INTERNATIONAL STANDARD

ISO 6149-4

Second edition
2017-08

Connections for fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing —

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

Raccordements pour transmissions hydrauliques et applications générales — Orifices et éléments mâles à filetage métrique ISO 261 et joint torique —

Partie 4: Dimensions, conception, méthodes d'essai et exigences des bouchons d'orifice à six pans externes et à six pans internes

Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 131, *Fluid power systems*, SC 4, *Connectors and similar products and components*.

This second edition cancels and replaces the first edition (ISO 6149-4:2006), of which it constitutes a minor revision.

The main change since last version is the addition of a warning statement about the hazards of intermixing of stud ends with the various port types.

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 connectors to tubes and pipes or to hose fittings and hoses. Fluid ports are closed by inserting a plug in the port.

Connections for fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing —

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

1 Scope

This document specifies dimensions and performance requirements for external hex and internal hex port plugs for use with ISO 6149-1 ports.

Port plugs in accordance with this document can be used at working pressures up to 63 MPa (630 bar[1)]). The permissible working pressure depends upon the plug end size, materials, design, working conditions, application, etc.

Conformance to the dimensional information in this document does not guarantee rated performance. Each manufacturer is expected to perform testing according to the specification contained in this document to assure that components comply with the performance ratings.

WARNING — The use of stud ends conforming to this document with ports conforming to the relevant parts of ISO 1179, ISO 9974 and ISO 11926 could lead to a hazardous situation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 IHRD)*

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

ISO 1629, *Rubber and latices — Nomenclature*

ISO 3601-3:2005, *Fluid power systems — O-rings — Part 3: Quality acceptance criteria*

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*

ISO 5598, *Fluid power systems and components — Vocabulary*

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

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

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

ISO 7789, *Hydraulic fluid power — Two-, three- and four-port screw-in cartridge valves — Cavities*

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

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
plug
stud end with no through hole for 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 across flats shall be in accordance with ISO 4759-1:2000, product grade A. External hex corners shall be chamfered 10 ° to 30 ° to a diameter equal to the width across flats, with a tolerance of $-^{0}_{4}$ 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 document shall be suitable for use at the working pressures given in Table 3 when used at temperatures between −40 °C and +120 °C. For use at pressures and/or temperatures outside of this range, the manufacturer shall be consulted.

Plugs conforming to this document 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 document 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 O-rings

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

— conform to the dimensions shown in Figure 3 and given in Table 4, and

— meet or exceed the O-ring quality acceptance criteria for grade N of ISO 3601-3:2005. Tolerances on O-ring dimensions shall be in accordance with ISO 6149-2.

7 Test methods

Port plug tests shall be conducted in accordance with ISO 19879 for burst, cyclic endurance (impulse) and vacuum. The qualification test torques given in Table 5 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 6149-4, then a hyphen, followed by the shape code PLEH for external hex or PLIH for internal hex, followed by a hyphen, followed by the plug size, followed by the O-ring code NBR for plugs delivered with an O-ring that conforms to the requirements of Clause 6. If desired, the code may be supplemented by a hyphen followed by the plating code in accordance with ISO 4042 or ISO 10683, followed by hyphen, followed by the O-ring material code in accordance with ISO 1629.

EXAMPLE 1 Plug with an external hex for an ISO 6149-1 port size M12 × 1,5 shall be designated as follows:

Plug ISO 6149**-4-PLEH-M12**

EXAMPLE 2 Plug with an external hex for an ISO 6149-1 port size M12 × 1,5, ordered assembled with an O-ring that conforms to the requirements of Clause 6 shall be designated as follows:

Plug ISO 6149**-4-PLEH-M12-NBR**

EXAMPLE 3 Plug with an external hex for an ISO 6149-1 port size M12 × 1,5, ordered assembled with an O-ring that conforms to the requirements of Clause 6 but made of FKM instead of NBR shall be designated as follows:

Plug ISO 6149**-4-PLEH-M12-FKM**

EXAMPLE 4 Plug with an external hex for an ISO 6149-1 port size M12 × 1,5, ordered galvanized zinc coated in accordance with ISO 4042 and assembled with an O-ring that conforms to the requirements of Clause 6 but made of FKM instead of NBR shall be designated as follows:

Plug ISO 6149**-4-PLEH-M12-A3C-FKM**

9 Identification

External hex plugs shall be identified in accordance with the identification required for non-adjustable stud ends in ISO 6149-2. Internal hex plugs shall be identified as shown in Figure 2.

10 Manufacture

10.1 Construction

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

10.2 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 that 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 $Ra \leq 6{,}3$ µm.

10.3 Finish

The external surface and threads of all carbon steel parts shall be plated or coated with a suitable material that passes a 72 h neutral salt spray test in accordance with ISO 9227, unless otherwise agreed upon by the manufacturer and the user. Any appearance of red rust during the salt spray test on any area, except those noted below, shall be considered failure:

— edges, such as hex points, serrations and crests of threads, where there can be mechanical deformation of the plating or coating typical of mass-produced parts or shipping effects;

— areas where there is mechanical deformation of the plating or coating caused by crimping, flaring, bending and other post-plate metal forming operations;

— areas where the parts are suspended or affixed in the test chamber where condensate can accumulate. Internal fluid passages shall be protected from corrosion during storage.

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

11 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 document, such as materials, pressures and temperatures, shall be agreed upon by the supplier and the purchaser.

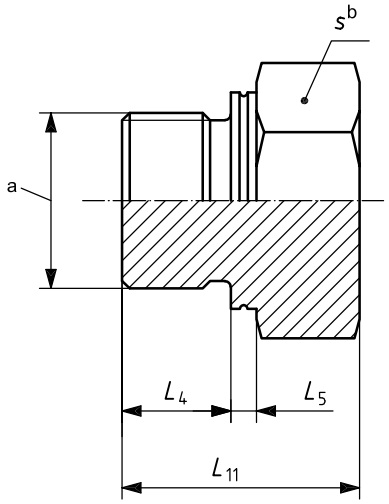
12 Marking

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

13 Identification statement (reference to this document)

It is strongly recommended to manufacturers who have chosen to conform to this document that they use the following statement in test reports, catalogues and sales literature:

"Port plugs conform to ISO 6149-4:2017, *Connections for fluid power and general use — Ports and stud ends with* ISO 261 *metric threads and O-ring sealing — Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs.*"



Key

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

b Width across flats.

NOTE Stud end in accordance with ISO 6149-2.

Figure 1 — External hex port plug (PLEH)

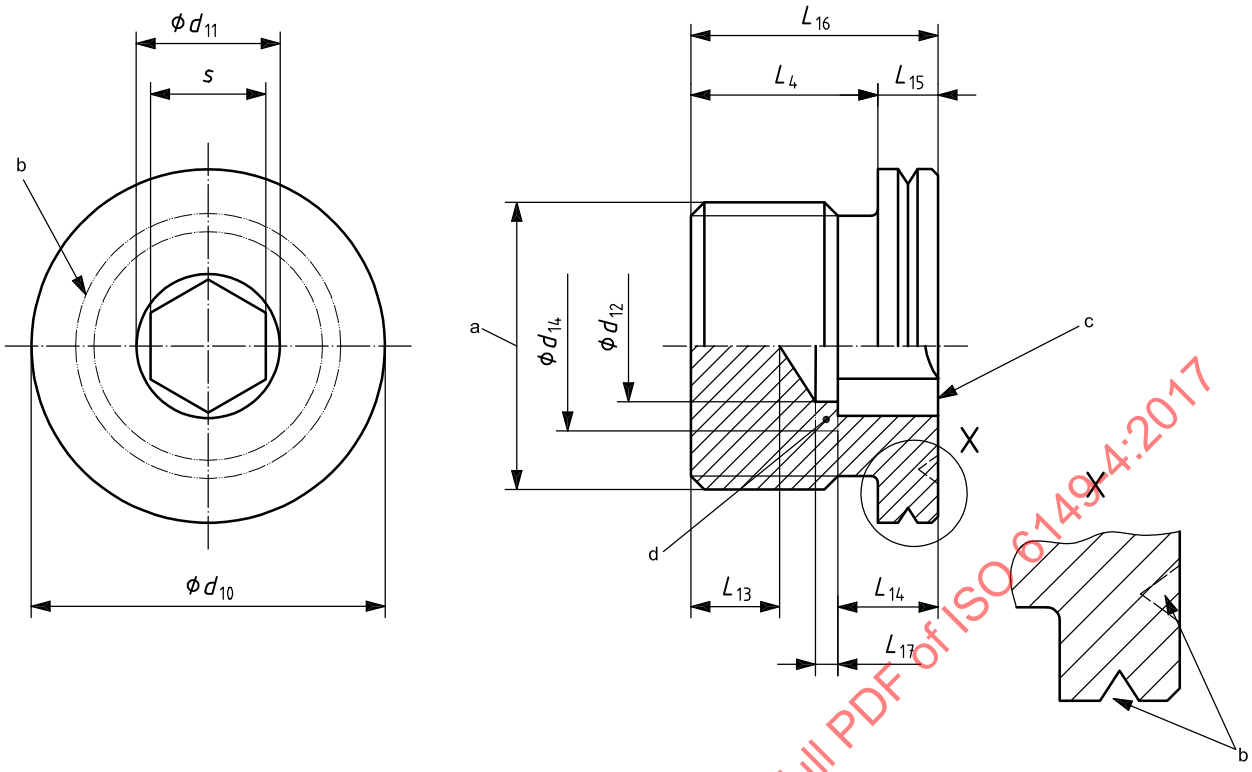
Table 1 — Dimensions of external hex port plugs

Dimensions in millimetres

Screw threads ($d_1 \times P$)	L_4 ref.	L_5 ref.	L_{11} ± 0,5	s[a]
M8 × 1	9,5	1,6	16,5	12
M10 × 1	9,5	1,6	17	14
M12 × 1,5	11	2,5	18,5	17
M14 × 1,5	11	2,5	19,5	19
M16 × 1,5	12,5	2,5	22	22
M18 × 1,5	14	2,5	24	24
M20 × 1,5[b]	14	2,5	25	27
M22 × 1,5	15	2,5	26	27
M27 × 2	18,5	2,5	31,5	32
M30 × 2	18,5	2,5	33	36
M33 × 2	18,5	3	34	41
M42 × 2	19	3	36,5	50
M48 × 2	21,5	3	40	55
M60 × 2	24	3	44,5	65

a See 4.2 for tolerances.

b For cartridge valve cavity applications only (see ISO 7789).



Key

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

b Identification groove 1 mm wide × 0,25 mm deep, of optional shape, located on the shoulder of the diameter, d_{10}, either near the middle of its width, l_{15}, or on the top surface, required for the identification of ISO 6149-2 metric stud end. As an option, the groove may be located on the top surface of the plug.

c Socket countersink 90° × diameter d_{11}.

d Optional socket undercut, $d_{14} \times L_{17}$.

NOTE Stud end in accordance with ISO 6149-2.

Figure 2 — Internal hex port plug (PLIH)

Table 2 — Dimensions of internal hex port plugs

Dimensions in millimetres

Screw threads ($d_1 \times P$)	d_{10} ±0,2	d_{11} $+^{0,25}_{0}$	d_{12} $+^{0,13}_{0}$	d_{14} $+^{0,25}_{0}$	L_4 ref.	L_{13} min.	L_{14} min.	L_{15} $-^{0}_{0,25}$	L_{16} ref.	L_{17} max.	s[a]
M8 × 1	11,8	4,6	4	4,7	9,5	3	5	3,5	13	2,1	4
M10 × 1	13,8	5,8	5	5,9	9,5	3	5,5	4	13,5	2,1	5
M12 × 1,5	16,8	6,9	6	7	11	3	7,5	4,5	15,5	2,5	6
M14 × 1,5	18,8	6,9	6	7	11	3	7,5	5	16	2,5	6
M16 × 1,5	21,8	9,2	8	9,3	12,5	3	8,5	5	17,5	2,5	8
M18 × 1,5	23,8	9,2	8	9,3	14	3	8,5	5	19	2,5	8
M20 × 1,5 [b]	26,8	11,5	10	11,6	14	3	8,5	5	19	2,9	10
M22 × 1,5	26,8	11,5	10	11,6	15	3	8,5	5	20	2,9	10

a See 4.2 for tolerance.

b For cartridge valve cavity applications only (see ISO 7789).

Table 2 *(continued)*

Screw threads ($d_1 \times P$)	d_{10} ±0,2	d_{11} $+^{0,25}_{0}$	d_{12} $+^{0,13}_{0}$	d_{14} $+^{0,25}_{0}$	L_4 ref.	L_{13} min.	L_{14} min.	L_{15} $-^{0}_{0,25}$	L_{16} ref.	L_{17} max.	s[a]
M27 × 2	31,8	13,9	12	14	18,5	3	10,5	5	23,5	3,7	12
M30 × 2	35,8	16,2	14	16,3	18,5	3	11	6	24,5	3,7	14
M33 × 2	40,8	16,2	14	16,3	18,5	3	11	6	24,5	3,7	14
M42 × 2	49,8	19,6	17	19,7	19	3	11	6	25	3,7	17
M48 × 2	54,8	19,6	17	19,7	21,5	3	11	6	27,5	3,7	17
M60 × 2	64,8	21,9	19	22	24	3	12	6	30	3,7	19

[a] See 4.2 for tolerance.

[b] For cartridge valve cavity applications only (see ISO 7789).

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

Thread	External hex port plugs			Internal hex port plugs		
	Working pressure[a]	Test pressures		Working pressure[a]	Test pressures	
		Burst	Impulse[b]		Burst	Impulse[b]
	MPa (bar)	MPa (bar)	MPa (bar)	MPa (bar)	MPa (bar)	MPa (bar)
M8 × 1	63 (630)	252 (2 520)	84 (840)	42 (420)	168 (1 680)	56 (560)
M10 × 1	63 (630)	252 (2 520)	84 (840)	42 (420)	168 (1 680)	56 (560)
M12 × 1,5	63 (630)	252 (2 520)	84 (840)	42 (420)	168 (1 680)	56 (560)
M14 × 1,5	63 (630)	252 (2 520)	84 (840)	63 (630)	252 (2 520)	84 (840)
M16 × 1,5	63 (630)	252 (2 520)	84 (840)	63 (630)	252 (2 520)	84 (840)
M18 × 1,5	63 (630)	252 (2 520)	84 (840)	63 (630)	252 (2 520)	84 (840)
M20 × 1,5[c]	40 (400)	160 (1 600)	52 (520)	40 (400)	160 (1 600)	52 (520)
M22 × 1,5	63 (630)	252 (2 520)	84 (840)	63 (630)	252 (2 520)	84 (840)
M27 × 2	40 (400)	160 (1 600)	52 (520)	40 (400)	160 (1 600)	52 (520)
M30 × 2	40 (400)	160 (1 600)	52 (520)	40 (400)	160 (1 600)	52 (520)
M33 × 2	40 (400)	160 (1 600)	52 (520)	40 (400)	160 (1 600)	52 (520)
M42 × 2	25 (250)	100 (1 000)	33 (330)	25 (250)	100 (1 000)	33 (330)
M48 × 2	25 (250)	100 (1 000)	33 (330)	25 (250)	100 (1 000)	33 (330)
M60 × 2	25 (250)	100 (1 000)	33 (330)	25 (250)	100 (1 000)	33 (330)

[a] These pressures were established using plugs made of low carbon steel.

[b] Cyclic endurance test pressure.

[c] For cartridge valve cavity applications only (see ISO 7789).

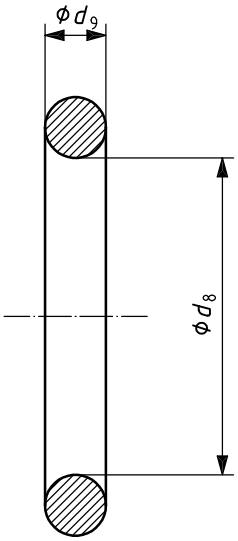


Figure 3 — O-ring

Table 4 — O-ring sizes

Dimensions in millimetres

Thread	O-ring size $d_8 \times d_9$
M8 × 1	6,1 × 1,6
M10 ×1	8,1 × 1,6
M12 × 1,5	9,3 × 2,2
M14 × 1,5	11,3 × 2,2
M16 × 1,5	13,3 × 2,2
M18 × 1,5	15,3 × 2,2
M20 × 1,5	17,3 × 2,2
M22 × 1,5	19,3 × 2,2
M27 × 2	23,6 × 2,9
M30 × 2	26,6 × 2,9
M33 × 2	29,6 × 2,9
M42 × 2	38,6 × 2,9
M48 × 2	44,6 × 2,9
M60 × 2	56,6 × 2,9
NOTE For complete dimensional specifications for these O-rings, see ISO 6149-2.	