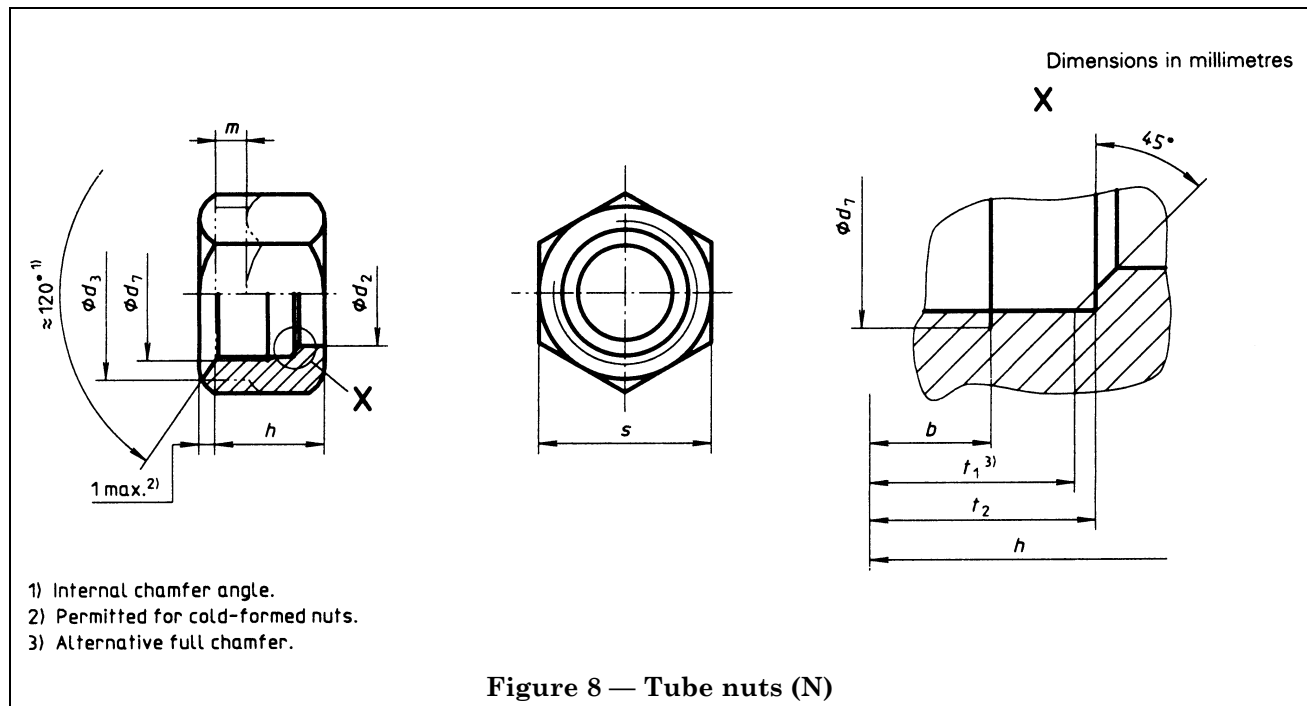
14 Marking of components

Fitting bodies, compression rings and nuts shall be permanently marked with the manufacturer's name, trademark or code identifier, unless otherwise agreed by the user and manufacturer. Nuts shall also be marked with the fitting size and series.

15 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 24° compression metallic fittings in accordance with ISO 8434-1:1994, *Metallic tube connections for fluid power and general use — Part 1:24 degree compression fittings.*”



Table, 4 — Dimensions of tube nuts

Dimensions in millimetres

Series	Tube OD	d_7	d_2		d_3^a	b min	h	m^a	s	t_1 +0,2 0	t_2 +0,2 0
			B11	+0,1 0							
LL	4	M8 × 1	4	—	9,8	5	11	3,5	10	7,5	8
	5	M10 × 1	5	—	11,8	5,5	11,5	3,5	12	7,8	8,5
	6	M10 × 1	6	—	11,8	5,5	11,5	3,5	12	8,2	8,5
	8	M12 × 1	8	—	13,8	6	12	3,5	14	8,7	9
L	6	M12 × 1,5	6	—	13,8	7	14,5	4	14	10	10,5
	8	M14 × 1,5	8	—	16,8	7	14,5	4	17	10	10,5
	10	M16 × 1,5	10	—	18,8	8	15,5	4	19	11	11,5
	12	M18 × 1,5	12	—	21,8	8	15,5	5	22	11	11,5
	15	M22 × 1,5	15	—	26,8	8,5	17	5	27	11,5	12,5
	18	M26 × 1,5	18	—	31,8	8,5	18	5	32	11,5	13
	22	M30 × 2	22	—	35,8	9,5	20	7	36	13,5	14,5
	28	M36 × 2	28	—	40,8	10	21	7	41	14	15
	35	M45 × 2	—	35,3	49,8	12	24	8	50	16	17
42	M52 × 2	—	42,3	59,6	12	24	8	60	16	17	
S	6	M14 × 1,5	6	—	16,8	8,5	16,5	5	17	11	12,5
	8	M16 × 1,5	8	—	18,8	8,5	16,5	5	19	11	12,5
	10	M18 × 1,5	10	—	21,8	8,5	17,5	5	22	11	12,5
	12	M20 × 1,5	12	—	23,8	8,5	17,5	5	24	11	12,5
	16	M24 × 1,5	16	—	29,8	10,5	20,5	6	30	13	14,5
	20	M30 × 2	20	—	35,8	12	24	8	36	15,5	17
	25	M36 × 2	25	—	45,8	14	27	9	46	17	19
	30	M42 × 2	30	—	49,8	15	29	10	50	18	20
	38	M52 × 2	—	38,3	59,6	17	32,5	10	60	19,5	22,5

^a d_3 and m are for optional machining of shoulders.

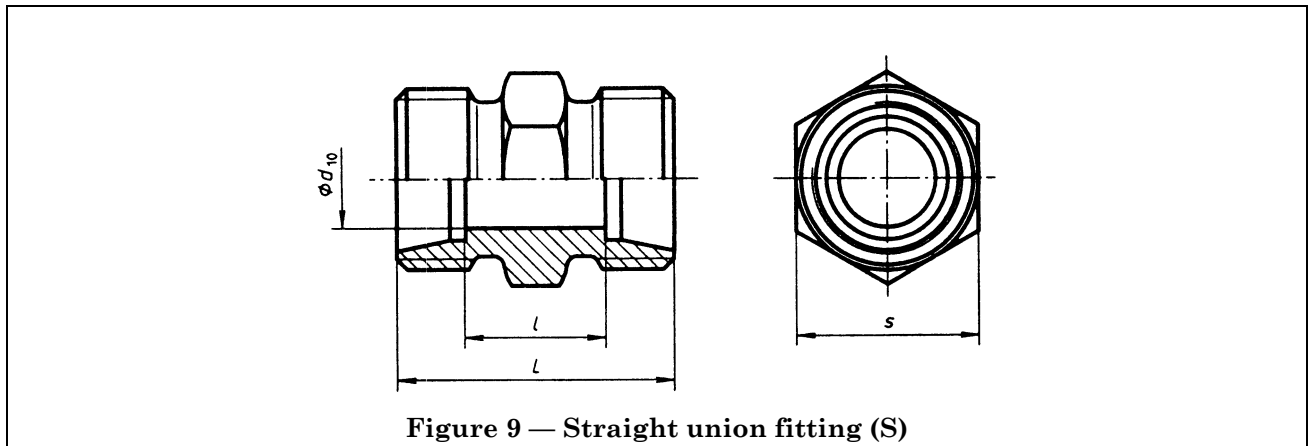


Figure 9 — Straight union fitting (S)

Table 5 — Dimensions of straight union fittings

Dimensions in millimetres

Series	Tube OD	d_{10}	L $\pm 0,3$	s	l ref.
LL	4	3	20	9	12
	5	3,5	20	11	9
	6	4,5	20	11	9
	8	6	23	12	12
L	6	4	24	12	10
	8	6	25	14	11
	10	8	27	17	13
	12	10	28	19	14
	15	12	30	24	16
	18	15	31	27	16
	22	19	35	32	20
	28	24	36	41	21
	35	30	41	46	20
	42	36	43	55	21
S	6	4	30	14	16
	8	5	32	17	18
	10	7	32	19	17
	12	8	34	22	19
	16	12	38	27	21
	20	16	44	32	23
	25	20	50	41	26
	30	25	54	46	27
	38	32	61	55	29

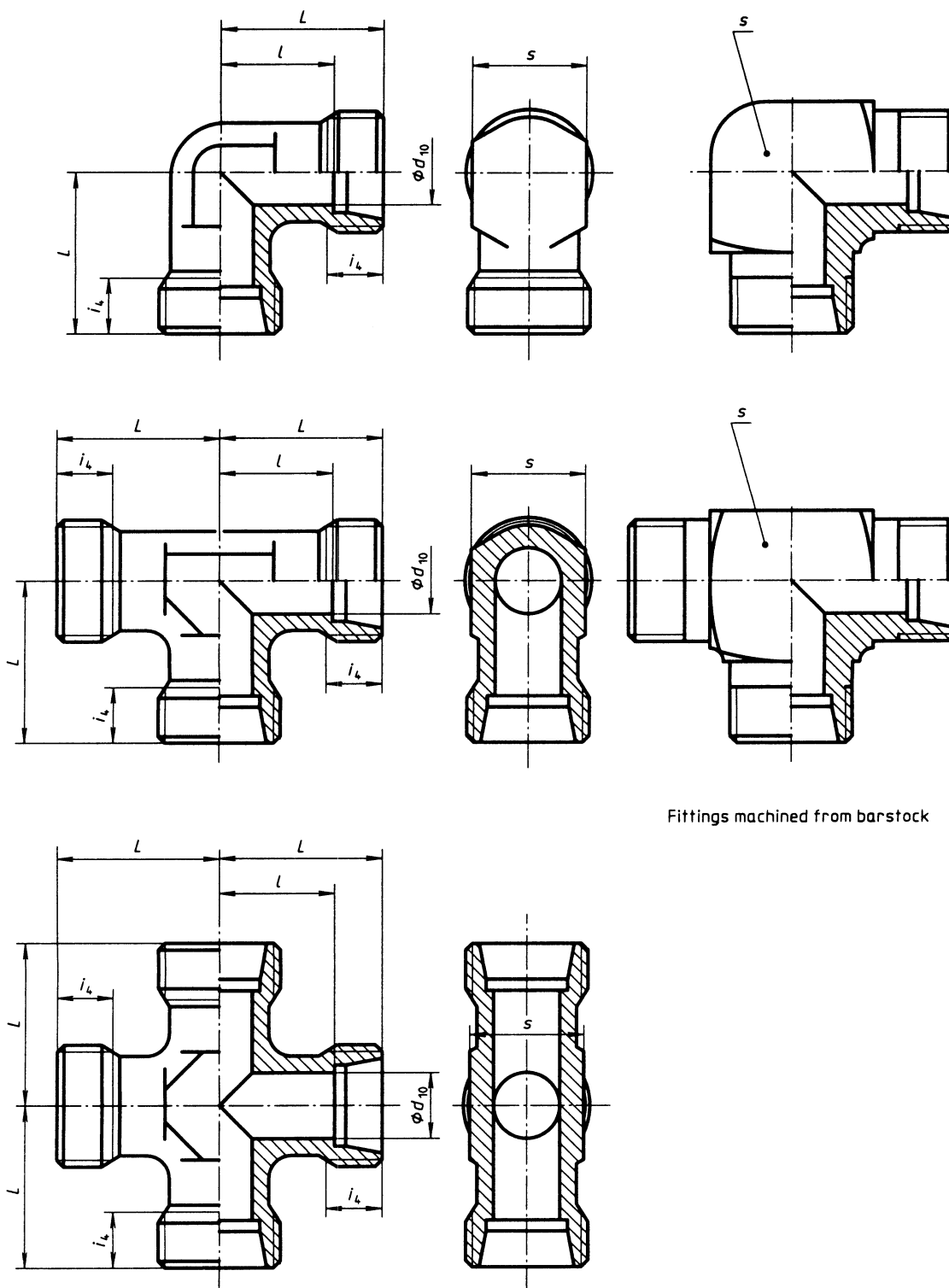
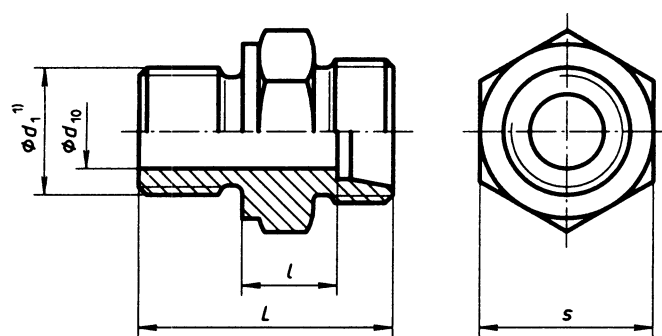


Figure 10 — Elbow (E), tee (T) and cross (K) union fittings (see Table 6)

Table 6 — Dimensions of elbow, tee and cross union fittings

Dimensions in millimetres

Series	Tube OD	d_{10}	i_4 min.	L $\pm 0,3$	s		l ref.
					Forged fitting	Fitting machined from barstock	
LL	4	3	6	15	9	9	11
	5	3,5	6	15	9	11	9,5
	6	4,5	6	15	9	11	9,5
	8	6	7	17	12	12	11,5
L	6	4	7	19	12	12	12
	8	6	7	21	12	14	14
	10	8	8	22	14	17	15
	12	10	8	24	17	19	17
	15	12	9	28	19	—	21
	18	15	9	31	24	—	23,5
	22	19	10	35	27	—	27,5
	28	24	10	38	36	—	30,5
	35	30	12	45	41	—	34,5
	42	36	12	51	50	—	40
S	6	4	9	23	12	14	16
	8	5	9	24	14	17	17
	10	7	9	25	17	19	17,5
	12	8	9	29	17	22	21,5
	16	12	11	33	24	—	24,5
	20	16	12	37	27	—	26,5
	25	20	14	42	36	—	30
	30	25	16	49	41	—	35,5
38	32	18	57	50	—	41	



1) Details per ISO 6149-2 and ISO 6149-3.

Figure 11 — Stud fittings (SDS) for ports in accordance with ISO 6149-1

Table 7 — Dimensions of stud fittings for ports in accordance with ISO 6149-1

Dimensions in millimetres

Series	Tube OD	d_1^a	d_{10}	i $\pm 0,2$	L $\pm 0,3$	s	l
L	6	M10 × 1	4	9,5	25	14	8,5
	8	M12 × 1,5	6	11	28	17	10
	10	M14 × 1,5	8	11	29	19	11
	12	M16 × 1,5	10	12,5	32	22	12,5
	15	M18 × 1,5	12	14	34,5	24	13,5
	18	M22 × 1,5	15	15	37	27	14,5
	22	M27 × 2	19	18,5	42,5	32	16,5
	28	M33 × 2	24	18,5	43,5	41	17,5
	35	M42 × 2	30	19	47	50	17,5
	42	M48 × 2	36	21,5	51,5	55	19
S	6	M12 × 1,5	4	11	31	17	13
	8	M14 × 1,5	5	11	33	19	15
	10	M16 × 1,5	7	12,5	35	22	15
	12	M18 × 1,5	8	14	38,5	24	17
	16	M22 × 1,5	12	15	42	27	18,5
	20	M27 × 2	16	18,5	49,5	32	20,5
	25	M33 × 2	20	18,5	53,5	41	23
	30	M42 × 2	25	19	56	50	23,5
	38	M48 × 2	32	21,5	63,5	55	26

^a For further details, see ISO 6149-2 and ISO 6149-3.

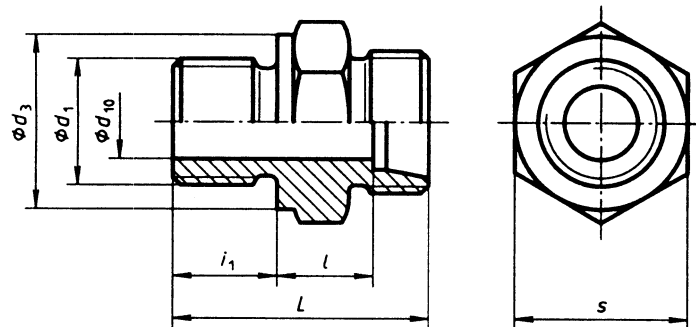


Figure 12 — Stud fittings (SDS) for ports with parallel threads and elastomeric sealing

Table 8 — Dimensions of stud fittings for ports with parallel threads and elastomeric sealing

Dimensions in millimetres

Series	Tube OD	ISO 9974-2 ^{a, b}						ISO 1179-2 and ISO 1179-3 ^a						d_{10}
		d_1	d_3	i_1 $\pm 0,2$	L $\pm 0,3$	s	l	d_1	d_3	i_1 $\pm 0,2$	L $\pm 0,3$	s	l	
L	6	M10 × 1	13,9	8	23,5	14	8,5	G 1/8 A	13,9	8	23,5	14	8,5	4
	8	M12 × 1,5	16,9	12	29	17	10	G 1/4 A	18,9	12	29	19	10	6
	10	M14 × 1,5	18,9	12	30	19	11	G 1/4 A	18,9	12	30	19	11	7
	12	M16 × 1,5	21,9	12	31,5	22	12,5	G 3/8 A	21,9	12	31,5	22	12,5	9
	15	M18 × 1,5	23,9	12	32,5	24	13,5	G 1/2 A	26,9	14	35	27	14	11
	18	M22 × 1,5	26,9	14	36	27	14,5	G 1/2 A	26,9	14	36	27	14,5	14
	22	M26 × 1,5	31,9	16	40	32	16,5	G 3/4 A	31,9	16	40	32	16,5	18
	28	M33 × 2	39,9	18	43	41	17,5	G 1 A	39,9	18	43	41	17,5	23
	35	M42 × 2	49,9	20	48	50	17,5	G 1 1/4 A	49,9	20	48	50	17,5	30
	42	M48 × 2	54,9	22	52	55	19	G 1 1/2 A	54,9	22	52	55	19	36
S	6	M12 × 1,5	16,9	12	32	17	13	G 1/4 A	18,9	12	32	19	13	4
	8	M14 × 1,5	18,9	12	34	19	15	G 1/4 A	18,9	12	34	19	15	5
	10	M16 × 1,5	21,9	12	34,5	22	15	G 3/8 A	21,9	12	34,5	22	15	7
	12	M18 × 1,5	23,9	12	36,5	24	17	G 3/8 A	21,9	12	36,5	22	17	8
	12	—	—	—	—	—	—	G 1/2 A	26,9	14	39	27	17,5	8
	16	M22 × 1,5	26,9	14	41	27	18,5	G 1/2 A	26,9	14	41	27	18,5	12
	16	—	—	—	—	—	—	G 3/4 A	31,9	16	45	32	20,5	16
	20	M27 × 2	31,9	16	47	32	20,5	G 3/4 A	31,9	16	47	32	20,5	16
	25	M33 × 2	39,9	18	53	41	23	G 1 A	39,9	18	53	41	23	20
	30	M42 × 2	49,9	20	57	50	23,5	G 1 1/4 A	49,9	20	57	50	23,5	25
38	M48 × 2	54,9	22	64	55	26	G 1 1/2 A	54,9	22	64	55	26	32	

^a For further details on sealing, see the relevant part(s) of ISO 9974 and ISO 1179.

^b For general applications only. For new designs in hydraulic fluid power applications, dimensions shall be in accordance with the relevant part of ISO 6149.

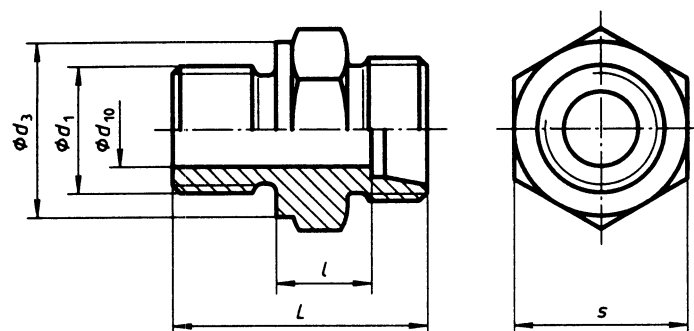


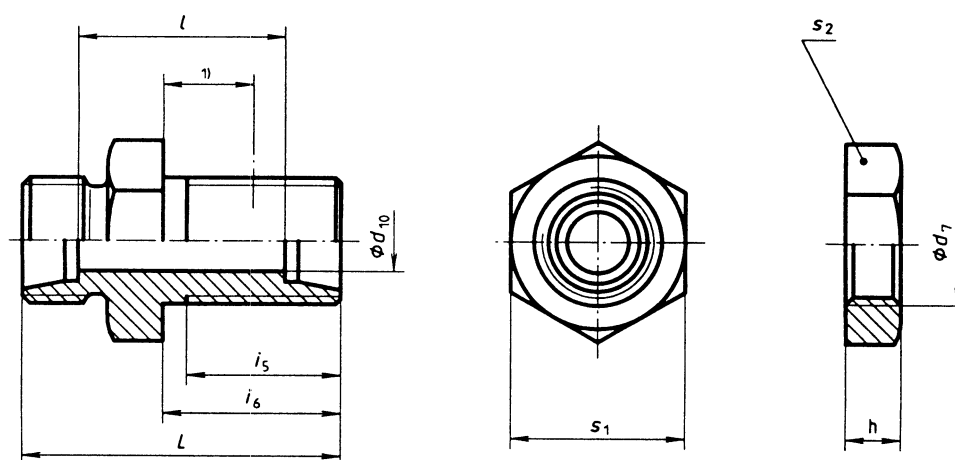
Figure 13 — Stud fittings (SDS) for ports with parallel threads and metal-to-metal sealing

Table 9 — Stud fittings for ports with parallel threads and metal-to-metal sealing

Dimensions in millimetres

Series	Tube OD	ISO 9974-3 ^a					ISO 1179-4 ^a					d_{10}
		d_1	d_3	L $\pm 0,3$	s	l	d_1	d_3	L $\pm 0,3$	s	l	
LL	4	M8 × 1	12	21,5	12	9,5	G 1/8 A	14	21,5	14	9,5	3
	5	M8 × 1	12	21,5	12	8	G 1/8 A	14	21,5	14	8	3
	6	M10 × 1	14	21,5	14	8	G 1/8 A	14	21,5	14	8	4
	8	M10 × 1	14	22,5	14	9	G 1/8 A	14	22,5	14	9	4,5
L	6	M10 × 1	14	23,5	14	8,5	G 1/8 A	14	23,5	14	8,5	4
	8	M12 × 1,5	17	29	17	10	G 1/4 A	18	29	19	10	6
	10	M14 × 1,5	19	30	19	11	G 1/4 A	18	30	19	11	7
	12	M16 × 1,5	21	31,5	22	12,5	G 3/8 A	22	31,5	22	12,5	9
	15	M18 × 1,5	23	32,5	24	13,5	G 1/2 A	26	35	27	14	11
	18	M22 × 1,5	27	36	27	14,5	G 1/2 A	26	36	27	14,5	14
	22	M26 × 1,5	31	40	32	16,5	G 3/4 A	32	40	32	16,5	18
	28	M33 × 2	39	43	41	17,5	G 1 A	39	43	41	17,5	23
	35	M42 × 2	49	48	50	17,5	G 1 1/4 A	49	48	50	17,5	30
	42	M48 × 2	55	52	55	19	G 1 1/2 A	55	52	55	19	36
S	6	M12 × 1,5	17	32	17	13	G 1/4 A	18	32	19	13	4
	8	M14 × 1,5	19	34	19	15	G 1/4 A	18	34	19	15	5
	10	M16 × 1,5	21	34,5	22	15	G 3/8 A	22	34,5	22	15	7
	12	M18 × 1,5	23	36,5	24	17	G 3/8 A	22	36,5	22	17	8
	12	—	—	—	—	—	G 1/2 A	26	39	27	17,5	8
	16	M22 × 1,5	27	41	27	18,5	G 1/2 A	26	41	27	18,5	12
	16	—	—	—	—	—	G 3/4 A	32	45	32	20,5	12
	20	M27 × 2	32	47	32	20,5	G 3/4 A	32	47	32	20,5	16
	25	M33 × 2	39	53	41	23	G 1 A	39	53	41	23	20
	30	M42 × 2	49	57	50	23,5	G 1 1/4 A	49	57	50	23,5	25
38	M48 × 2	55	64	55	26	G 1 1/2 A	55	64	55	26	32	

^a For general applications only. For new designs in hydraulic fluid power applications, dimensions shall be in accordance with the relevant part of ISO 6149.



1) Maximum bulkhead thickness: 16 mm.

Figure 14 — Bulkhead union fittings (BH) and locknuts (LN)

Table 10 — Dimensions of bulkhead union fittings and locknuts

Dimensions in millimetres

Series	Tube OD	Bulkhead union fittings						Locknuts ^a		
		d_{10}	i_5 min.	i_6 $\pm 0,2$	L $\pm 0,3$	s_1	l	s_2	d_7	h
L	6	4	30	34	48	17	34	17	M12 × 1,5	6
	8	6	30	34	49	19	35	19	M14 × 1,5	6
	10	8	31	35	52	22	38	22	M16 × 1,5	6
	12	10	32	36	53	24	39	24	M18 × 1,5	6
	15	12	34	38	57	27	43	30	M22 × 1,5	7
	18	15	36	40	61	32	46	36	M26 × 1,5	8
	22	19	37	42	66	36	51	41	M30 × 2	9
	28	24	38	43	69	41	54	46	M36 × 2	9
	35	30	42	47	76	50	55	55	M45 × 2	9
	42	36	42	47	77	60	55	65	M52 × 2	10
S	6	4	32	36	55	19	41	19	M14 × 1,5	6
	8	5	32	36	56	22	42	22	M16 × 1,5	6
	10	7	33	37	59	24	44	24	M18 × 1,5	6
	12	8	34	38	60	27	45	27	M20 × 1,5	6
	16	12	36	40	65	32	48	32	M24 × 1,5	7
	20	16	39	44	72	41	51	41	M30 × 2	8
	25	20	42	47	79	46	55	46	M36 × 2	9
	30	25	46	51	86	50	59	50	M42 × 2	9
	38	32	48	53	91	65	59	65	M52 × 2	10

^a Locknuts for the following sizes in the L and S series share identical dimensions:

- L series size 8 and S series size 6;
- L series size 10 and S series size 8;
- L series size 12 and S series size 10;
- L series size 22 and S series size 20;
- L series size 28 and S series size 25;
- L series size 42 and S series size 38.

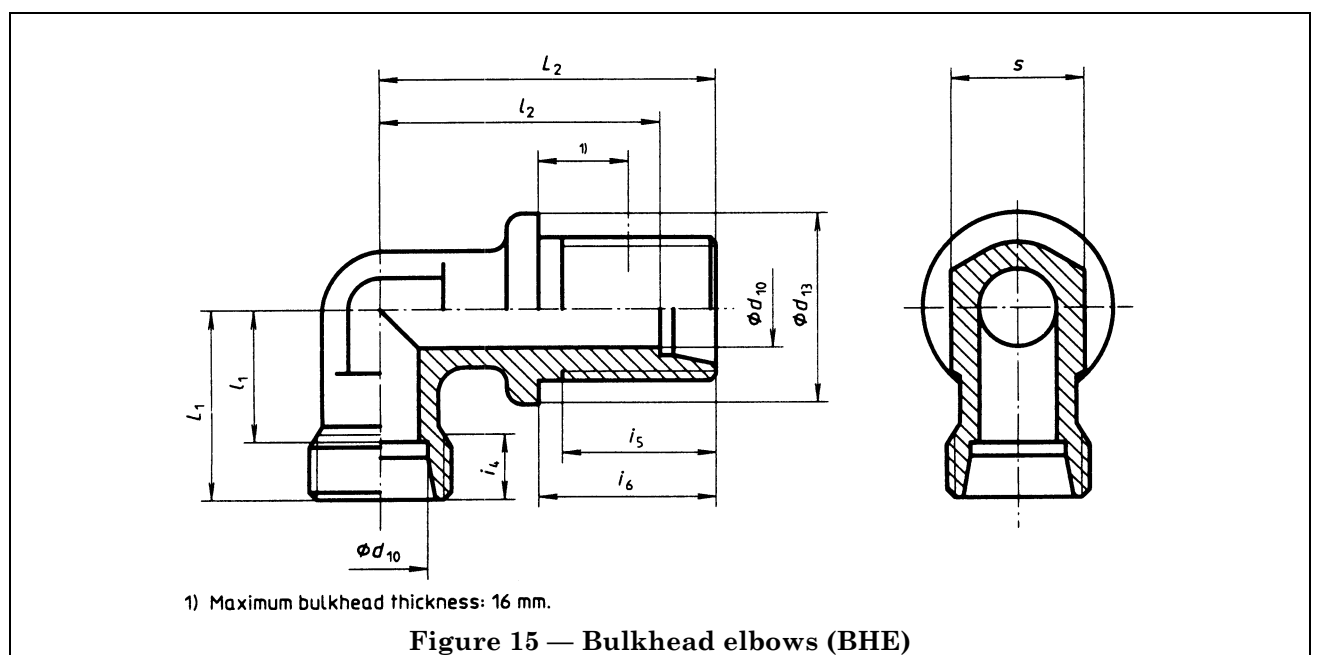


Table 11 — Dimensions of bulkhead elbows

Dimensions in millimetres

Series	Tube OD	d_{10}	d_{13}	i_4 min.	i_5 min.	i_6 $\pm 0,2$	L_1 $\pm 0,3$	L_2 $\pm 0,3$	s	l_1	l_2
L	6	4	17	7	30	34	19	48	12	12	41
	8	6	19	7	30	34	21	51	12	14	44
	10	8	22	8	31	35	22	53	14	15	46
	12	10	24	8	32	36	24	56	17	17	49
	15	12	27	9	34	38	28	61	19	21	54
	18	15	32	9	36	40	31	64	24	23,5	56,5
	22	19	36	10	37	42	35	72	27	27,5	64,5
	28	24	42	10	38	43	38	77	36	30,5	69,5
	35	30	50	12	42	47	45	86	41	34,5	75,5
	42	36	60	12	42	47	51	90	50	40	79
S	6	4	19	9	32	36	23	53	12	16	46
	8	5	22	9	32	36	24	54	14	17	47
	10	7	24	9	33	37	25	57	17	17,5	49,5
	12	8	27	9	34	38	29	59	17	21,5	51,5
	16	12	30	11	36	40	33	64	24	24,5	55,5
	20	16	36	12	39	44	37	74	27	26,5	63,5
	25	20	42	14	42	47	42	81	36	30	69
	30	25	50	16	46	51	49	90	41	35,5	76,5
	38	32	60	18	48	53	57	96	50	41	80

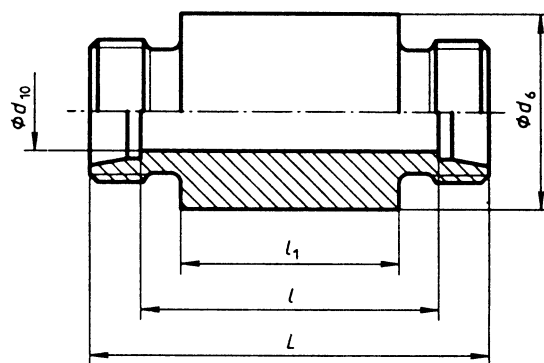


Figure 16 — Weld-in bulkhead fittings (WDBH)

Table 12 — Dimensions of weld-in bulkhead fittings

Dimensions in millimetres

Series	Tube OD	d_6	d_{10}	L $\pm 0,3$	l	l_1
L	6	18	4	70	56	50
	8	20	6	70	56	50
	10	22	8	72	58	50
	12	25	10	72	58	50
	15	28	12	84	70	60
	18	32	15	84	69	60
	22	36	19	88	73	60
	28	40	24	88	73	60
	35	50	30	92	71	60
	42	60	36	92	70	60
S	6	20	4	74	60	50
	8	22	5	74	60	50
	10	25	7	74	59	50
	12	28	8	74	59	50
	16	35	12	88	71	60
	20	38	16	92	71	60
	25	45	20	96	72	60
	30	50	25	100	73	60
	38	60	32	104	72	60

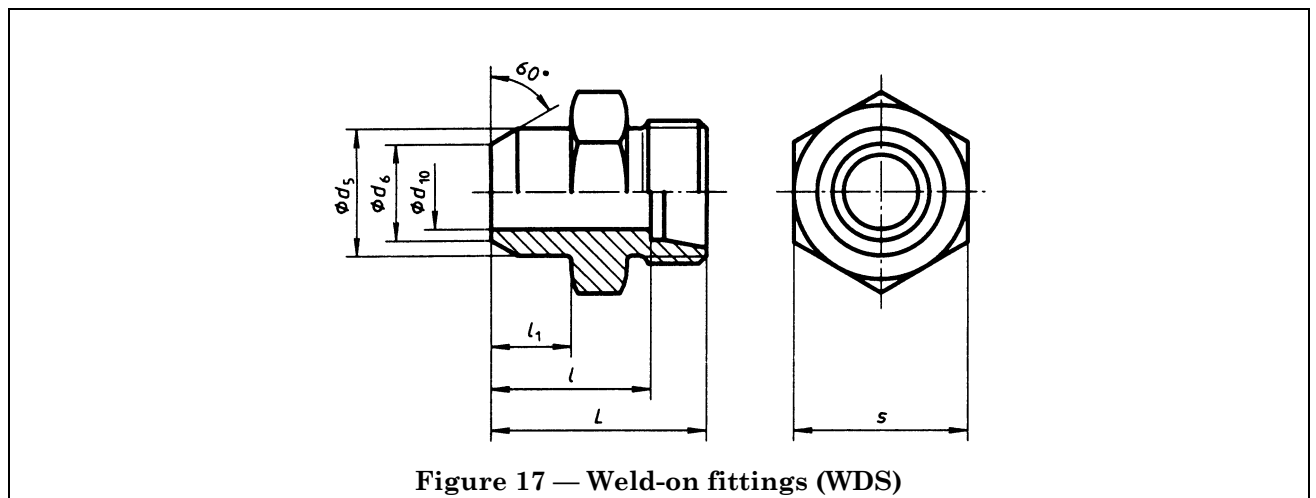


Table 13 — Dimensions of weld-on fittings

Dimensions in millimetres

Series	Tube OD	d_5	d_6	d_{10}	l_1 $\pm 0,2$	L $\pm 0,3$	s	l
L	6	10	6	4	7	21	12	14
	8	12	8	6	8	23	14	16
	10	14	10	8	8	25	17	18
	12	16	12	10	8	25	19	18
	15	19	15	12	10	29	22	22
	18	22	18	15	10	31	27	23,5
	22	27	22	19	12	36	32	28,5
	28	32	28	24	12	38	41	30,5
	35	40	35	30	14	43	46	32,5
	42	46	42	36	16	46	55	35
S	6	11	6	4	7	26	14	19
	8	13	8	5	8	28	17	21
	10	15	10	7	8	30	19	22,5
	12	17	12	8	10	32	22	24,5
	16	21	16	12	10	35	27	26,5
	20	26	20	16	12	40	32	29,5
	25	31	24	20	12	44	41	32
	30	36	29	25	14	49	46	35,5
	38	44	36	32	16	54	55	38

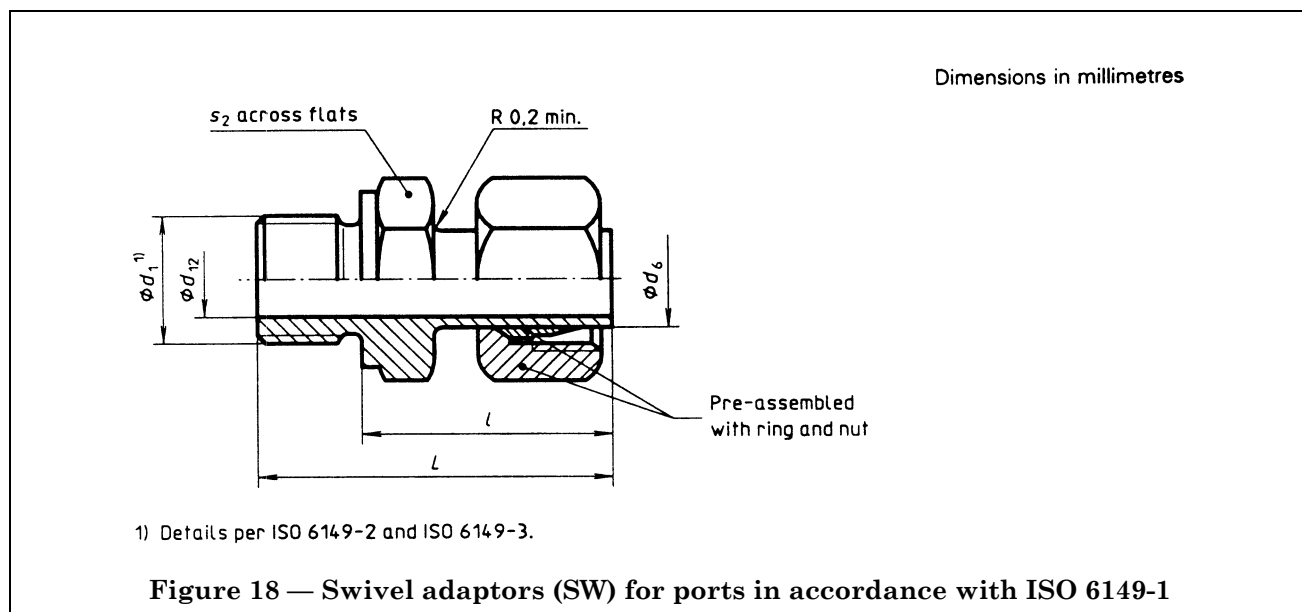


Table 14 — Dimensions for swivel adaptors for ports in accordance with ISO 6149-1

Dimensions in millimetres

Series	Tube OD	d_6	d_1^a	L $\pm 0,5$	s_2	d_{12} max.	l
L	6	6	M10 × 1	34	14	3,5	24,5
	8	8	M12 × 1,5	37,5	17	5,5	26,5
	10	10	M14 × 1,5	38,5	19	7,5	27,5
	12	12	M16 × 1,5	43	22	9	30,5
	15	15	M18 × 1,5	45,5	24	11,5	31,5
	18	18	M22 × 1,5	46,5	27	14,5	31,5
	22	22	M27 × 2	49	32	17	32,5
	28	28	M33 × 2	53,5	41	23	35
	35	35	M42 × 2	61,5	50	29	42,5
	42	42	M48 × 2	68	55	35,5	46,5
S	6	6	M12 × 1,5	38	17	3,5	27
	8	8	M14 × 1,5	40,5	19	4,5	29,5
	10	10	M16 × 1,5	44,5	22	6,5	32
	12	12	M18 × 1,5	48	24	7,5	34
	16	16	M22 × 1,5	52	27	11,5	37
	20	20	M27 × 2	61,5	32	15,5	43
	25	25	M33 × 2	66,5	41	18	48
	30	30	M42 × 2	70	50	23,5	51
		38	38	M48 × 2	81,5	55	29,5

^a For further details, see ISO 6149-2 and ISO 6149-3.

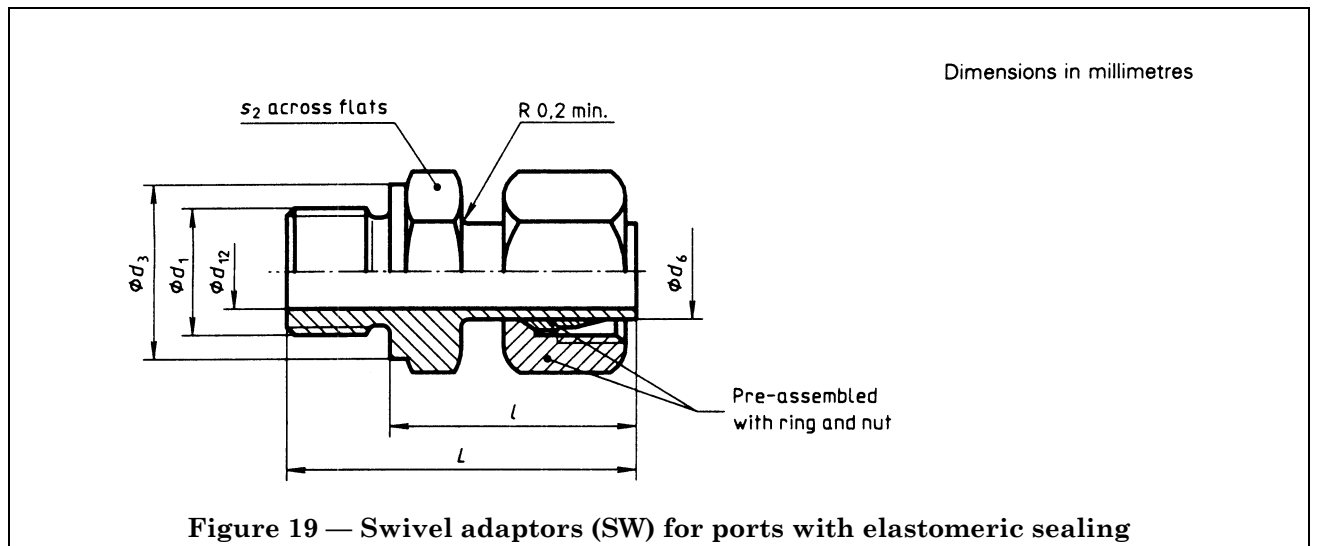


Table 15 — Dimensions for swivel adaptors for ports with elastomeric sealing

Dimensions in millimetres

Series	Tubes OD	d_6^b	ISO 9974-2 ^a						ISO 1179-2 and ISO 1179-3 ^a					
			d_1	d_3	$L \pm 0,5$	s_2	d_{12} max.	l	d_1	d_3	$L \pm 0,5$	s_2	d_{12} max.	l
L	6	6	M10 × 1	13,9	32,5	14	3,5	24,5	G 1/8 A	13,9	32,5	14	3,5	24,5
	8	8	M12 × 1,5	16,9	38,5	17	5,5	26,5	G 1/4 A	18,9	41,5	19	4,5	29,5
	10	10	M14 × 1,5	18,9	39,5	19	7,5	27,5	G 1/4 A	18,9	39,5	19	7	27,5
	12	12	M16 × 1,5	21,9	42,5	22	9	30,5	G 3/8 A	21,9	46	22	7,5	34
	15	15	M18 × 1,5	23,9	43,5	24	11,5	31,5	G 1/2 A	26,9	46	27	11	32
	18	18	M22 × 1,5	26,9	45,5	27	14,5	31,5	G 1/2 A	26,9	45,5	27	14	31,5
	22	22	M26 × 1,5	31,9	48,5	32	17	32,5	G 3/4 A	31,9	48,5	32	18	32,5
	28	28	M33 × 2	39,9	53	41	23	35	G 1 A	39,9	53	41	23	35
	35	35	M42 × 2	49,9	62,5	50	29	42,5	G 1 1/4 A	49,9	62,5	50	29,5	42,5
	42	42	M48 × 2	54,9	68,5	55	35,5	46,5	G 1 1/2 A	54,9	68,5	55	35,5	46,5
S	6	6	M12 × 1,5	16,9	39	17	3,5	27	G 1/4 A	18,9	39	19	3,5	27
	8	8	M14 × 1,5	18,9	41,5	19	4,5	29,5	G 1/4 A	18,9	41,5	19	4,5	29,5
	10	10	M16 × 1,5	21,9	44	22	6,5	32	G 3/8 A	21,9	44	22	6,5	32
	12	12	M18 × 1,5	23,9	46	24	7,5	34	G 3/8 A	21,9	46	22	7,5	34
	12	12	—	—	—	—	—	—	G 1/2 A	26,9	48,5	27	7,5	34,5
	16	16	M22 × 1,5	26,9	51	27	11,5	37	G 1/2 A	26,9	51	27	11,5	37
	16	16	—	—	—	—	—	39	G 3/4 A	31,9	55	32	11,5	39
	20	20	M27 × 2	31,9	59	32	15,5	43	G 3/4 A	31,9	59	32	15,5	43
	25	25	M33 × 2	39,9	66	41	18	48	G 1 A	39,9	66	41	18	48
	30	30	M42 × 2	49,9	71	50	23,5	51	G 1 1/4 A	49,9	71	50	23	51
38	38	M48 × 2	54,9	82	55	29,5	60	G 1 1/2 A	54,9	82	55	29	60	

^a For further details on sealing, see the relevant part(s) of ISO 9974 and ISO 1179. For new designs in hydraulic fluid power applications, dimensions in accordance with the relevant part of ISO 6149 shall be used.

^b For tolerances, see Table 3.

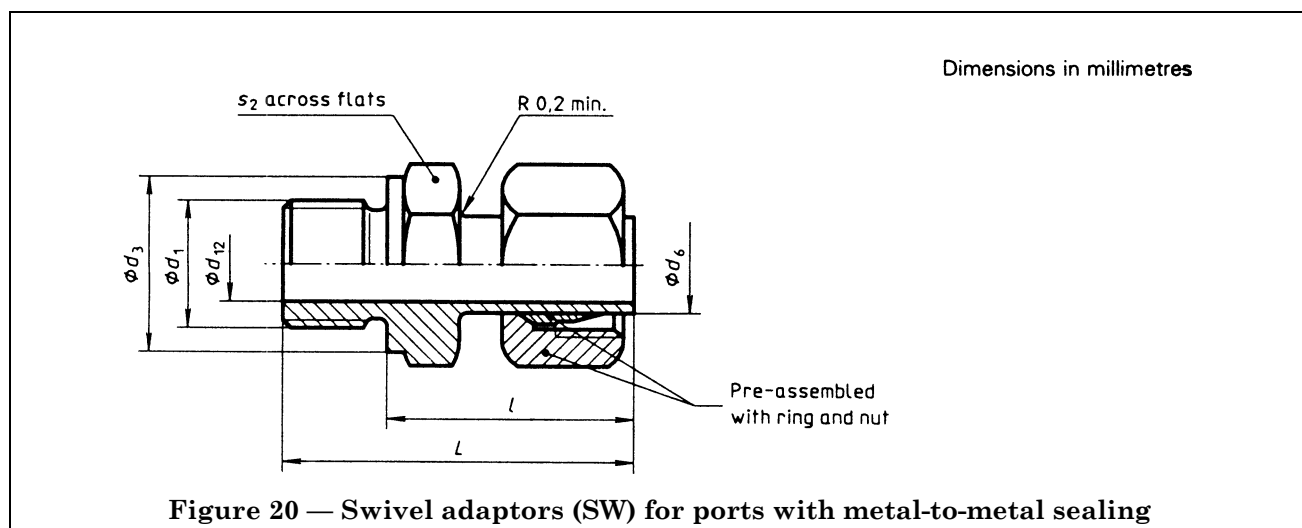


Table 16 — Dimensions of swivel adaptors for ports with metal-to-metal sealing

Dimensions in millimetres

Series	Tube OD	d_6^b	ISO 9974-3 ^a						ISO 1179-4 ^a					
			d_1	d_3	L $\pm 0,5$	s_2	d_{12} max.	l	d_1	d_3	L $\pm 0,5$	s_2	d_{12} max.	l
L	6	6	M10 × 1	14	32,5	14	3,5	24,5	G 1/8 A	14	32,5	14	3,5	24,5
	8	8	M12 × 1,5	17	38,5	17	5,5	26,5	G 1/4 A	18	41,5	19	4,5	29,5
	10	10	M14 × 1,5	19	39,5	19	7,5	27,5	G 1/4 A	18	39,5	19	7	27,5
	12	12	M16 × 1,5	21	42,5	22	9	30,5	G 3/8 A	22	46	22	7,5	34
	15	15	M18 × 1,5	23	43,5	24	11,5	31,5	G 1/2 A	26	46	27	11	32
	18	18	M22 × 1,5	27	45,5	27	14,5	31,5	G 1/2 A	26	45,5	27	14	31,5
	22	22	M26 × 1,5	31	48,5	32	17	32,5	G 3/4 A	32	48,5	32	18	32,5
	28	28	M33 × 2	39	53	41	23	35	G 1 A	39	53	41	23	35
	35	35	M42 × 2	49	62,5	50	29	42,5	G 1 1/4 A	49	62,5	50	29,5	42,5
	42	42	M48 × 2	55	68,5	55	35,5	46,5	G 1 1/2 A	55	68,5	55	35,5	46,5
S	6	6	M12 × 1,5	17	39	17	3,5	27	G 1/4 A	18	39	19	3,5	27
	8	8	M14 × 1,5	19	41,5	19	4,5	29,5	G 1/4 A	18	41,5	19	4,5	29,5
	10	10	M16 × 1,5	21	44	22	6,5	32	G 3/8 A	22	44	22	6,5	32
	12	12	M18 × 1,5	23	46	24	7,5	34	G 3/8 A	22	46	22	7,5	34
	12	12	—	—	—	—	—	—	G 1/2 A	26	48,5	27	7,5	34,5
	16	16	M22 × 1,5	27	51	27	11,5	37	G 1/2 A	26	51	27	11,5	37
	16	16	—	—	—	—	39	39	G 3/4 A	32	55	32	11,5	39
	20	20	M27 × 2	32	59	32	15,5	43	G 3/4 A	32	59	32	15,5	43
	25	25	M33 × 2	39	66	41	18	48	G 1 A	39	66	41	18	48
	30	30	M42 × 2	49	71	50	23,5	51	G 1 1/4 A	49	71	50	23	51
38	38	M48 × 2	55	82	55	29,5	60	G 1 1/2 A	55	82	55	29	60	

^a These dimensions are for general applications only, not for fluid power applications. For new designs in hydraulic fluid power applications, dimensions in accordance with the relevant part of ISO 6149 shall be used.
^b For tolerances, see Table 3.

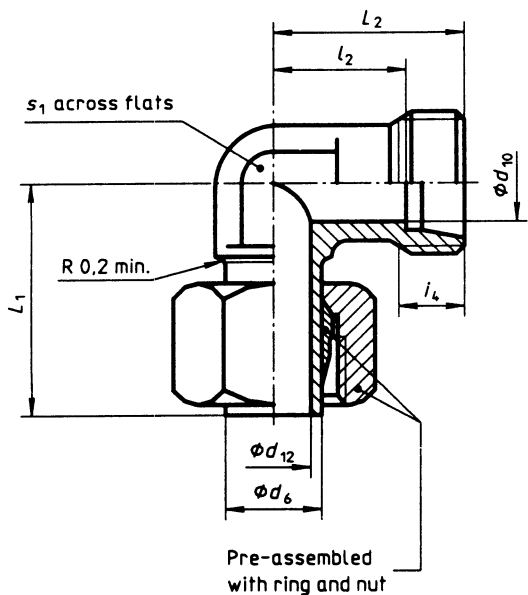
Table 17 — Dimensions of swivel elbows, branch tees and run tees

Dimensions in millimetres

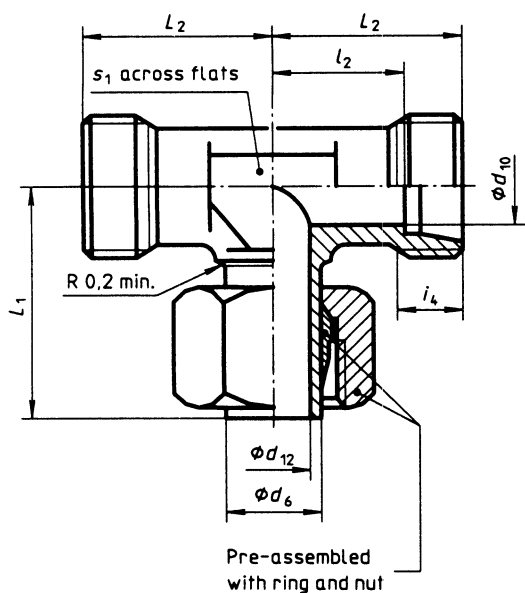
Series	Tube OD	d_6^a	d_{10}	d_{12} max.	L_1 $\pm 0,5$	L_2 $\pm 0,3$	i_4 min.	s_1	l_2
L	6	6	4	3,5	26	19	7	12	12
	8	8	6	5,5	27,5	21	7	12	14
	10	10	8	7,5	29	22	8	14	15
	12	12	10	9,5	29,5	24	8	17	17
	15	15	12	11,5	32,5	28	9	19	21
	18	18	15	14,5	35,5	31	9	24	23,5
	22	22	19	17	38,5	35	10	27	27,5
	28	28	24	23	41,5	38	10	36	30,5
	35	35	30	29	51	45	12	41	34,5
	42	42	36	35,5	56	51	12	50	40
S	6	6	4	3,5	27	23	9	12	16
	8	8	5	4,5	27,5	24	9	14	17
	10	10	7	6,5	30	25	9	17	17,5
	12	12	8	7,5	31	29	9	17	21,5
	16	16	12	11,5	36,5	33	11	24	24,5
	20	20	16	15,5	44,5	37	12	27	26,5
	25	25	20	18	50	42	14	36	30
	30	30	25	23,5	55	49	16	41	35,5
38	38	32	29,5	63	57	18	50	41	

^a For tolerances, see Table 3.

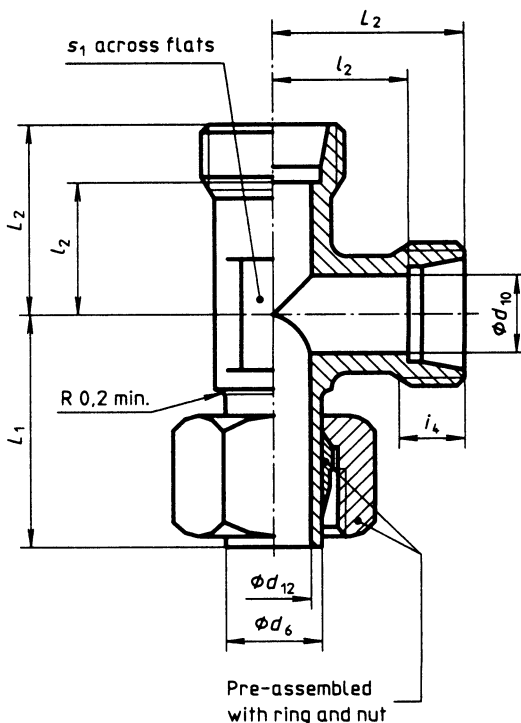
Dimensions in millimetres



a) Swivel elbow



b) Swivel branch tee



c) Swivel run tee

Figure 21 — Swivel elbows (SWE), branch tees (SWBT) and run tees (SWRT)

Annex A (normative)**Port and stud end pressure ratings and combination of tube outside diameter and thread size**

See Table A.1 for values for fluid power applications and general use, and Table A.2 for values for general use only.

Table A.1 — Values for fluid power and general use

Series	Tube OD mm	Thread	ISO 6149		Thread	ISO 1179 ^a	
			Max. working pressure ^b			Max. working pressure ^b	
			MPa	(bar)		MPa	(bar)
L	6	M10 × 1	25	(250)	G 1/8 A	25	(250)
	8	M12 × 1,5	25	(250)	G 1/4 A	25	(250)
	10	M14 × 1,5	25	(250)	G 1/4 A	25	(250)
	12	M16 × 1,5	25	(250)	G 3/8 A	25	(250)
	15	M18 × 1,5	25	(250)	G 1/2 A	25	(250)
	18	M22 × 1,5	16	(160)	G 1/2 A	16	(160)
	22	M27 × 2	16	(160)	G 3/4 A	16	(160)
	28	M33 × 2	10	(100)	G 1 A	10	(100)
	35	M42 × 2	10	(100)	G 1 1/4 A	10	(100)
	42	M48 × 2	10	(100)	G 1 1/2 A	10	(100)
S	6	M12 × 1,5	63	(630)	G 1/4 A	63	(630)
	8	M14 × 1,5	63	(630)	G 1/4 A	63	(630)
	10	M16 × 1,5	63	(630)	G 3/8 A	63	(630)
	12	M18 × 1,5	63	(630)	G 3/8 A	63	(630)
	16	M22 × 1,5	40	(400)	G 1/2 A	40	(400)
	20	M27 × 2	40	(400)	G 3/4 A	40	(400)
	25	M33 × 2	40	(400)	G 1 A	40	(400)
	30	M42 × 2	25	(250)	G 1 1/4 A	25	(250)
	38	M48 × 2	25	(250)	G 1 1/2 A	25	(250)

^a Type E with elastomeric sealing.
^b With a design factor of 4 to 1.

Table A.2 — Values for general use only

Series	Tube OD mm	Thread	Maximum working pressure ^a				Thread	Maximum working pressure ^a	
			ISO 9974-3 type B ^b		ISO 9974-2 type E ^c			ISO 1179-4 type B ^b	
			MPa	(bar)	MPa	(bar)		MPa	(bar)
LL	4	M8 × 1	10	(100)	—	—	G 1/8 A	10	(100)
	5	M8 × 1	10	(100)	—	—	G 1/8 A	10	(100)
	6	M10 × 1	10	(100)	—	—	G 1/8 A	10	(100)
	8	M10 × 1	10	(100)	—	—	G 1/8 A	10	(100)
L	6	M10 × 1	25	(250)	25	(250)	G 1/8 A	25	(250)
	8	M12 × 1,5	25	(250)	25	(250)	G 1/4 A	25	(250)
	10	M14 × 1,5	25	(250)	25	(250)	G 1/4 A	25	(250)
	12	M16 × 1,5	25	(250)	25	(250)	G 3/8 A	25	(250)
	15	M18 × 1,5	25	(250)	25	(250)	G 1/2 A	25	(250)
	18	M22 × 1,5	16	(160)	16	(160)	G 1/2 A	16	(160)
	22	M26 × 1,5	16	(160)	16	(160)	G 3/4 A	16	(160)
	28	M33 × 2	10	(100)	10	(100)	G 1 A	10	(100)
	35	M42 × 2	10	(100)	10	(100)	G 1 1/4 A	10	(100)
	42	M48 × 2	10	(100)	10	(100)	G 1 1/2 A	10	(100)
S	6	M12 × 1,5	40	(400)	63	(630)	G 1/4 A	40	(400)
	8	M14 × 1,5	40	(400)	63	(630)	G 1/4 A	40	(400)
	10	M16 × 1,5	40	(400)	63	(630)	G 3/8 A	40	(400)
	12	M18 × 1,5	40	(400)	63	(630)	G 3/8 A	40	(400)
	16	M22 × 1,5	40	(400)	40	(400)	G 1/2 A	40	(400)
	20	M27 × 2	40	(400)	40	(400)	G 3/4 A	40	(400)
	25	M33 × 2	25	(250)	40	(400)	G 1 A	25	(250)
	30	M42 × 2	16	(160)	25	(250)	G 1 1/4 A	16	(160)
	38	M48 × 2	16	(160)	25	(250)	G 1 1/2 A	16	(160)

^a With a design factor of 4 to 1.
^b With metal-to-metal sealing.
^c With elastomeric sealing.

Annex B (informative)**Bibliography**

- [1] ISO 228-2:1987, *Pipe threads where pressure-tight joints are not made on the threads — Part 2: Verification by means of limit gauges.*
- [2] ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.*
- [3] ISO 4397:1993, *Fluid power systems and components — Connectors and associated components — Nominal outside diameters of tubes and nominal inside diameters of hoses.*
- [4] ISO 4399:1977, *Fluid power systems and components — Connectors and associated components — Nominal pressures.*

Annex ZA (normative)**Normative reference to international publications with their relevant European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

Publication	Year	Title	EN	Year
ISO 286-2	1988	<i>ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits</i>	EN 20286-2	1993
ISO 1127	1992	<i>Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length</i>	EN ISO 1127	1996

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