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Metallic tube connections for fluid power and general use -- Part 3: O-ring face seal fittings

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Raccords de tubes métalliques pour transmissions hydrauliques et pneumatiques et applications générales -- Partie 3: Raccords à joints faciaux toriques

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

Part 3:
O-ring face seal fittings

(standards.iteh.ai)

*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)

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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.

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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 bar¹⁾) 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 = 10⁵Pa; 1 MPa = 1 N/mm²

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 defi-

3) To be published.

nitions 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

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.

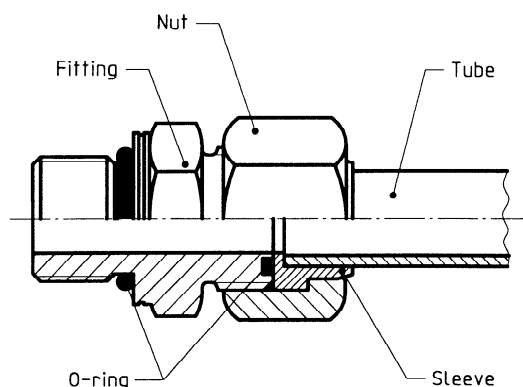


Figure 1 — Cross-section of typical O-ring face seal fitting

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 $-20\text{ }^{\circ}\text{C}$ and $+100\text{ }^{\circ}\text{C}$.

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.

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 $\pm 0,4$ mm.

Table 3 — Inch tube sizes

Tube OD		Limits of OD	
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.

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 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.

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.

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 $R_a \leq 6,3 \mu\text{m}$, 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.