BS ISO 6162-1:2012



BSI Standards Publication

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

Part 1: Flange connectors, ports and mounting surfaces for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127

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National foreword

This British Standard is the UK implementation of ISO 6162-1:2012. It supersedes BS ISO 6162-1:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/18/-/4, Connectors and associated components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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INTERNATIONAL STANDARD

ISO 6162-1

Second edition
2012-12-15

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

Part 1: Flange connectors, ports and mounting surfaces for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127

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

Partie 1: Brides, orifices et surfaces de montage pour utilisation à des pressions de 3,5 MPa (35 bar) à 35 MPa (350 bar), DN 13 à DN 127

Reference number
ISO 6162-1:2012(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.

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 6162-1 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This second edition cancels and replaces the first edition (ISO 6162-1:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 6162-1:2002/Cor.1:2004. In this second edition, property class 8.8 screws in accordance with ISO 898-1 have been deleted to avoid the potential problem of a user using these screws in an application that requires screws conforming to the requirements of property class 10.9.

ISO 6162 consists of the following parts, under the general title *Hydraulic fluid power -– Flange connections with split or one-piece flange clamps and metric or inch screws*:

— *Part 1: Flange connectors, ports and mounting surfaces for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127*

— *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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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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INTERNATIONAL STANDARD

ISO 6162-1:2012(E)

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

Part 1:
Flange connectors, ports and mounting surfaces for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127

WARNING Users of this part of ISO 6162 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 part of ISO 6162 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 pressures of 3,5 MPa (35 bar[1)]) to 35 MPa (350 bar). It also specifies the dimensions of the seals to be used, as well as the grooves that house the seals.

This part of ISO 6162 also recognizes the need to accommodate metric screw fasteners (type 1), as well as to provide a means to use existing inch screw fasteners (type 2).

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.

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.

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, *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 Specification — Indications 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, *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.

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:

For nominal flange size DN 13:

— minimum yield strength: 220 MPa

— minimum elongation at fracture: 3 %

and for all other nominal flange sizes:

— minimum yield strength: 415 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

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

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.

NOTE Connectors conforming to this part of ISO 6162 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.

4.5 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 6162-1 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

5.1 Ensure that the flange connection needs to conform to ISO 6162-1, 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.

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}), 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 (dimension d_{10}) and thickness (dimension l_{14}) with an accuracy of 0,5 mm or less.

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

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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).

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

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 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 salt spray test in accordance with ISO 9227.

NOTE The torque values specified in this part of ISO 6162 were determined using phosphate-coated screws.

7.3 Any appearance of red rust during the above salt spray tests shall be considered 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.

7.4 Parts conforming to this part of ISO 6162 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.

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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 part of ISO 6162 shall be subjected to the burst and cyclic endurance tests specified in ISO 19879 to verify that they meet the specified pressure/temperature requirements.

8.2 Flange connections conforming to this part of ISO 6162 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 part of ISO 6162 shall not be assembled at temperatures lower than −20 °C.

8.3 Flange connections conforming to this part of ISO 6162 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 part of ISO 6162 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 manufacturer's name or trademark.

9.2 Only size DN 32 type 1 (metric) FCM and FSCM clamps shall be permanently marked with the letter "M" for identification, to denote the 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 outside of the flange. No identification is required for type 2 (inch) FC and FCS clamps or clamps that are intended to be used with either metric or inch screws.

NOTE This edition of ISO 6162-1 specifies screw hole dimensions that, in most cases, accommodate both metric and inch screws. In previous editions, several clamp sizes could only be used with metric screws and were marked with an "M".

9.3 Ports for type 1 (metric) flange connections shall be permanently marked with an "M" for identification. Letter height shall be 3 mm minimum. The "M" shall be imprinted and located on the centreline between holes defined by dimension l_{10} (see Figure 6) and shall not extend into the O-ring sealing area. No identification is required for ports for type 2 (inch) flange connections.

10 Designation of flange connections and their parts

NOTE Only flange clamps are typically ordered using the given designations; the designations of ports and flanged heads are used only to describe these parts, because they are features of a more complex part (e.g. manifold or connector).

10.1 Flange clamps shall be designated by

a) "Clamp";

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b) reference to this part of ISO 6162, i.e. ISO 6162-1;

c) FCS or FCSM (for split flange clamp pair) or FC or FCM (for one-piece flange clamp) and the nominal size designation, separated by a multiplication symbol without spacing.

EXAMPLES

Split flange clamp of size DN 25:

Clamp ISO 6162-1, FCS×25

One-piece flange clamp of size DN 25:

Clamp ISO 6162-1, FC×25

Split flange clamp size DN 32 to be used only with inch screws (type 2):

Clamp ISO 6162-1, FCS×32

Split flange clamp size DN 32 to be used only with metric screws (type 1):

Clamp ISO 6162-1, FCSM×32

One-piece flange clamp size DN 32 to be used only with inch screws (type 2):

Clamp ISO 6162-1, FC×32

One-piece flange clamp size DN 32 to be used only with metric screws (type 1):

Clamp ISO 6162-1, FCM×32

10.2 Flange ports shall be designated by:

a) "Port";

b) reference to this part of ISO 6162, i.e. ISO 6162-1;

c) the letter P followed by the nominal size and, if the flange ports use metric screws, the letter M (e.g. P76 or P76M).

EXAMPLES

Port for a flange connection of size 76 that uses inch screws:

Port ISO 6162-1 P76

Port for a flange connection of size 76 that uses metric screws:

Port ISO 6162-1 P76M

10.3 Flanged heads shall be designated by:

a) "Head";

b) reference to this part of ISO 6162, i.e. ISO 6162-1;

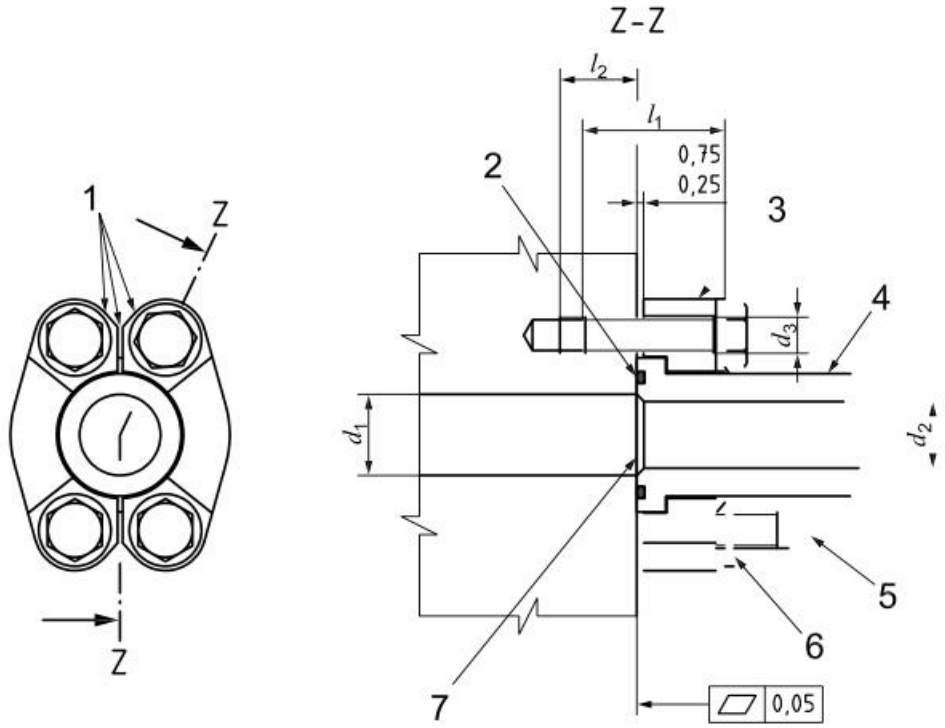
c) FH, followed by a multiplication symbol (×) and the nominal size, without any spacing (e.g. FH×76).

EXAMPLE

Flanged head for a flange connection of size DN 76:

Head ISO 6162-1, FH×76

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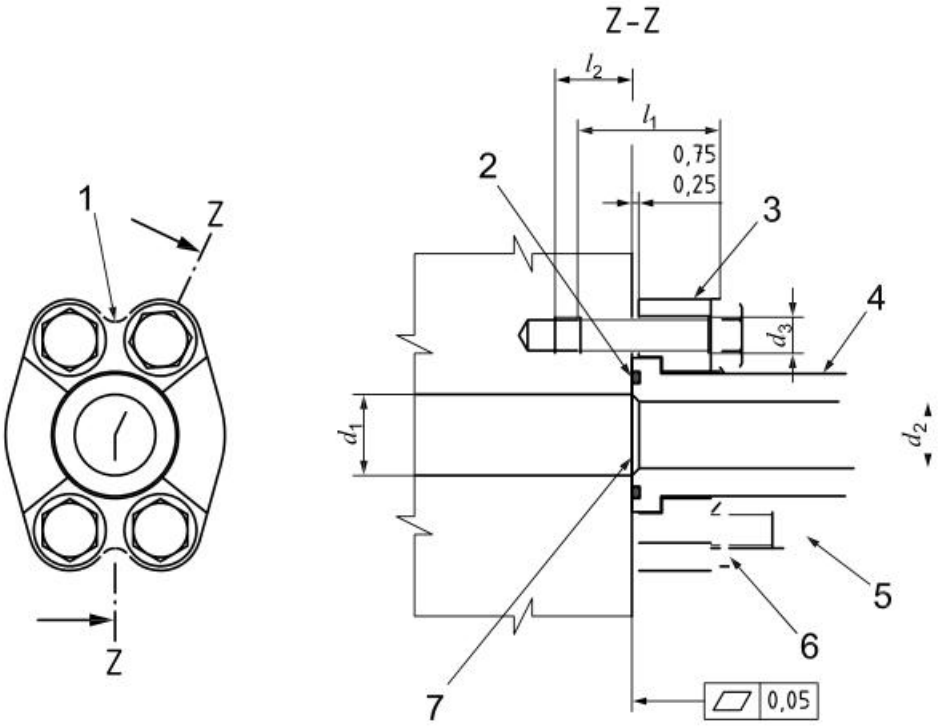


Key

1 shape optional
2 O-ring
3 split flange clamp
4 flanged head
5 screw (d_3)
6 hardened washer (recommended; see 4.5)
7 face of port on adapter, pump, etc.

Figure 1 — Assembled flange connection with split flange clamp (FCS or FCSM) (see Tables 1 and 2)

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Key

1 shape optional
2 O-ring
3 one-piece flange clamp
4 flanged head
5 screw (d_3)
6 hardened washer (recommended; see 4.5)
7 face of port on adapter, pump, etc.

Figure 2 — Assembled flange connection with one-piece flange clamp (FC or FCM) (see Tables 1 and 2)

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Table 1 — Dimensions, torques and maximum working pressures for type 1 flange assemblies for use with metric screws

Dimensions in millimetres unless noted

Nominal size DN[a]	d_1	d_2	O-ring size code[b]	Flat washer[c] (recommended)	Type 1 – metric screws of property class 10.9				Maximum working pressure	Minimum burst pressure
					d_3 Screw thread[d]	l_1 Screw length[e]	l_2 Min. full thread	Screw torque[f] N·m		
	+0 −1,5	max.						+10 % −0	MPa (bar)	MPa (bar)
13	13,0	13,0	210	M8	M8	25	16	32	35 (350)	140 (1 400)
19	19,2	19,2	214	M10	M10	30	18	70	35 (350)	140 (1 400)
25	25,6	25,6	219	M10	M10	30	18	70	32 (320)	128 (1 280)
32	32,0	32,0	222	M10[c]	M10	30	18	70	28 (280)	112 (1 120)
38	38,2	38,2	225	M12	M12	35	23	130	21 (210)	84 (840)
51	51,0	51,0	228	M12	M12	35	23	130	21 (210)	84 (840)
64	63,5	63,5	232	M12	M12	40	23	130	17,5 (175)	70 (700)
76	76,2	76,2	237	M16	M16	50	30	295	16 (160)	64 (640)
89	89,0	89,0	241	M16	M16	50	30	295	3,5 (35)	14 (140)
102	101,6	101,6	245	M16	M16	50	30	295	3,5 (35)	14 (140)
127	127,0	127,0	253	M16	M16	55	30	295	3,5 (35)	14 (140)

WARNING — It is important that all screws be lightly torqued before applying the final recommended torque values to avoid breaking the split flange clamps or one-piece flange clamps during installation (see Annex A for assembly guidelines).

[a] See definition in ISO 5598.

[b] O-ring size code in accordance with ISO 3601-1; see Annex B for reference dimensions.

[c] ANSI/ASME B18.22.1 Type B narrow washers of HV 300 quality material sized for the corresponding inch screw specified in Table 2 may be substituted for all but the DN 32 size, where a 7/16 washer in accordance with ANSI/ASME B18.22.1 might cause interference.

[d] Coarse pitch thread in accordance with ISO 261 and ISO 724.

[e] Screw lengths are calculated for steel; use of other materials can require different screw lengths.

[f] These torque values are only a guide when using lubricated screws, calculated with a coefficient of friction of 0,17. Net tightening torque depends on many factors, including lubrication, coating and surface finish.

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Table 2 — Dimensions, torques and maximum working pressures for type 2 flange assemblies for use with inch screws (not to be used for new designs – see 5.4)

Dimensions in millimetres unless noted

Nominal size DN	d_1	d_2	O-ring size code[a]	Flat washer[b] (recommended)	Type 2 – inch screws of grade 8 in accordance with SAE J429				Maximum working pressure	Minimum burst pressure
					d_3 Screw thread[c]	l_1 Screw length[d]	l_2 Min. full thread	Screw torque[e] (N·m)		
	+0 −1,5	max.			UNC	nom.		+10 % −0	MPa (bar)	MPa (bar)
13	13,0	13,0	210	M8	5/16-18	32	20	32	35 (350)	140 (1 400)
19	19,2	19,2	214	M10	3/8-16	32	22	60	35 (350)	140 (1 400)
25	25,6	25,6	219	M10	3/8-16	32	22	60	32 (320)	128 (1 280)
32	32,0	32,0	222	7/16 [b]	7/16-14	38	25	92	28 (280)	112 (1 120)
38	38,2	38,2	225	M12	1/2-13	38	27	150	21 (210)	84 (840)
51	51,0	51,0	228	M12	1/2-13	38	27	150	21 (210)	84 (840)
64	63,5	63,5	232	M12	1/2-13	44	27	150	17,5 (175)	70 (700)
76	76,2	76,2	237	M16	5/8-11	44	30	295	16 (160)	64 (640)
89	89,0	89,0	241	M16	5/8-11	51	30	295	3,5 (35)	14 (140)
102	101,6	101,6	245	M16	5/8-11	51	30	295	3,5 (35)	14 (140)
127	127,0	127,0	253	M16	5/8-11	57	30	295	3,5 (35)	14 (140)

WARNING — It is important that all screws be lightly torqued before applying the final recommended torque values to avoid breaking the split flange clamps or one-piece flange clamps during installation (see Annex A for assembly guidelines).

[a] O-ring size code in accordance with ISO 3601-1; see Annex B for reference dimensions.

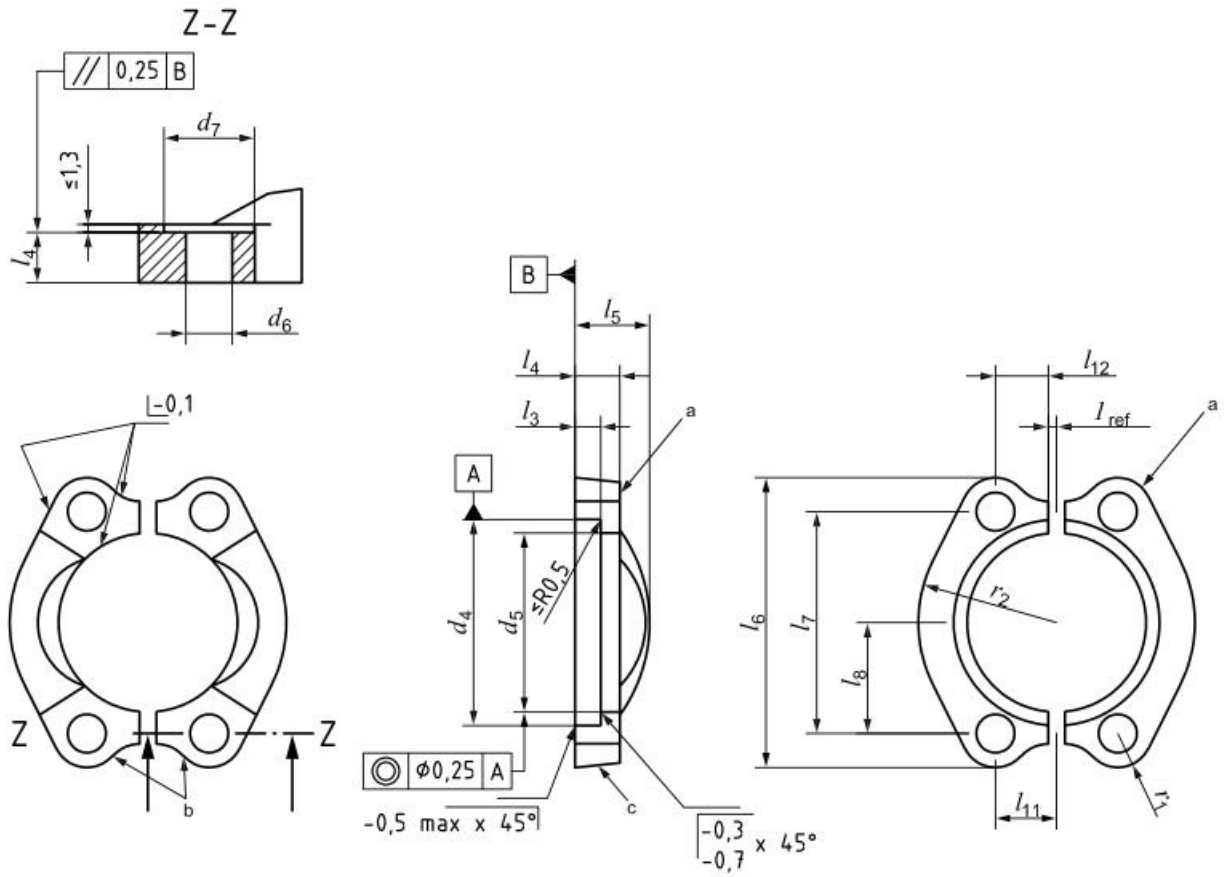
[b] ANSI/ASME B18.22.1 Type B narrow washers of HV 300 quality material for the corresponding screw size in this table may be substituted for all sizes except for DN 32, where a washer conforming to ISO 7089 might cause interference.

[c] Coarse pitch thread in accordance with ISO 263 and ISO 725 (UNC-2A for screw threads, UNC-2B for port threads).

[d] Screw lengths are calculated for steel; use of other materials can require different screw lengths.

[e] These torque values are only a guide when using lubricated screws, calculated with a coefficient of friction of 0,17. Net tightening torque depends on many factors, including lubrication, coating and surface finish.

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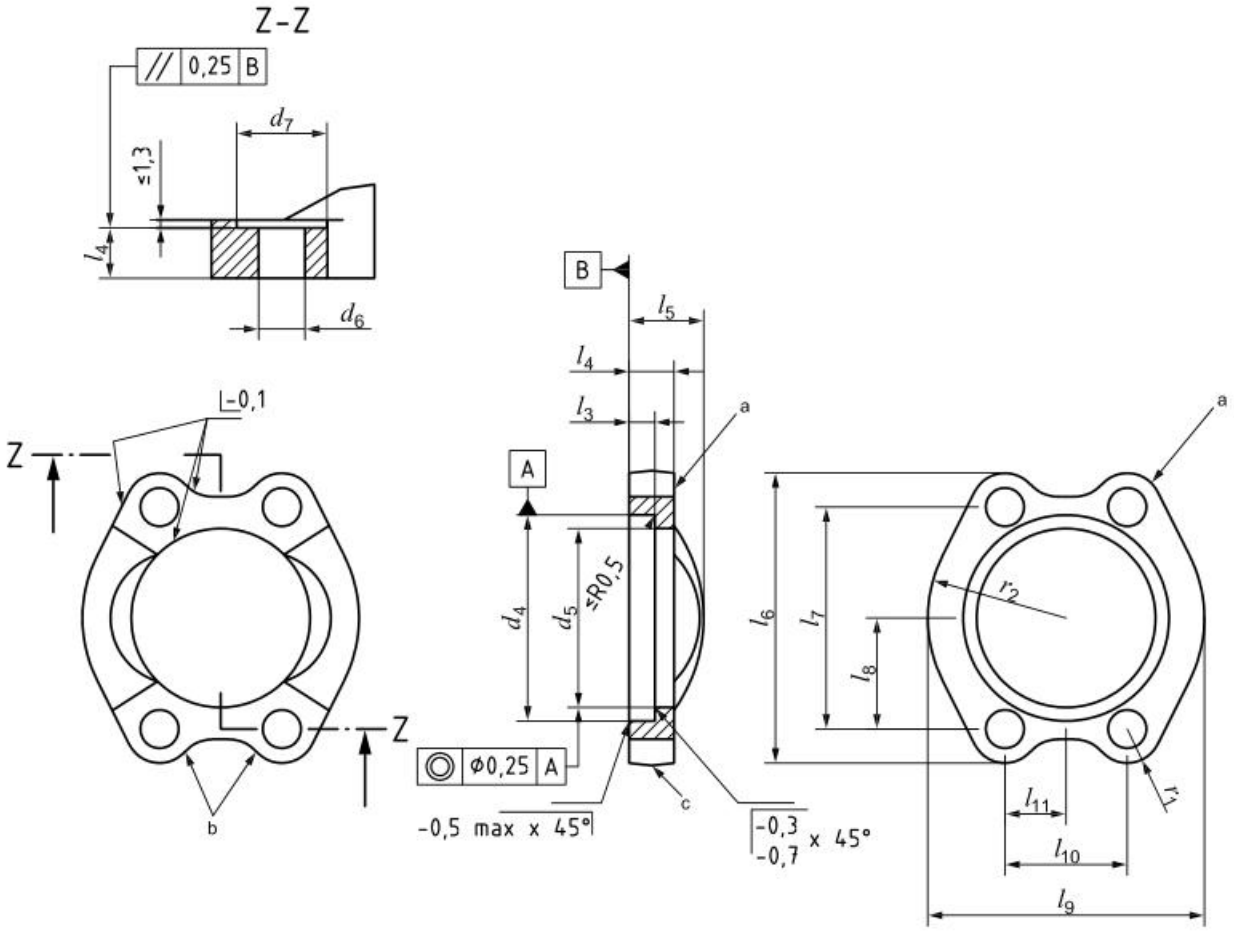
[a] Letter M to indicate that metric screws are to be used, required only for size DN 32 type 1 clamp; for alternative marking, see 9.2.

[b] Shape optional.

[c] Draft angle of 6° maximum; see Clause 6.

Figure 3 — Split flange clamp (FCS or FCSM) (see Table 3)

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[a] Letter M to indicate that metric screws are to be used, required only for size DN 32 type 1 clamp; for alternative marking, see 9.2.

[b] Shape optional.

[c] Draft angle of 6° maximum; see Clause 6.

Figure 4 — One-piece flange clamp (FC or FCM) (see Table 3)

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Table 3 — Dimensions of split and one-piece flange clamps

Dimensions in millimetres

Nominal size	d_4	d_5	d_6	d_7	l_3	l_4	l_5	l_6	
DN	±0,25	±0,25	±0,15	min	±0,15	±0,5	±0,8	max	min
13	30,95	24,25	8,9	16,5	6,2	12,7	19	54,9	53,1
19	38,90	32,15	10,6	20,5	6,2	14,2	22,5	65,8	64,3
25	45,25	38,50	10,6	20,5	7,5	15,8	24	70,6	69,1
32	51,60	43,70	10,6[a]	24,5	7,5	14,2[b]	22,5[c]	80,3	78,5
38	61,10	50,80	13,3	26	7,5	15,8	25,5	94,5	93,0
51	72,25	62,75	13,5	26	9,0	15,8	26	103,1	100,1
64	84,95	74,95	13,5	26	9,0	19,1	38	115,8	112,8
76	102,40	90,95	16,7	32,5	9,0	22,4	41	136,7	133,4
89	115,10	102,40	16,7	32,5	10,7	22,4	28,5	153,9	150,9
102	127,80	115,10	16,7	32,5	10,7	25,4	35	163,6	160,3
127	153,20	140,50	16,7	32,5	10,7	28,5	41	185,7	182,6

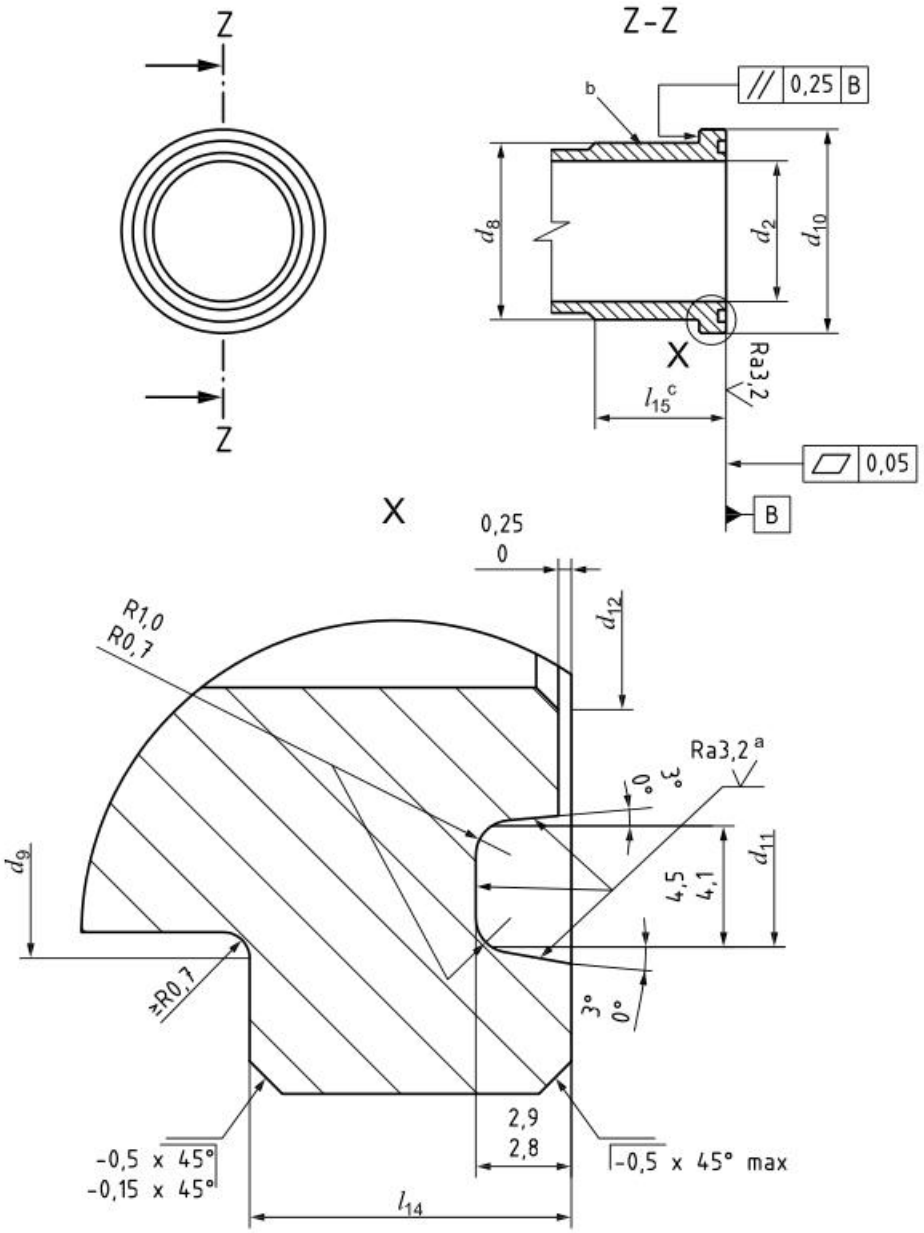
Nominal size	l_7	l_8	l_9	l_{10}	l_{11}	l_{12}	l_{13}	r_1	r_2
DN	±0,25	±0,25	±0,8	±0,25	±0,25	±0,4	±0,8	ref	ref
13	38,1	19,05	46,0	17,5	8,75	7,9	21,8	8,0	23,0
19	47,6	23,80	52,3	22,2	11,10	10,2	24,9	8,5	26,0
25	52,4	26,20	58,7	26,2	13,10	12,2	28,2	8,5	29,5
32	58,7	29,35	73,2	30,2	15,10	14,2	35,3	10,5	36,5
38	69,9	34,95	82,6	35,7	17,85	17,0	40,1	12,0	41,5
51	77,8	38,90	96,8	42,9	21,45	20,6	47,2	12,0	48,5
64	88,9	44,45	108,7	50,8	25,40	24,4	53,1	12,5	54,5
76	106,4	53,20	131,1	61,9	30,95	30,0	64,3	14,0	65,5
89	120,7	60,35	139,7	69,9	34,95	34,0	68,6	15,5	70,0
102	130,2	65,10	152,4	77,8	38,90	37,8	74,9	15,5	76,0
127	152,4	76,20	180,9	92,1	46,05	45,2	89,4	15,5	90,5

[a] For type 2 (inch), use (12 ± 0,25) mm.

[b] 15,8 is also acceptable.

[c] 24 is also acceptable.

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a 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.

b Optional contour.

c Connector design beyond l_{15} length is optional providing adequate clearance for installing screws is maintained.

Figure 5 — Flanged head (see Table 4)

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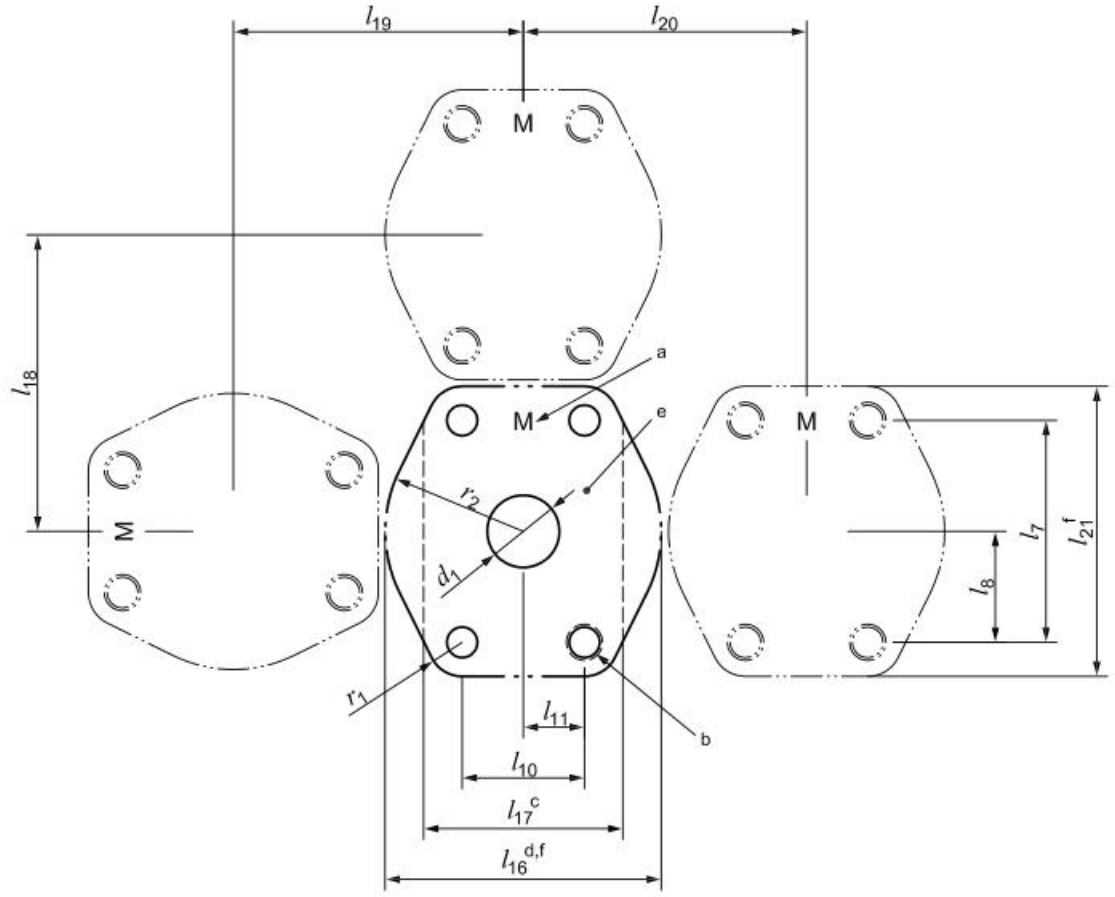
Table 4 — Dimensions of flanged heads

Dimensions in millimetres

Nominal size	d_2	d_8	d_9	d_{10}	d_{11}	d_{11}	d_{12}	l_{14}	l_{15}
DN	max	max	max	±0,25	max	min	max	±0,15	ref
13	13,0	23,9	25,3	30,20	25,53	25,40	14,2	6,8	13
19	19,2	31,8	33,2	38,10	31,88	31,75	21,0	6,8	14
25	25,6	38,1	39,5	44,45	39,75	39,62	27,0	8,0	14
32	32,0	43,2	44.6	50,80	44,58	44,45	33,3	8,0	14
38	38,2	50,3	51.7	60,35	53,98	53,72	39,6	8,0	16
51	51,0	62,2	63,6	71,40	63,50	63,25	52,3	9,6	16
64	63,5	74,2	75,6	84,10	76,33	76,07	65,0	9,6	18
76	76,2	90,2	91,6	101,60	92,08	91,82	77,7	9,6	19
89	89,0	101,6	103	114,30	104,52	104,01	90,4	11,3	22
102	101,6	114,3	115,7	127,00	117,22	116,71	103,1	11,3	25
127	127,0	139,7	141,1	152,40	142,62	142,11	129,0	11,3	28

WARNING — The flanged head material and wall thickness depend on the selected working pressure and the d_8 diameter.

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a Letter M to indicate metric type 1 port – raised surface not allowed.

b Four threaded holes of diameter d_3 on the port with full thread length l_2.

c Minimum flange pad width.

d Recommended flange pad width.

e Maximum surface roughness of port face is ISO 1302-MRR Ramax 3,2.

f Projections within this area can cause interferences.

Figure 6 — Port dimensions for flange connections and minimum and recommended flange pad widths (see Table 5)

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Table 5 — Dimensions of flange ports and flange pad widths

Dimensions in millimetres

Nominal size DN	d_1 +0 −1,5	r_1 ref	r_2 ref	d_3	l_2	l_7 ±0,25	l_8 ±0,25	l_{10} ±0,25	l_{11} ±0,25	l_{16} ref.	l_{17} min	l_{18} min	l_{19} min	l_{20} min	l_{21} min
13	13,0	8,0	23,0			38,1	19,05	17,5	8,75	50	33	59	55	51	58
19	19,2	8,5	26,0			47,6	23,80	22,2	11,10	56	41	70	63	57	69
25	25,6	8,5	29,5			52,4	26,20	26,2	13,10	63	47	75	69	64	74
32	32,0	10,5	36,5			58,7	29,35	30,2	15,10	77	53	84	81	78	83
38	38,2	12,0	41,5	See Table 1 (type 1) or Table 2 (type 2)		69,9	34,95	35,7	17,85	86	63	99	93	87	98
51	51,0	12,0	48,5			77,8	38,90	42,9	21,45	101	76	107	104	102	106
64	63,5	12,5	54,5			88,9	44,45	50,8	25,40	113	88	120	117	114	119
76	76,2	14,0	65,5			106,4	53,20	61,9	30,95	135	106	141	138	136	140
89	89,0	15,5	70,0			120,7	60,35	69,9	34,95	144	119	158	151	145	157
102	101,6	15,5	76,0			130,2	65,10	77,8	38,90	156	131	168	162	157	167
127	127,0	15,5	90,5			152,4	76,20	92,1	46,05	185	157	190	188	186	189

WARNING — Users of this part of ISO 6162 should ensure that suitable material is chosen for the port to maintain the required working pressure, if carbon steel is not used.

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Annex A
(informative)

Recommended assembly procedures and screw torque levels for flange connections conforming to ISO 6162-1

A.1 Ensure that the flange connection selected meets the requirements of the application (e.g. rated pressure).

A.2 Ensure that the flange components and ports conform to ISO 6162-1 and that the correct screws (metric for type 1 and inch for type 2) are used.

NOTE Flange connections conforming to ISO 6162-1 have a lower rated pressure than that of flange connections that conform to ISO 6162-2. The pressure rating of the flange assembly depends on the use of the correct grade of screw. The two styles are differentiated by different hole patterns, and flanged heads that conform to ISO 6162-2:2012 have an identification groove; components conforming to one part of ISO 6162 cannot be intermixed with components conforming to the other.

A.3 Ensure that all sealing and surface interfaces are free of burrs, nicks, scratches and any foreign material.

A.4 To help minimize O-ring scrub-out, lubricate the O-ring with a light coat of the hydraulic fluid used in the system or a compatible oil, when necessary. Take special care, as excess lubricant can seep out of the joint and lead to a false indication of leakage.

A.5 Position the flanged head and the flange clamps.

A.6 If used, place the hardened washers on the screws, and place the screws through the holes in the clamps.

A.7 Hand tighten the screws in the sequence shown in Figure A.1 to ensure uniform contact at all four screw locations to prevent the flange tipping, which can lead to the flange breaking during application of final torque.

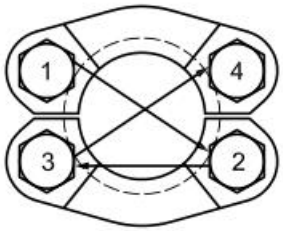


Figure A.1 — Screw tightening sequence

A.8 Torque the screws in the sequence shown in Figure A.1 in two or more increments to the recommended screw torque level selected from Tables 1 and 2 using the relevant wrench sizes in Table A.1.

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Table A.1 — Wrench sizes for assembling flange connections that conform to ISO 6162-1

Nominal size	Maximum working pressure	Type 1 (metric)			Type 2 (inch)		
		Thread	Wrench		Thread	Wrench	
			for hexagon head screw	for socket head screw		for hexagon head screw	for socket head screw
	MPa (bar)		mm	mm		in	in
13	35 (350)	M8	13	6	5/16-18	1/2	1/4
19	35 (350)	M10	16	8	3/8-16	9/16	5/16
25	31,5 (315)	M10	16	8	3/8-16	9/16	5/16
32	25 (250)	M10	16	8	7/16-14	5/8	3/8
38	20 (200)	M12	18	10	1/2-13	3/4	3/8
51	20 (200)	M12	18	10	1/2-13	3/4	3/8
64	16 (160)	M12	18	10	1/2-13	3/4	3/8
76	16 (160)	M16	24	14	5/8-11	15/16	1/2
89	3,5 (35)	M16	24	14	5/8-11	15/16	1/2
102	3,5 (35)	M16	24	14	5/8-11	15/16	1/2
127	3,5 (35)	M16	24	14	5/8-11	15/16	1/2

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Annex B
(informative)

O-ring designation codes and dimensions

Table B.1 — Designation codes and dimensions of O-rings used in ISO 6162-1 (for reference only)

ISO 3601-1 size code	ISO 3601-1 designation code	Inside diameter mm	Cross-section mm
210	O-ring-ISO3601-1-210A-18,64×3,53-N	18,64	
214	O-ring-ISO3601-1-214A-24,99×3,53-N	24,99	
219	O-ring-ISO3601-1-219A-32,92×3,53-N	32,92	
222	O-ring-ISO3601-1-222A-37,69×3,53-N	37,69	
225	O-ring-ISO3601-1-225A-47,22×3,53-N	47,22	
228	O-ring-ISO3601-1-228A-56,74×3,53-N	56,74	3,53
232	O-ring-ISO3601-1-232A-69,44×3,53-N	69,44	
237	O-ring-ISO3601-1-237A-85.32×3,53-N	85,32	
241	O-ring-ISO3601-1-241A-98,02×3,53-N	98,02	
245	O-ring-ISO3601-1-245A-110,72×3,53-N	110,72	
253	O-ring-ISO3601-1-253A-136,12×3,53-N	136,12	

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[1] ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

[2] ISO 68-2, *ISO general-purpose screw threads — Basic profile — Part 2: Inch screw threads*

[3] ISO 273, *Fasteners — Clearance holes for bolts and screws*

[4] ISO 1101, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out -– Generalities, definitions, symbols, indications on drawings*

[5] ISO 5864, *ISO inch screw threads — Allowances and tolerances*

[6] ISO 6164, *Hydraulic fluid power –– Four-screw, one piece square-flange connections for use at pressures of 25 MPa and 40 MPa (250 bar and 400 bar)*

[7] ISO 6708, *Pipework components — Definition and selection of DN (nominal size)*

[8] ISO 6892 (all parts), *Metallic materials — Tensile testing*

[9] ISO 10763, *Hydraulic fluid power — Plain-end, seamless and welded precision steel tubes — Dimensions and nominal working pressures*

[10] ISO 12151-3, *Connections for hydraulic fluid power and general use — Hose fittings — Part 3: Hose fittings with ISO 6162-1 or ISO 6162-2 flange ends*

[11] ISO 13715, *Technical drawings — Edges of undefined shape — Vocabulary and indications*

[12] ISO 80000-1, *Quantities and units — Part 1: General*

[13] SAE J515, *Specification for O-ring Materials Used with Hydraulic Connectors*

[14] ANSI/ASME B18.22.1, *Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)*

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