
**Connections for general use and fluid
power — Ports and stud ends with
ISO 261 threads with elastomeric or
metal-to-metal sealing —**

Part 4:

**Dimensions, design, test methods and
requirements for external hex and
internal hex port plugs**

*Raccordements pour applications générales et transmissions
hydrauliques et pneumatiques — Orifices et éléments mâles à filetage
ISO 261 et joint en élastomère ou étanchéité métal sur métal —*

*Partie 4: Dimensions, conception, méthodes d'essai et exigences des
bouchons*



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Foreword

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

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

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

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

ISO 9974-4 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

ISO 9974 consists of the following parts, under the general title *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*
- *Part 2: Stud ends with elastomeric sealing (type E)*
- *Part 3: Stud ends with metal-to-metal sealing (type B)*
- *Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs*

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 can be conveyed under pressure.

Components are connected through their threaded ports by stud ends on fluid conductor fittings to tubes and pipes or to hose fittings and hoses. Fluid ports are closed by inserting a plug into the port.

For threaded ports and stud ends specified in new designs in hydraulic fluid power applications, ISO/TC 131/SC 4 recommends that the ISO 6149 series be used because these International Standards specify ports and stud ends with metric threads and O-ring sealing and because the sub-committee would like to help users by recommending one preferred system. ISO/TC 131/SC 4 further recommends that threaded ports and stud ends in accordance with the ISO 1179 series, ISO 9974 series and ISO 11926 series not be used for new designs in hydraulic fluid power applications; these International Standards are maintained because they specify ports and stud ends that are currently used in hydraulic systems worldwide.

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Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing —

Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs

1 Scope

This part of ISO 9974 specifies dimensions and performance requirements for metric external hex and internal hex port plugs for use with ISO 9974-1 ports.

Port plugs in accordance with this part of ISO 9974 can be used at working pressures up to 63 MPa (630 bar¹⁾). The permissible working pressure depends upon the plug end size, materials, design, working conditions, application, etc.

Conformance to the dimensional information in this part of ISO 9974 does not guarantee rated performance. It is important that each manufacturer perform testing according to the specification contained in this part of ISO 9974 to assure that components comply with the performance ratings.

NOTE The Introduction of this part of ISO 9974 gives recommendations for ports and stud ends to be used for new designs in hydraulic fluid power applications.

2 Normative references

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

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

ISO 261:1998, *ISO general purpose metric screw threads — General plan*

ISO 1629, *Rubber and latices — Nomenclature*

ISO 4042, *Fasteners — Electroplated coatings*

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

1) 1 bar = 0,1 MPa = 10⁵ Pa; 1 MPa = 1 N/mm².

ISO 5598²⁾, *Fluid power systems and components — Vocabulary*

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

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

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

ISO 10683, *Fasteners — Non-electrolytically applied zinc flake coatings*

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

3 Terms and definitions

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

3.1

plug

stud end without fluid passage, used to contain hydraulic fluid

4 Dimensions

4.1 Plug dimensions

External hex and internal hex plugs shall conform to the dimensions shown in Figures 1 and 2 and given in Tables 1 and 2, respectively.

4.2 Hex tolerances

External hex tolerances across flats shall be in accordance with ISO 4759-1:2000, product grade C. Minimum across corner dimensions are 1,092 times the nominal width across flats. The minimum side flat is 0,43 times the nominal width across flats. Internal hex tolerances shall conform to ISO 4759-1:2000, product grade A. Unless otherwise specified or shown, hex corners shall be chamfered 10° to 30° to a diameter equal to the width across flats, with a tolerance of $\begin{smallmatrix} 0 \\ -0,4 \end{smallmatrix}$ mm.

4.3 Screw threads

The screw threads on the plug shall be metric screw threads conforming to ISO 261:1998, class 6g.

5 Requirements

5.1 Working pressures and working temperatures

External hex and internal hex plugs conforming to this part of ISO 9974 shall be suitable for use at the working pressures given in Table 3 when used at temperatures from – 40 °C to + 120 °C. For use at pressures and/or temperatures outside of this range, the manufacturer shall be consulted.

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

Plugs conforming to this part of ISO 9974 may contain elastomeric seals. Unless otherwise specified, plugs are made and delivered with elastomeric seals for use within the specified working temperature range with petroleum-based hydraulic fluids. The use of these plugs and elastomeric seals with other hydraulic fluids can result in a reduced working temperature range or can render the plugs unsuitable for the application. Manufacturers may supply, upon request, plugs with elastomeric seals for use with hydraulic fluids other than petroleum-based hydraulic fluids that meet the specified working temperature range of the plugs.

5.2 Performance

External hex and internal hex plugs conforming to this part of ISO 9974 shall meet the burst and impulse pressures given in Table 3, and shall be capable of withstanding a vacuum of 6,5 kPa (0,065 bar) absolute pressure when tested in accordance with Clause 7.

6 Elastomeric sealing

Unless otherwise specified, for use at the pressure and temperature requirements in 5.1 and Table 3 and for testing, the elastomeric sealing shall

- be made of NBR (nitrile) with a hardness of (90 ± 5) IRHD, measured in accordance with ISO 48;
- conform to the relevant dimensions given in ISO 9974-2 (see Annex A).

7 Test methods

Port plug tests shall be conducted in accordance with ISO 19879 for burst, cyclic endurance (impulse) and vacuum tests. The qualification test torques given in Table 4 shall be used in testing. Test results shall be reported on the test data form in ISO 19879.

8 Designation of port plugs

Port plugs shall be designated by an alphanumeric code to facilitate ordering. They shall be designated by the word "Plug", then a space followed by ISO 9974-4, then a dash, followed by the shape code PLEH for external hex plug or PLIH for internal hex plug, followed by sealing code S for plugs delivered with elastomeric sealing, then a dash, followed by the plug size. If desired, the code can be supplemented by a dash followed by the elastomeric sealing material code in accordance with ISO 1629, followed by a dash, followed by the plating code in accordance with ISO 4042 or ISO 10683.

EXAMPLE 1 Plug with an external hex for an ISO 9974-1 port size M12 \times 1,5 is designated as follows:

Plug ISO 9974-4-PLIH-M12

EXAMPLE 2 Plug with an external hex for an ISO 9974-1 port size M12 \times 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6 is designated as follows:

Plug ISO 9974-4-PLIHS-M12

EXAMPLE 3 Plug with an internal hex for an ISO 9974-1 port size M12 \times 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6 but made of FKM instead of NBR is designated as follows:

Plug ISO 9974-4-PLIHS-M12-FKM

EXAMPLE 4 Plug with an internal hex for an ISO 9974-1 port size M12 \times 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6, and plated with galvanized zinc in accordance with ISO 4042 is designated as follows:

Plug ISO 9974-4-PLIHS-M12-A3C

9 Manufacture

9.1 Construction

Plugs may be made from low carbon steel by forming or machined from bar stock, unless otherwise recommended.

9.2 Workmanship

Workmanship shall conform to the best commercial practice to produce high quality plugs. Plugs shall be free from visual contaminants, all hanging burrs, loose scale and slivers which can be dislodged in use, and any other defects that can affect the function of the parts. Unless otherwise specified, surface finish on all surfaces shall be $Ra \leq 6,3 \mu\text{m}$.

9.3 Finish

The external surface and threads on all port plugs shall be protected with an appropriate coating to pass a minimum 72-h salt spray test in accordance with ISO 9227, unless otherwise agreed upon by the manufacturer and the user. Any appearance of red rust during the salt spray test shall be considered failure.

Corrosion protection requirements do not apply to corners or edges such as hex points, serrations, the crest of threads and areas where the parts are suspended or affixed in the test chamber where condensate can accumulate.

Cadmium plating is not allowed due to environmental concerns. Parts manufactured to this part of ISO 9974 shall not be cadmium plated. Changes in plating can affect assembly torques and require requalification, when applicable.

10 Procurement information

The purchaser should supply a description of the plug using the designation in accordance with Clause 8 when making an inquiry or placing an order. Deviations from the requirements of this part of ISO 9974, such as materials, pressures and temperatures, shall be agreed upon by the supplier and the purchaser.

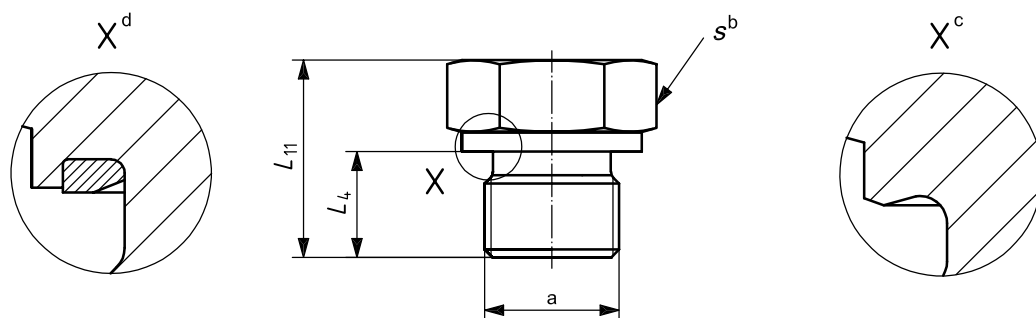
11 Marking

Port plugs shall be permanently marked with the manufacturer's name or trademark.

12 Identification statement (reference to this part of ISO 9974)

It is strongly recommended to manufacturers who have chosen to conform to this part of ISO 9974 that the following statement be used in test reports, catalogues and sales literature:

"Port plugs conform to ISO 9974-4:2006, Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs."



NOTE Stud end details in accordance with ISO 9974-2.

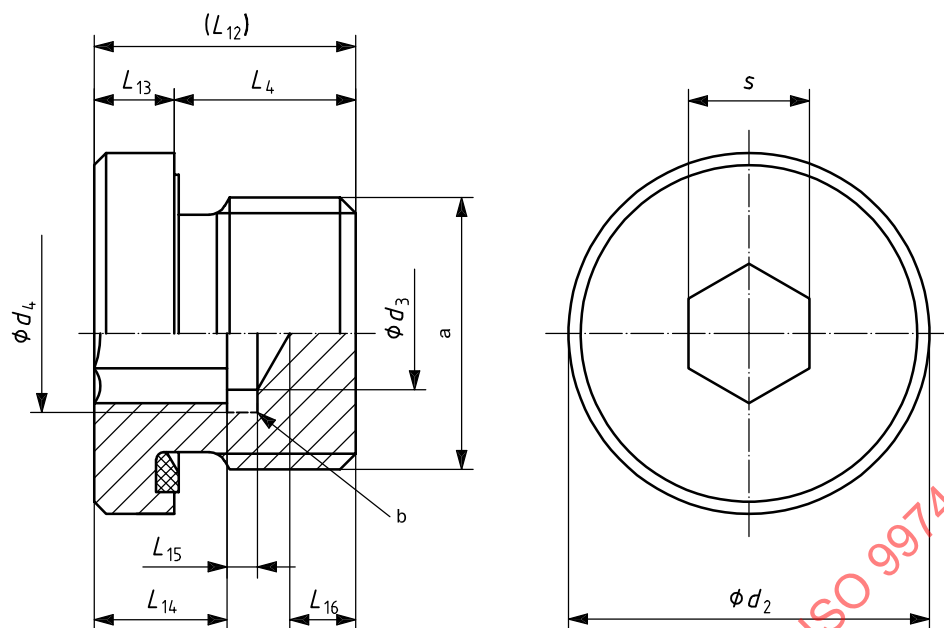
- a Screw thread ($d_1 \times P$).
- b Width across flats.
- c Type B (PLEH).
- d Type E (PLEHS).

Figure 1 — External hex port plug (PLEH and PLEHS)

Table 1 — Dimensions of external hex port plugs

Dimensions in millimetres

Screw thread ($d_1 \times P$)	L_4 $\pm 0,2$	L_{11} $\pm 0,5$	s^a	Sealing type
M8 \times 1	8	15	12	B
M10 \times 1	8	16	14	E
M12 \times 1,5	12	20	17	
M14 \times 1,5	12	20	19	
M16 \times 1,5	12	22	22	
M18 \times 1,5	12	23	24	
M20 \times 1,5 ^b	14	25	27	
M22 \times 1,5	14	26	27	
M26 \times 1,5	16	29	32	
M27 \times 2	16	29	32	
M33 \times 2	16	34	41	
M42 \times 2	16	36	50	
M48 \times 2	16	37	55	
^a See 4.2 for tolerance.				
^b For measurement applications.				



NOTE Stud end details in accordance with ISO 9974-2.

a Screw thread ($d_1 \times P$).

b Optional socket undercut $d_4 \times L_{15}$.

Figure 2 — Internal hex port plug (PLIHS)

Table 2 — Dimensions of internal hex port plugs

Dimensions in millimetres

Screw thread $(d_1 \times P)$	d_2 0 -0,2	d_3 $\pm 0,1$	d_4 +0,25 0	L_4 $\pm 0,2$	L_{12} ref.	L_{13} $\pm 0,1$	L_{14} min.	L_{15} max.	L_{16} min.	s^a	Sealing type
M10 \times 1	14	5	5,9	8	12,3	4,3	5	2	3	5	E
M12 \times 1,5	17	6	7	12	17,3	5,3	7	2	3	6	
M14 \times 1,5	19	6	7	12	17,3	5,3	7	2	3	6	
M16 \times 1,5	22	8	9,3	12	17,3	5,3	7	2	3	8	
M18 \times 1,5	24	8	9,3	12	17,3	5,3	7	2	3	8	
M20 \times 1,5 ^b	26	10	11,6	14	19,3	5,3	7,5	2	3	10	
M22 \times 1,5	27	10	11,6	14	19,3	5,3	7,5	2	3	10	
M26 \times 1,5	32	12	14	16	21,3	5,3	9	2,4	3	12	
M27 \times 2	32	12	14	16	21,3	5,3	9	2,4	3	12	
M33 \times 2	40	17	19,7	16	22,8	6,8	9	2,5	3	17	
M42 \times 2	50	22	25,5	16	22,8	6,8	10,5	2,5	3	22	
M48 \times 2	55	24	27,8	16	22,8	6,8	10,5	2,5	3	24	
^a See 4.2 for tolerance.											
^b For measurement applications.											

Table 3 — Pressures for external hex and internal hex port plugs

Thread	Plug				Test pressures			
	External hex		Internal hex					
	Working pressure ^a				Burst		Impulse ^b	
	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)
M8 × 1	63	(630)	—	—	252	(2 520)	83,8	(838)
M10 × 1	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M12 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M14 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M16 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M18 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M20 × 1,5 ^c	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M22 × 1,5	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M26 × 1,5 ^d	16	(160)	16	(160)	64	(640)	21,3	(213)
M27 × 2	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M33 × 2	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M42 × 2	25	(250)	25	(250)	100	(1 000)	33,2	(332)
M48 × 2	25	(250)	25	(250)	100	(1 000)	33,2	(332)

^a These pressures were established using plugs made of low carbon steel, when tested in accordance with the requirements of Clause 7.

^b Cyclic endurance test pressures.

^c For measurement applications.

^d Used in light-duty (L series) application only.

Table 4 — Torques for external hex and internal hex port plug qualification test

Thread	Plug	
	external hex	internal hex
	Torque ^a N·m $+10_{0}^{+10} \%$	
M8 × 1	15	—
M10 × 1	20	12
M12 × 1,5	30	25
M14 × 1,5	45	35
M16 × 1,5	60	50
M18 × 1,5	80	60
M20 × 1,5 ^b	100	70
M22 × 1,5	80	80
M26 × 1,5	120	120
M27 × 2	135	135
M33 × 2	225	225
M42 × 2	360	360
M48 × 2	400	400
^a For zinc-plated carbon steel, lubricated by hydraulic oil.		
^b For measurement applications.		