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Third edition
2018-03

Hydraulic fluid power — Flange connections with split or one-piece flange clamps and metric or inch screws —

Part 2: Flange connectors, ports and mounting surfaces for use at a pressure of 42 MPa (420 bar), DN 13 to DN 76

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Transmissions hydrauliques — Raccordements à bride avec demi-brides ou bride monobloc et vis métriques ou en inches —

Partie 2: Brides, orifices et surfaces de montage pour utilisation à une pression de 42 MPa (420 bar), de DN 13 à DN 76

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Foreword

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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).

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For an explanation on 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.

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The committee responsible for this document is ISO/ TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This third edition cancels and replaces the second edition (ISO 6162-2:2012), which has been technically revised. In this edition, a new part number designation is used, the position of the identification groove is corrected, and other minor changes were made for clarification.

A list of all the parts in the ISO 6162 series can be found on the ISO website.

Changes to this addition include the following:

— restructuring the wording to follow new rules;

— changing Clause 10 Designation of flange connections and their parts to conform to the ISO/IEC Directives, Part 2;

— moving the identification groove on the flange head to reflect the correct position;

— changing the drawings to improve clarity;

— adding chamfers to the top of the O-ring groove and clarifying other chamfer notes;

— adding a perpendicular requirement to the tapped holes on the port.

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Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Components are interconnected through their ports and associated fluid conductor connector ends.

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Hydraulic fluid power — Flange connections with split or one-piece flange clamps and metric or inch screws —

Part 2: Flange connectors, ports and mounting surfaces for use at a pressure of 42 MPa (420 bar), DN 13 to DN 76

WARNING — Users of this document should ensure that suitable material is chosen for the port to maintain the required working pressure, if carbon steel is not used. In addition, flanged head material and wall thickness depend on the selected working pressure and the d_8 diameter.

1 Scope

This document gives general and dimensional specifications for flanged heads, split flange clamps (FCS and FCSM), one-piece flange clamps (FC and FCM), ports and mounting surfaces applicable to four-screw, split and one-piece flange clamp type tube connectors and hose fittings for use at a pressure of 42 MPa (420 bar[1)]). It also specifies the dimensions of the seals to be used, as well as the grooves that house the seals.

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This document also recognizes the need to accommodate metric screw fasteners (type 1) (for DN 13 to DN 76), as well as to provide a means to use existing inch screw fasteners (type 2) (for DN 13 to DN 51).

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These connections are intended for application in hydraulic systems on industrial and commercial products where it is desired to avoid the use of threaded connectors.

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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 IRHD)*

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

ISO 263, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0,06 to 6 in*

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

ISO 725, *ISO inch screw threads — Basic dimensions*

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

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

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ISO 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and designation codes*

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

ISO 4017, *Fasteners — Hexagon head screws — Product grades A and B*

ISO 4762, *Hexagon socket head cap screws*

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

ISO 7089, *Plain washers — Normal series — Product grade A*

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

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

ANSI/ASME B18.3, *Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys (Inch Series)*

ASTM A574, *Standard Specification for Alloy Steel Socket Head Cap Screws*

SAE J429, *Mechanical and Material Requirements for Externally Threaded Fasteners*

3 Terms and definitions

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

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

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

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— ISO Online browsing platform: available at http://www.iso.org/obp/3.1

4 Material

4.1 Split flange clamps (see Figure 3) and one-piece flange clamps (see Figure 4) shall be ferrous material with the following properties in the finished condition:

— minimum yield strength: 330 MPa;

— minimum elongation at fracture: 3 %.

4.2 Flanged heads shall be ferrous material with the following properties in the finished condition:

— minimum yield strength: 215 MPa;

— minimum elongation at fracture: 10 %.

4.3 Unless otherwise specified, one of the following screw options shall be used:

a) hexagon head screws conforming to ISO 4017 of property class 10.9 (minimum) in accordance with ISO 898-1, or

b) socket head screws conforming to ISO 4762 of property class 10.9 (minimum) in accordance with ISO 898-1, or

c) inch hexagon head screws conforming to SAE J429 of grade 8 (minimum), or

d) inch socket head screws conforming to the product specifications of ANSI/ASME B18.3 and made of material conforming to ASTM A574.

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4.4 Unless otherwise specified, the O-rings shall be made of NBR (nitrile) with a hardness of (90 ± 5) IRHD, measured in accordance with ISO 48, for use at the pressure and temperature requirements given in Clause 8 and Table 1 or Table 2, and for testing. The O-rings specified in Tables 1 and 2 shall conform to the dimensions given in ISO 3601-1 for the relevant size code, conform to tolerance class A in ISO 3601-1 and shall meet or exceed the O-ring quality acceptance criteria for grade N of ISO 3601-3. If the flange connection is expected to be used at temperatures higher than specified in Clause 8, O-rings made of materials that meet the higher temperature requirements shall be used.

4.5 Connectors conforming to this document contain elastomeric seals. Unless otherwise specified, connectors are made and delivered with elastomeric seals for use within the specified working temperature range with petroleum base hydraulic fluids. The use of these connectors and elastomeric seals with other hydraulic fluids might result in a reduced working temperature range or might render the connectors unsuitable for the application. Upon request, manufacturers may supply connectors with elastomeric seals which are intended for use with non-petroleum base hydraulic fluid and which meet the specified working temperature range of the connectors.

4.6 The surface pressure between the screw head and the flange clamp should be considered. The use of hardened washers is recommended; however, flange connections conforming to previous editions of ISO 6162-2 might not accommodate the use of this type of washer. Washers, if used, shall conform to ISO 7089 (HV 300) type A and be sized for the corresponding screw. Plain washers conforming to ANSI/ASME B18.22.1, type B narrow series HV 300, may be substituted when using type 2 screws; see Tables 1 and 2 for exceptions.

5 Selection

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5.1 Ensure that the flange connection needs to conform to ISO 6162-2, taking into account the maximum working pressure and the dimensional differences between ISO 6162-1 and ISO 6162-2. Parts shall not be interchanged between flange connections that conform to ISO 6162-1 and 6162-2.

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NOTE See 9.1 b) for the method of identifying flanged heads that conform to this document.

5.2 For new design, select the flange connector size by the nominal flange size that corresponds to the maximum diameter of the bore through the flanged head (dimension d_2) or the flange pad (dimension d_1).

5.3 Match the nominal flange sizes for the clamp, port, and flanged head.

5.4 Select either type 1 (for use with either metric or inch screws) or type 2 (for use with inch screws only), split (FCS or FCSM) or one-piece (FC or FCM) flange clamps and ports, depending on whether metric or inch screw fasteners are required. Type 2 (inch) flange ports and assemblies shall not be used for new designs in hydraulic fluid power.

NOTE The selection of the flanged head and O-ring is not affected by the difference in metric or inch screw fasteners.

5.5 Select screws, O-rings, and washer sizes corresponding to the nominal flange size and from the tables corresponding to type 1 (Table 1) or type 2 (Table 2).

5.6 To match an existing pad, measure the bolt pattern dimensions L_7 and L_{10} (see Figure 6), and determine screw type to select the proper flanged head and clamp. To avoid interchange between flange connections conforming to ISO 6162-1 and ISO 6162-2, the pattern should be measured with an accuracy of 1 mm or less.

5.7 To match an existing flanged head, measure the diameter d_{10} and thickness L_{14} (see Figure 5) with an accuracy of 0,5 mm or less.

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5.8 Select between a one-piece flange clamp (FC or FCM) or a split flange clamp (FCS or FCSM).

6 Dimensions and tolerances

6.1 Dimensions of type 1 flange assemblies, including screws, shall be in accordance with Figure 1 (for split flange clamp) or Figure 2 (for one-piece clamp) and Table 1. Dimensions of type 2 flange assemblies, including screws, shall be in accordance with Figure 1 (for split flange clamp) or Figure 2 (for one-piece clamp) and Table 2.

6.2 Dimensions of split flange clamps shall be in accordance with Figure 3 and Table 3. Dimensions of one-piece flange clamps shall be in accordance with Figure 4 and Table 3. A maximum draft angle of 6° from surface B as shown in Figure 3 or Figure 4 or from the middle of the side each way is allowed.

6.3 Dimensions of flanged heads shall be in accordance with Figure 5 and Table 4.

6.4 Dimensions of ports for flange connections and flange pad widths shall be in accordance with Figure 6 and Table 5.

6.5 Dimensions of O-rings shall be in accordance with ISO 3601-1; Tables 1 and 2 provide the size code in accordance with ISO 3601-1.

6.6 Unless otherwise specified, tolerances shall be in accordance with ISO 2768-1, class designation m (medium).

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6.7 Dimensions and tolerances given in the tables apply to the finished parts, plated or otherwise processed, as specified by the purchaser.

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7 Corrosion protection

7.1 The external surface of all carbon steel flange clamps and carbon steel flanged heads, except weld-on flanged heads, 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 supplier and purchaser. Weld-on flanged heads shall be protected from corrosion by an oil film, phosphate coating or by other means that do not negatively affect weldability. This protection shall meet or exceed a 16-h neutral salt spray test in accordance with ISO 9227, unless otherwise agreed upon by the supplier and purchaser.

7.2 Screws and washers shall be protected from corrosion by an oil film, phosphate coating, or other means that do not encourage hydrogen embrittlement, to meet or exceed the requirements of a 16-h neutral salt spray test in accordance with ISO 9227.

NOTE The torque values specified in this document were determined using phosphate-coated screws.

7.3 Any appearance of red rust during the above salt spray tests shall be considered a failure, except for the following:

— all internal passages;

— 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 and condensate can accumulate.

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7.4 Parts conforming to this document shall not be cadmium plated. Hexavalent chromate coatings are not preferred for commercial and industrial usage for environmental reasons. Changes in plating can affect assembly torques and require requalification.

7.5 Internal fluid passages shall be protected from corrosion during storage and shipping.

7.6 All connection components shall be free from all hanging burrs, loose scale and slivers that might become dislodged in use, and from all other defects that might affect their serviceability. All machined surfaces shall have a surface roughness value of ISO 1302-MRR Ramax 6,3, except where otherwise specified.

7.7 A smooth sealing surface shall be provided. Annular (circumferential) tool marks up to a surface roughness value of ISO 1302-MRR Ramax 3,2 are acceptable. Scratches with a width greater than 0,13 mm running perpendicular, radial, or spiral to the connector inside diameter on the bottom and outside diameter of the O-ring groove are not acceptable.

7.8 For more specific finish requirements, see Figures 1 to 6.

8 Pressure/temperature requirements

8.1 Flange connections conforming to this document shall be subjected to the burst and cyclic endurance tests specified in ISO 19879 to verify that they meet the specified pressure/temperature requirements. Surges of pressure higher than the nominal ratings can reduce the ability of the flange connections to retain the hydraulic fluid. This needs to be taken into account in the design of the hydraulic system.

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8.2 Flange connections conforming to this document and made of carbon steel shall be suitable for use at the working pressures given in Tables 1 and 2 when used at temperatures between −40 °C and +120 °C. Flange connections conforming to this document shall not be assembled at temperatures lower than −20 °C.

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8.3 Flange connections conforming to this document and made of stainless steel shall be suitable for use at the working pressures given in Tables 1 or 2 when used at temperatures between −60 °C and +50 °C. Working pressure for connectors made from stainless steel and used at elevated temperatures shall be reduced by 4 % for temperatures from +50 °C up to 100 °C, by 11 % for temperatures from +100 °C up to 200 °C, and by 20 % for temperatures from +200 °C to 250 °C. Flange connections conforming to this document shall not be assembled at temperatures lower than −20 °C.

9 Marking

9.1 The flanged head shall be permanently marked, at the minimum, with the following:

a) the manufacturer's name or trademark;

b) an identification groove 1 mm to 1,5 mm wide and 0,5 mm to 0,75 mm deep, of optional shape, located on the circumference of the flange disk starting at a distance (L_{14} - 3) mm from the face, i.e. reference datum "B", can be used to identify flanged heads that conform to this document. This groove is optional on flanged heads manufactured before 2019-01-01 and shall be mandatory on and after that date.

NOTE Flanged heads for use at 42 MPa (420 bar) that conform to ISO 6162:1994 or ISO 6162-2:2012 do not have this groove.

9.2 Only size DN 25 type 1 (metric) FCM and FCSM clamps shall be permanently marked with the letter "M" for identification, to denote use of metric screws. Letter height shall be 5 mm minimum. Location of the marking may differ from the location shown in Figures 3 and 4. Marking shall be on the topside or

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