

**Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection  
Part 2: 42 MPa (Code 62)****RATIONALE**

Numerous changes have occurred in the industry since this standard was last updated. ISO 6162 was adopted and it added metric bolts. Over the years, SAE J518 has gone from hard inch to inch (metric referenced) and with this revision metric. The metric dimensions needed to be fine-tuned to eliminate conversion errors. The metric numbers in the SAE standard were reference numbers in the old document that moved the acceptance range by as much as 30% of the tolerance when compared to the inch numbers. At the same time, the standard is to be harmonized with the current ISO 6162-2 with the intent of incorporating the changes into an ISO 6162-2 proposed revision. To help eliminate confusion and improve the connection, a minimum of class 10.9 metric (SAE grade 8 or better) screws are now required. This revision corrects the numbers, corrects problems with the O-ring groove, increases the radius between the  $d_8$  and  $d_9$  flange head dimension, uses a common clearance hole for inch and metric bolts, adds burst pressure and other requirements, changes & recommends a washer, and numerous other changes from the 1993 revision. The pad spacing has also been changed to recognize that it could be a cavity as well as a raised or flat surface.

**FOREWORD**

In an effort to standardize within a global market and to ensure companies can remain competitive in an international market it is the intent to convert to metric units and material sizes which will:

- lead to one global system
- guide users to preferred system
- reduce complexity
- eliminate duplications
- reduce confusion

This SAE J518 standard has been split into parts:

Part 1: 3.5 MPa to 35 MPa (Code 61)

Part 2: 42 MPa (Code 62)

**1. SCOPE**

This SAE Standard covers general and dimensional specifications for the Code 62 metric (type 1) and inch (type 2) flanged heads, flange clamps (FC and FCM), and split flange clamps (FCS & FCSM) applicable to four-screw flange type tube, pipe, and hose connections. Also included are the recommended port dimensions and port design considerations. Type 2 (inch) flange clamps and split flanges are not for new design.

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The flange heads specified are incorporated into fittings having suitable means for attachment of tubes, pipes, or hoses to provide connection ends. These connections are intended for application in hydraulic systems, on industrial and commercial products, where it is desired to avoid the use of threaded connections.

The rated working pressure of an assembly shall not exceed the least of all the component working pressure rated values.

The following general specifications supplement the dimensional data contained in the tables with respect to all unspecified detail. Parts manufactured to this standard are interchangeable with ISO 6162-2 and connectors to either standard can be supplied.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners

SAE J846 Coding Systems for Identification of Fluid Conductors and Connectors

SAE J2593 Information Report for the Installation of Fluid Conductors and Connectors

#### 2.1.2 ASME Publication

Available from ASME, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, [www.asme.org](http://www.asme.org).

ASME B18.22.1 Plain Washers

ASME B18.3 2003 Socket Cap, Shoulder, and Set Screws, Hex and Spline Keys (Inch Series)

#### 2.1.3 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org)

ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM A574 Standard Specification for Alloy Steel Socket-Head Cap Screws

## 2.1.4 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002,  
Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org) or [www.iso.org](http://www.iso.org).

ISO 48	Rubber, vulcanized or thermoplastic - Determination of hardness (hardness between 10 IRHD and 100 IRHD)
ISO 261	ISO general purpose screw metric Threads - General plan
ISO 273	Fasteners - Clearance holes for bolts and screws
ISO 724	ISO general purpose metric screw threads - Basic dimensions
ISO 725	ISO general purpose 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 3601-1	Fluid power systems - O-ring - Part 1: Inside diameters, cross sections, tolerances, and designation code
ISO 3601-3	Fluid power systems - O-ring - Part 3: Quality acceptance criteria
ISO 4017	Hexagon head screws - Product grades A & B
ISO 4762	Hexagon socket head cap screws
ISO 6162-2	Hydraulic fluid power - Flange connectors with split or one-piece flange clamps and metric or inch screws - Part 2: Flange connectors for use at pressures of 42 MPa (420 bar), DN 13 to DN 73
ISO 7089	Plain washers - Normal series - Product grade A
ISO 9227	Corrosion test in artificial atmospheres - Salt spray test
ISO 10763	Hydraulic fluid power - Plain-end, seamless and welded precision steel tubes - Dimensions and nominal working pressures
ISO 19879	Metallic tube connections for fluid power and general use - Test methods for threaded hydraulic fluid power connections

## 2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

### 2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE J515 Specification for Hydraulic O-Ring Materials, Properties, and Sizes for Metric and Inch Stud Ends, Face Seal Fitting and Four-Screw Flange Tube Connections

SAE J516 Hydraulic Hose Fittings

SAE J517 Hydraulic Hose

### 2.2.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org) or [www.iso.org](http://www.iso.org).

ISO 68-1 ISO general purpose screw threads - Basic profile - Part 1: Metric screws threads

ISO 68-2 ISO general purpose screw threads - Basic profile - Part 2: Inch screw threads

ISO 225 Fasteners - Bolts, screws, studs and nuts - Symbols and designations of dimensions

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

ISO 5598 Fluid power systems and components - Vocabulary

ISO 6162-1 Hydraulic fluid power - Flange connectors with split or one-piece flange clamps and metric or inch screws - Part 1: Flange connectors for use at pressures of 3.5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127

## 3. SIZE DESIGNATION

Four-screw flange connection sizes are designated by the nominal flange size that corresponds to the maximum inside diameter of the hole through the flanged head.

## 4. DIMENSIONS AND TOLERANCES

Tabulated dimensions and tolerances shall apply to the finished parts, plated or otherwise processed, as specified by the purchaser. Tolerances on all dimensions for flanged heads, flange clamps, split flange clamps, and ports not otherwise specified shall be  $\pm 0.4$  mm. A maximum draft angle of  $6^\circ$  from surface B as shown in Figure 2A and Figure 2B or from the middle of the side each way is allowed.

## 5. MATERIAL

### 5.1 Flange Heads

Shall be made of ferrous material of the following properties:

- Minimum yield strength: 215 MPa
- Minimum elongation at fracture 10%

### 5.2 Flange Clamps and Split Flange Clamps

Shall be made from a ferrous material with the following properties:

- Minimum yield strength: 330 MPa
- Minimum elongation at fracture 3%

### 5.3 Port

Users of this part of SAE J518 should ensure that suitable material is chosen for the port to maintain the required working pressure, if carbon steel is not used.

Projections into the maximum material condition of the port can result in interferences.

Ports tapped with inch threads shall not be used for new design.

### 5.4 O-ring Seals

Connectors conforming to this International Standard use 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 can result in a reduced working temperature range or can render the connectors unsuitable for the application. Manufacturers may supply, upon request, connectors with elastomeric seals for use with hydraulic fluids other than petroleum base hydraulic fluids which meet the specified working temperature range of the connectors.

The O-rings in Tables 1A and 1B shall correspond to the size code, 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. Unless otherwise specified, the O-rings shall be of NBR (nitrile) with a hardness of  $90 \pm 5$  IRHD measured in accordance with ISO 48.

### 5.5 Screws

Unless otherwise specified, use hexagon head screws, conforming to ISO 4017, or socket head screws, conforming to ISO 4762, either of property class 10.9 (minimum), as specified in ISO 898-1, or equivalent inch (SAE J429 grade 8 hex head cap screws or ASME 18.3 socket head cap screw of ASTM A574 material) screws. Inch screws shall not be used for new design.

## 5.6 Washers

Considering the surface pressure between the screw head and the clamp, the use of hardened washers is recommended; however, flange connections conforming to previous editions of this part of SAE J518 and ISO 6162 might not accommodate the use of this type of washer. Washers, if used, shall conform to ISO 7089 (HV 300) type A and shall be sized for the corresponding screw except for the DN 25 (-16) type 2 (inch) size which shall conform to ASME 18.22.1 type B narrow (HV300). Plain washers conforming to ASME B18.22.1, type B narrow (HV300) series, may be substituted when using Type 2 screws except for the DN 25 (-16) size. The ISO 7089 washer might cause interferences if used with the inch screw in the DN 25 (-16) size.

## 6. CORROSION PROTECTION

### 6.1 External Surfaces and Threads

The external surfaces and threads of all carbon steel flanges except weld-on flanged heads shall be plated or coated with a suitable material that passes a 72-h salt spray test in accordance with ASTM B117 (ISO 9227). Any appearance of red rust during the 72-h salt spray test shall be considered failure, except for the following:

- a. All internal fluid passages.
- b. 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.
- c. Areas where there is mechanical deformation of the plating or coating caused by crimping, flaring, bending and other post-plate metal forming operations.
- d. Areas where the parts are suspended or affixed in the test chamber where condensate can accumulate.

Parts manufactured to this standard shall not be cadmium plated. Hexavalent chromate coatings are not preferred for commercial and industrial usage due to environmental reasons. Internal fluid passages shall be protected from corrosion during storage and shipping. Changes in plating or coating shall be requalified to ensure assembly torque is not affected.

### 6.2 Weld-on Flange Heads

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 to meet a 16-h neutral salt spray test in accordance with ASTM B117 (ISO 9227) unless otherwise agreed upon by the purchaser and supplier.

### 6.3 Screws and Washers

Screws and washers shall meet the requirements of a 16-h salt spray test in accordance with ASTM B117 (ISO 9227). All screws shall be phosphate coated with an oil finish unless otherwise agreed upon by the purchaser and supplier. The use of a flat washer is recommended where possible. Torque values specified in this part of SAE J518 were determined using phosphate coated, oil finished screws.

## 7. WORKMANSHIP

### 7.1 All Components

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  $R_a \max \leq 6.3 \mu\text{m}$ , except where otherwise specified.

### 7.2 Sealing Surfaces

Annular (circumferential) tool marks up to a surface roughness value of ISO 1302-MRR  $R_a \max 3.2 \mu\text{m}$  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.

7.3 Figures include additional information on surface finish and draft angle requirements.

## 8. PRESSURE / TEMPERATURE REQUIREMENTS

### 8.1 Testing

Burst test and cyclic endurance testing shall be conducted in accordance with ISO 19879 to determine that flange connectors conforming to this part of the standard meet the specified pressure/temperature requirements.

### 8.2 Temperatures—Carbon Steel

Flange connectors complying with this part of the standard and made of carbon steel shall be suitable for use at the working pressures given in table 1 when used at fluid temperatures between  $-40 \text{ }^\circ\text{C}$  and  $+120 \text{ }^\circ\text{C}$ .

Contact manufacturer concerning instructions for assembly at temperatures below  $-20 \text{ }^\circ\text{C}$ .

### 8.3 Temperatures—Stainless Steel

Flange connectors complying with this part of the standard and made of stainless steel shall be suitable for the working pressures given in table 1 when used at temperatures between  $-60 \text{ }^\circ\text{C}$  and  $+50 \text{ }^\circ\text{C}$ . Working pressure for connectors made from stainless steel and used at elevated temperatures shall be reduced:

4% above  $+50 \text{ }^\circ\text{C}$  to  $< +100 \text{ }^\circ\text{C}$

11%  $+100 \text{ }^\circ\text{C}$  to  $< +200 \text{ }^\circ\text{C}$

20%  $+200 \text{ }^\circ\text{C}$  to  $+250 \text{ }^\circ\text{C}$

Contact manufacturer concerning instructions for assembly at temperatures below  $-20 \text{ }^\circ\text{C}$ .

## 9. MARKING

### 9.1 Flange Head

The flange head should be marked at a minimum with the Manufacture's name or trademark.

### 9.2 Flange Clamp and Split Flange Clamp

Only size DN 25 (-16) type 1 (metric) clamps (FCSM & FCM) shall be marked on the topside or outside with the letter "M" with a minimum letter height of 5 mm. No identification is required for type 2 (inch) clamps (FC & FCS).

### 9.3 Ports

Type 1 (metric) ports shall be permanently marked with an "M" for identification to denote use of metric screws. Letter height shall be 3 mm minimum. The "M" shall be imprinted and located on the centerline between holes defined by  $l_{10}$  and shall not extend into the O-ring sealing area. No identification is required for type 2 (inch) ports.

## 10. INSTALLATION

Refer to SAE J2593 for installation instructions

## 11. ORDERING INFORMATION

### 11.1 Flange Clamp and Split Flange Clamp (FC, FCM, FCS, FCSM)

Flange clamps and split flange clamps ordered to this standard can be specified as shown in SAE J846.

SAE Code 62 split flange clamp, carbon steel Type 2 (Inch) - SAE J518 -\*\*-1162C; \*\* represents the dash size.

SAE Code 62 split flange clamp, carbon steel Type 1 (Metric) - SAE J518 -\*\*-11M62C; \*\* represents the dash size.

SAE Code 62 split flange clamp, stainless Type 2 (Inch) - SAE J518 -\*\*-1162S; \*\* represents the dash size.

SAE Code 62 flange clamp, carbon steel Type 2 (Inch) - SAE J518 -\*\*-0562C; \*\* represents the dash size.

EXAMPLE: A pair of Code 62 split flange clamps for use with metric screws made of carbon steel size DN 25 (-16) is:

1 pr. SAE J518-16-11M62C

### 11.2 Flange Heads

A part number for flanged heads is not shown because of the many possibilities for the other end connection. Refer to SAE J846 for specific configurations. Screws, washers, and O-rings are specified separately.

### 11.3 Port

Use the following identification statement in test reports, catalogues, and sales literature when electing to comply with this part of SAE J518:

Port conforms to SAE J518-2, Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection - Part 2: 42 MPa (Code 62)

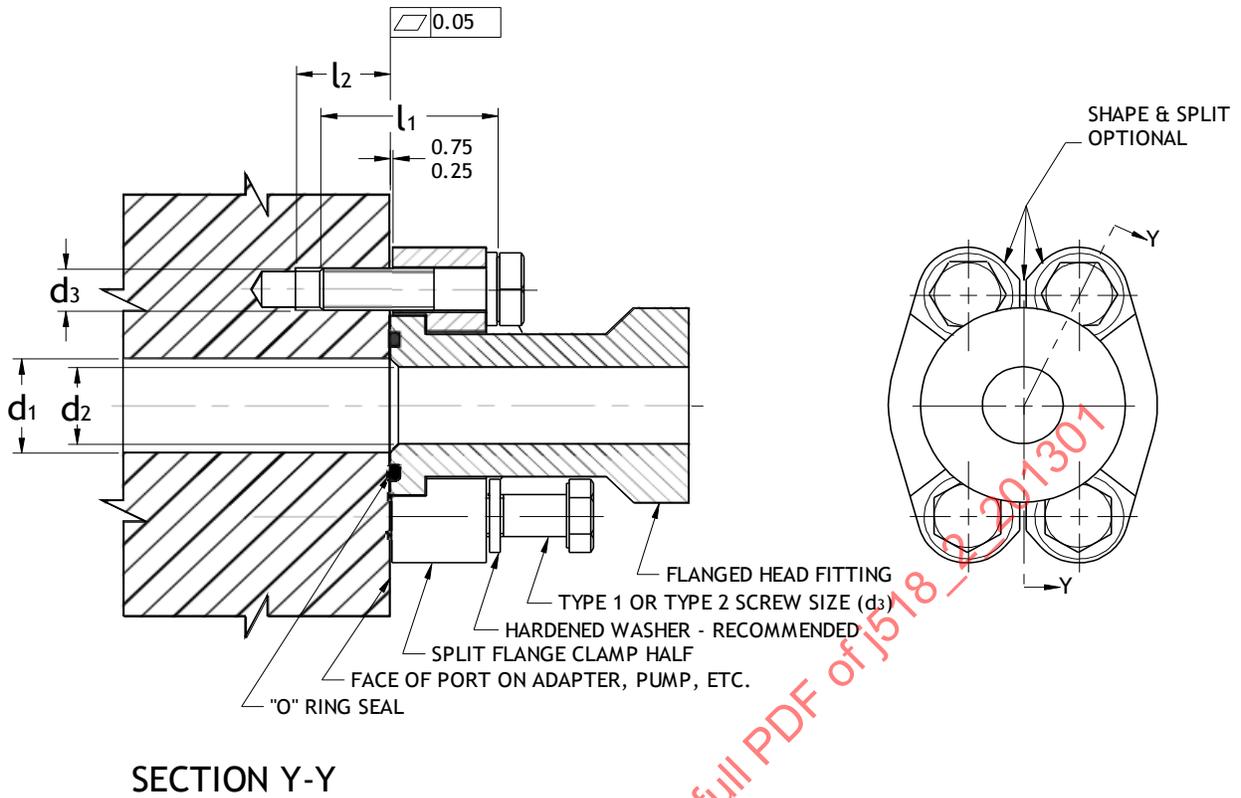


FIGURE 1A - ASSEMBLY DRAWING SPLIT FLANGE CLAMP, FLANGE HEAD, SCREWS, WASHERS, AND PORT

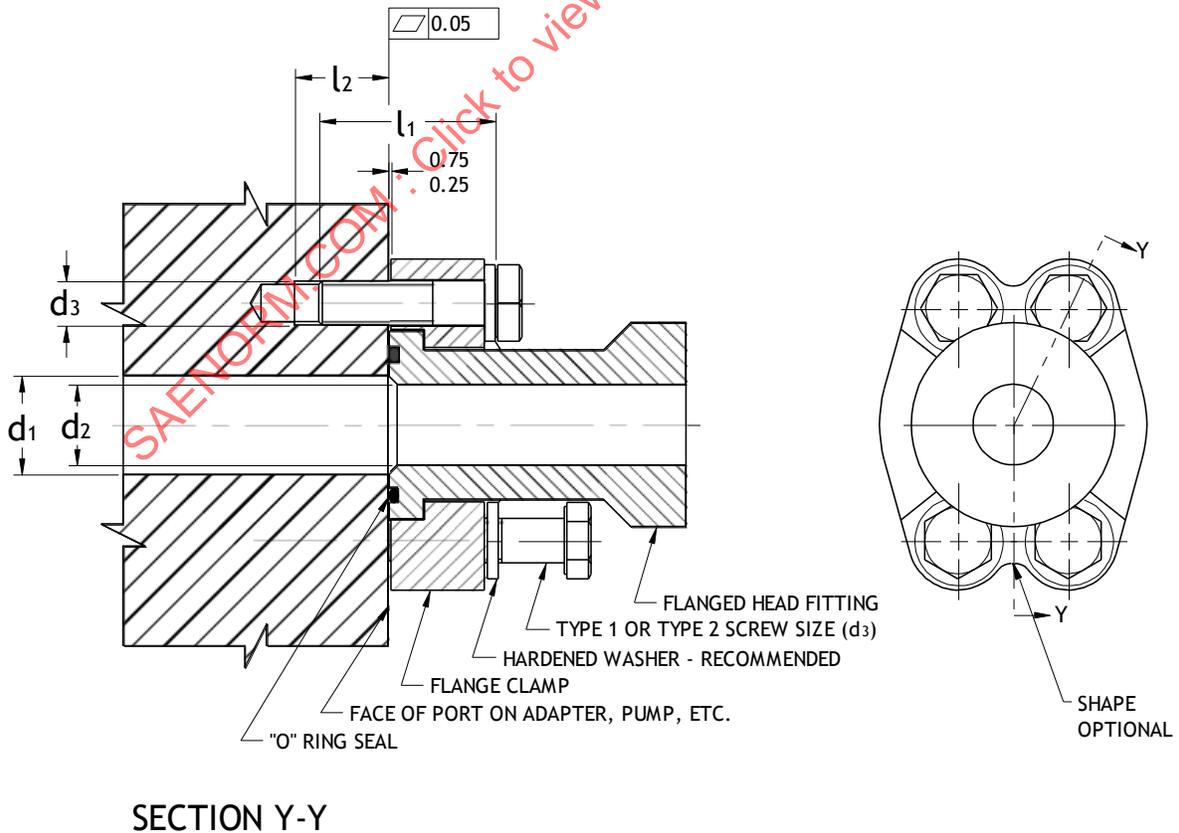


FIGURE 1B - ASSEMBLY DRAWING FLANGE CLAMP, FLANGE HEAD, SCREWS, WASHERS, AND PORT

TABLE 1A - DIMENSIONS, TORQUES, AND PRESSURES FOR CODE 62 ASSEMBLIES - TYPE 1 (METRIC)

Nominal Size		Dimensions in mm unless noted									
Metric Size	Dash Size	O-ring Size	Flat Washer <sup>g</sup> (recommended)	d <sub>1</sub> +0 / -1.5	d <sub>2</sub> max	d <sub>3</sub> Screw Thread <sup>c</sup>	l <sub>1</sub> Screw Length <sup>d</sup>	Screw Torque <sup>e</sup> Nm +10% -0	l <sub>2</sub> Minimum Full Thread	Maximum Working Pressure <sup>b</sup> MPa	Minimum Burst Pressure <sup>b</sup> MPa
13	-8	210	M8	13.0	13.0	M8	30	32	16	42	168
19	-12	214	M10	19.2	19.2	M10	35	70	18	42	168
25	-16	219	M12	25.6	25.6	M12	45	130	23	42	168
32	-20	222	M12	32.0	32.0	M12	45	130	23	42	168
38	-24	225	M16	38.2	38.2	M16	55	295	27	42	168
51	-32	228	M20	51.0	51.0	M20	70	550	35	42	168

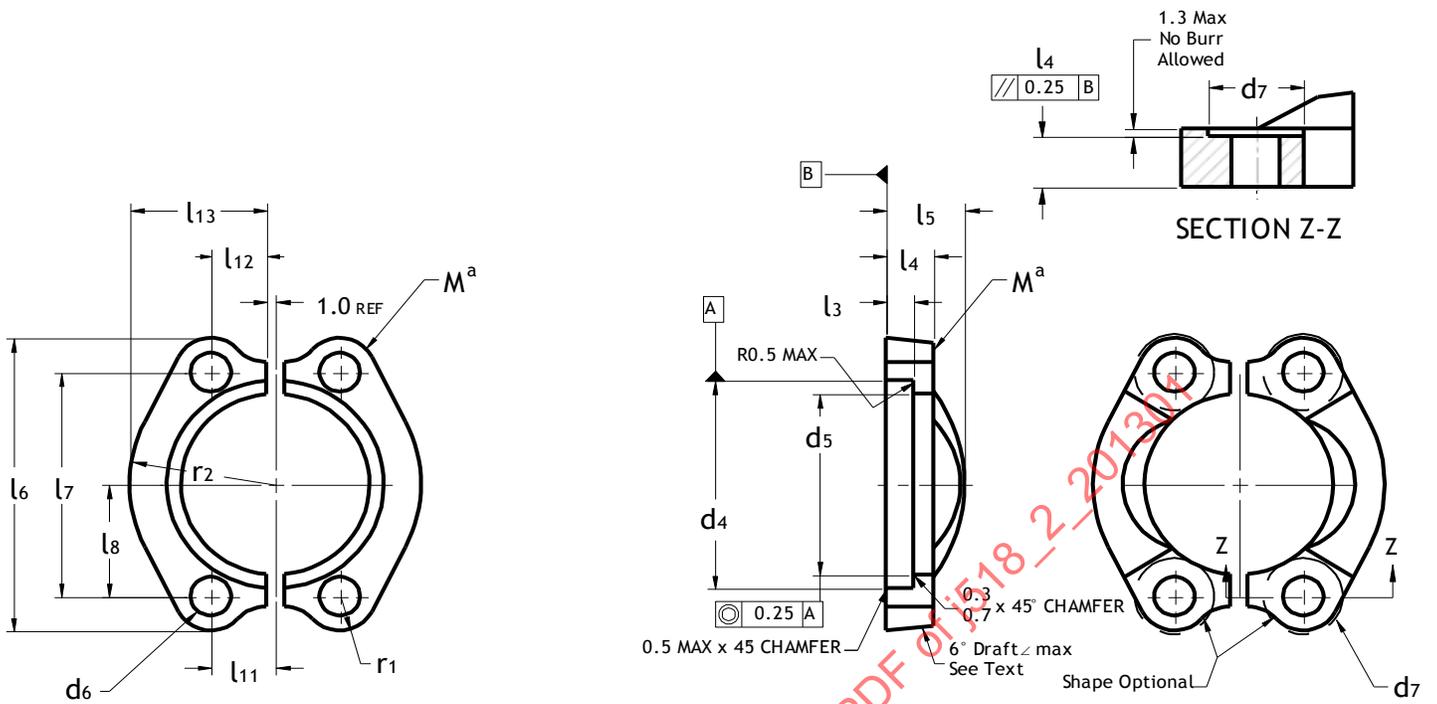
TABLE 1B - DIMENSIONS, TORQUES, AND PRESSURES FOR CODE 62 ASSEMBLIES - TYPE 2 (INCH)

Not for new design

Nominal Size		Dimensions in mm unless noted									
Metric Size	Dash Size	O-ring Size	Flat Washer <sup>g</sup> (recommended)	d <sub>1</sub> +0 / -1.5	d <sub>2</sub> max	d <sub>3</sub> Screw Thread <sup>f</sup> (UNC)	l <sub>1</sub> Screw Length <sup>d</sup>	Screw Nominal Torque <sup>e</sup> N-m +10% -0	l <sub>2</sub> Minimum Full Thread	Maximum Working Pressure <sup>b</sup> MPa	Minimum Burst Pressure <sup>b</sup> MPa
13	-8	210	M8	13.0	13.0	5/16-18	32	32	21	42	168
19	-12	214	M10	19.2	19.2	3/8-16	38	60	24	42	168
25	-16	219	7/16 <sup>g</sup>	25.6	25.6	7/16-14	44	92	27	42	168
32	-20	222	M12	32.0	32.0	1/2-13	44	150	25	42	168
38	-24	225	M16	38.2	38.2	5/8-11	57	295	35	42	168
51	-32	228	M20	51.0	51.0	3/4-10	70	450	38	42	168

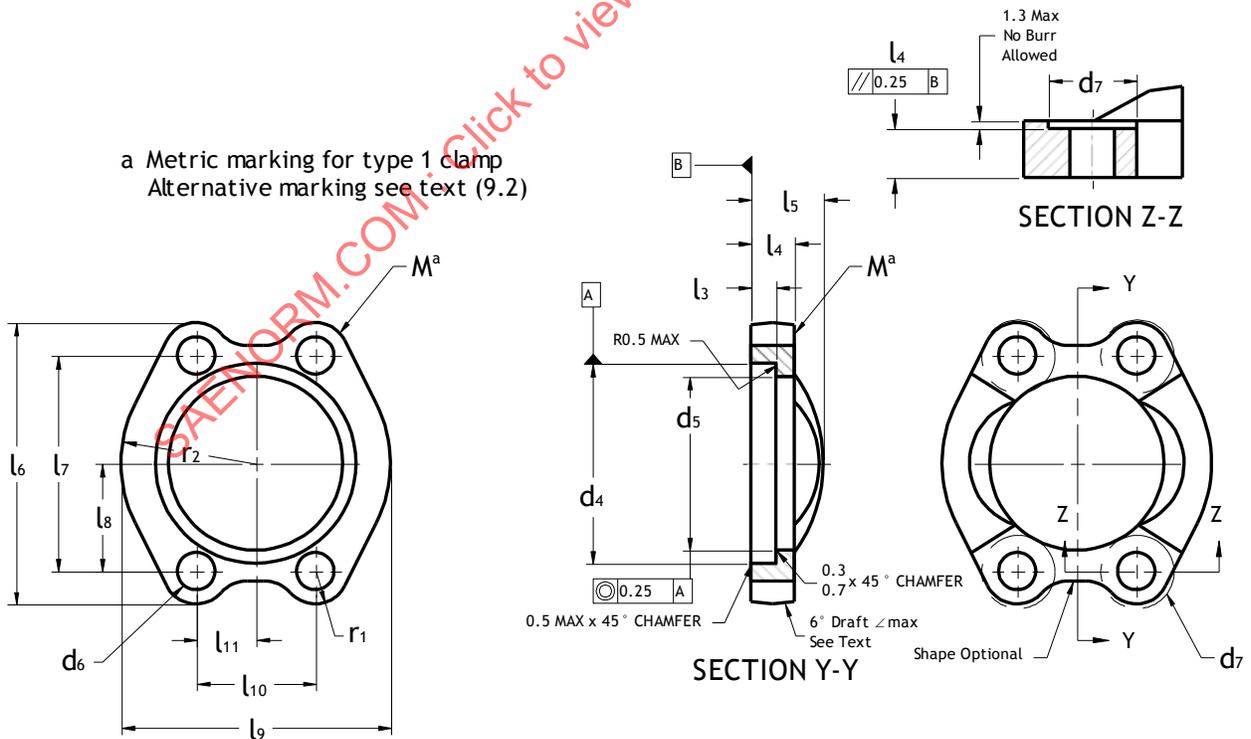
CAUTION: IT IS IMPORTANT THAT ALL SCREWS BE LIGHTLY TORQUED BEFORE APPLYING THE FINAL RECOMMENDED TORQUE VALUES TO AVOID BREAKING THE FLANGE CLAMP DURING INSTALLATION – REFER TO SAE J2593 FOR INSTALLATION INSTRUCTIONS.

- Type 2 connections shall not be used for new design.
- Minimum Burst Pressure = Working Pressure X 4.
- Coarse pitch thread in accordance with ISO 261 and ISO 724.
- Screw thread lengths calculated for steel into steel; use of other materials can require different screw lengths.
- 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.
- Coarse pitch thread in accordance with ISO 263 and ISO 725 (UNC-2A for screw threads, UNC-2B for port threads).
- ASME B18.22.1 Type B Narrow (HV300) washers sized by matching to the inch screw can be substituted except for the DN 25(-16) size. To avoid possible interferences, do not substitute for the DN 25 (-16) size. Use of the specified washers might not be compatible with older version of this standard.



a Metric marking for type 1 clamp  
Alternative marking see text (9.2)

FIGURE 2A - SPLIT FLANGE CLAMP (FCS AND FCMS)



a Metric marking for type 1 clamp  
Alternative marking see text (9.2)

FIGURE 2B - FLANGE CLAMP (FC & FCM)

TABLE 2 - FLANGE CLAMP - SPLIT FLANGE CLAMP DIMENSIONS

Dimensions in mm unless noted										
Nominal Size		d <sub>4</sub>	d <sub>5</sub>	d <sub>6</sub>	d <sub>7</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>	l <sub>6</sub>	l <sub>6</sub>
Metric Size	Dash Size	±0.25	±0.25	± 0.15	minimum	± 0.15	± 0.5	± 0.8	max	minimum
13	-8	32.50	24.65	8.9	16.5	7.2	15.7	22.5	57.2	55.6
19	-12	42.00	32.50	10.6	20.5	8.2	19.1	28.5	72.1	70.6
25	-16	48.40	38.85	13.3 <sup>a</sup>	26.0	9.0	23.9	33.5	81.8	80.3
32	-20	54.75	44.45	13.3	26.0	9.8	26.9	38.0	96.0	94.5
38	-24	64.25	51.55	16.7	32.5	12.1	30.2	43.0	114.3	111.3
51	-32	80.15	67.55	20.6	38.0	12.1	36.6	52.5	134.9	131.8

Nominal Size		l <sub>7</sub>	l <sub>8</sub>	l <sub>9</sub>	l <sub>10</sub>	l <sub>11</sub>	l <sub>12</sub>	l <sub>13</sub>	r <sub>1</sub>	r <sub>2</sub>
Metric Size	Dash Size	± 0.25	± 0.25	± 0.8	± 0.25	± 0.25	± 0.4	± 0.8	ref	ref
13	-8	40.5	20.25	47.8	18.2	9.1	8.1	22.6	8	24
19	-12	50.8	25.4	60.5	23.8	11.9	10.9	29.0	10.5	30
25	-16	57.2	28.6	69.9	27.8	13.9	13.0	33.8	12	35
32	-20	66.7	33.35	77.7	31.8	15.9	15.0	37.6	14	39
38	-24	79.4	39.7	95.3	36.5	18.25	17.3	46.5	17	48.5
51	-32	96.8	48.4	114.3	44.5	22.25	21.3	55.9	18	57

<sup>a</sup> Type 2 (inch) to be 12 mm ± 0.25

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