



SURFACE VEHICLE STANDARD	J518™-1	MAR2023
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Superseding J518-1 JAN2013		
(R) Hydraulic Flange Tube, Pipe, and Hose Connections Four-Screw Flange Connection - Part 1: 3.5 to 35 MPa (Code 61)		

RATIONALE

This ballot version contains a resolution to the comments made on the last ballot. Several reference standard names have been updated, clarifications of corrosion requirements have been included, and drawing and table formatting have been changed.

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 to 35 MPa (Code 61)

Part 2: 42 MPa (Code 62)

Part 3: Low pressure 2 screw connectors

Part 4: In-line, elbow, and tee block connectors for Code 61

Part 5: In-line, elbow, and tee connectors for Code 62

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1. SCOPE

This SAE Standard covers general and dimensional specifications for the Code 61 metric (Type 1) and inch (Type 2) flanged heads, flange clamps (FC and FCM), and split flange clamps (FCS and 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.

The flanged 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 6162-1 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 +1 724-776-4970 (outside USA), 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 Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B18.21.1 Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

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

2.1.3 ASTM Publications

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

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

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

2.1.4 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 48-2	Rubber, Vulcanized or Thermoplastic - Determination of Hardness - Part 2: (Hardness between 10 IRHD and 100 IRHD)
ISO 261	ISO General Purpose Metric Screw 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 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 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 6162-1	Hydraulic Fluid Power - Flange Connectors 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
ISO 7089	Plain Washers - Normal Series - Product Grade A
ISO 9227	Corrosion Tests in Artificial Atmospheres - Salt Spray Tests
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
ISO 21920-1	Geometrical Product Specifications (GPS) - Surface Texture: Profile - Part 1: Indication of Surface Texture

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 +1 724-776-4970 (outside USA), www.sae.org.

SAE J515 Specification for O-Ring Materials Used with Hydraulic Connectors

SAE J516 Hydraulic Hose Fittings

SAE J517 Hydraulic Hose

2.2.2 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.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 Screws Threads

ISO 225 Fasteners - Bolts, Screws, Studs and Nuts - Symbols and Descriptions 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 6162-2 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

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 ± 0.4 mm.

5. MATERIAL

5.1 Flanged 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:

5.2.1 For Nominal Size 13

- Minimum yield strength: 220 MPa
- Minimum elongation at fracture: 3%

5.2.2 For All Other Nominal Sizes

- Minimum yield strength: 415 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 IRHD \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 B18.3 socket head cap screws of ASTM A574 material) screws with corrosion protection conforming to 7.3. 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 Type A, Class 300HV, and be sized for the corresponding screw except for the DN 32 (-20) Type 2 (inch) size which shall conform to ASME B18.21.1, Type B narrow (HV300), except if used with clamps manufactured to a previous version of this standard. Plain washers conforming to ASME B18.21.1, Type B narrow (HV300) series, may be substituted when using Type 2 screws except for the DN 32 (-20) size. The ISO 7089 washer might cause interferences if used with the inch screw in the DN 32 (-20) size. Corrosion protection shall conform to 7.3.

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 96-hour neutral salt spray test in accordance with ISO 9227 or ASTM B117. The following requirements shall apply:

- No appearance of corrosion products of the protective coating before 96 hours
- No appearance of corrosion products of the base metal before 144 hours

The following exceptions shall apply:

- 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. Parts with changes in plating or coating shall be requalified to ensure assembly torque and torque retention are not affected.

6.2 Weld-on Flanged 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-hour 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-hour 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 $R_a \text{max} \leq 6.3 \mu\text{m}$, except where otherwise specified.

7.2 Sealing Surfaces

Annular (circumferential) tool marks up to a surface roughness value of ISO 21920-1 MRR $R_a \text{max} 3.2 \mu\text{m}$ 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.

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 °C and +120 °C.

Contact manufacturer concerning instructions for assembly at temperatures below -20 °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 °C and +50 °C. Working pressure for connectors made from stainless steel and used at elevated temperatures shall be reduced:

4% above +50 °C to < +100 °C

11% +100 °C to < +200 °C

20% +200 °C to +250 °C

Contact manufacturer concerning instructions for assembly at temperatures below -20 °C or for suitable O-ring material for use at temperatures above the NBR range (+120 °C).

9. MARKING

9.1 Flanged Head

The flanged head should be marked at a minimum with the manufacturer's name or trademark. No groove is allowed on the surface described by L₁₅ dimension.

9.2 Flange Clamp and Split Flange Clamp

Size DN 32 (-20) Type 1 (metric) clamps (FCSM and 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) (FCS and FC) clamps.

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 L₁₀ 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 61 split flange clamp, carbon steel Type 2 (Inch) - SAE J518 -**-1161C; ** represents the dash size.

SAE Code 61 split flange clamp, carbon steel Type 1 (Metric) - SAE J518 -**-11M61C; ** represents the dash size.

SAE Code 61 split flange clamp, stainless Type 2 (Inch) - SAE J518 -**-1161S; ** represents the dash size.

SAE Code 61 flange clamp, carbon steel Type 2 (Inch) - SAE J518 -**-0561C; ** represents the dash size.

EXAMPLE: A pair of Code 61 split flange clamps for use with metric screws made of carbon steel size DN 32 (-20) is:

1 pr. SAE J518-20-11M61C

11.2 Flanged 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 J518-1.

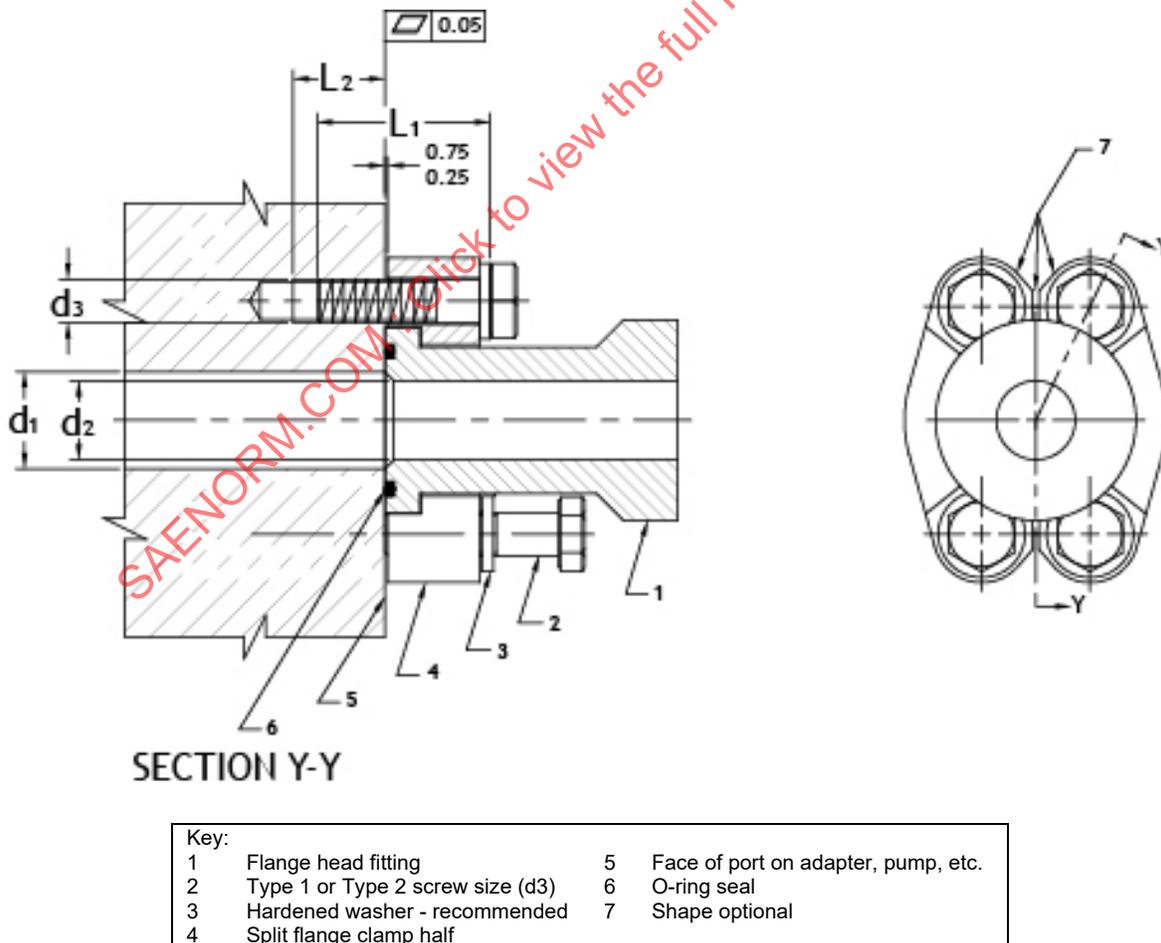
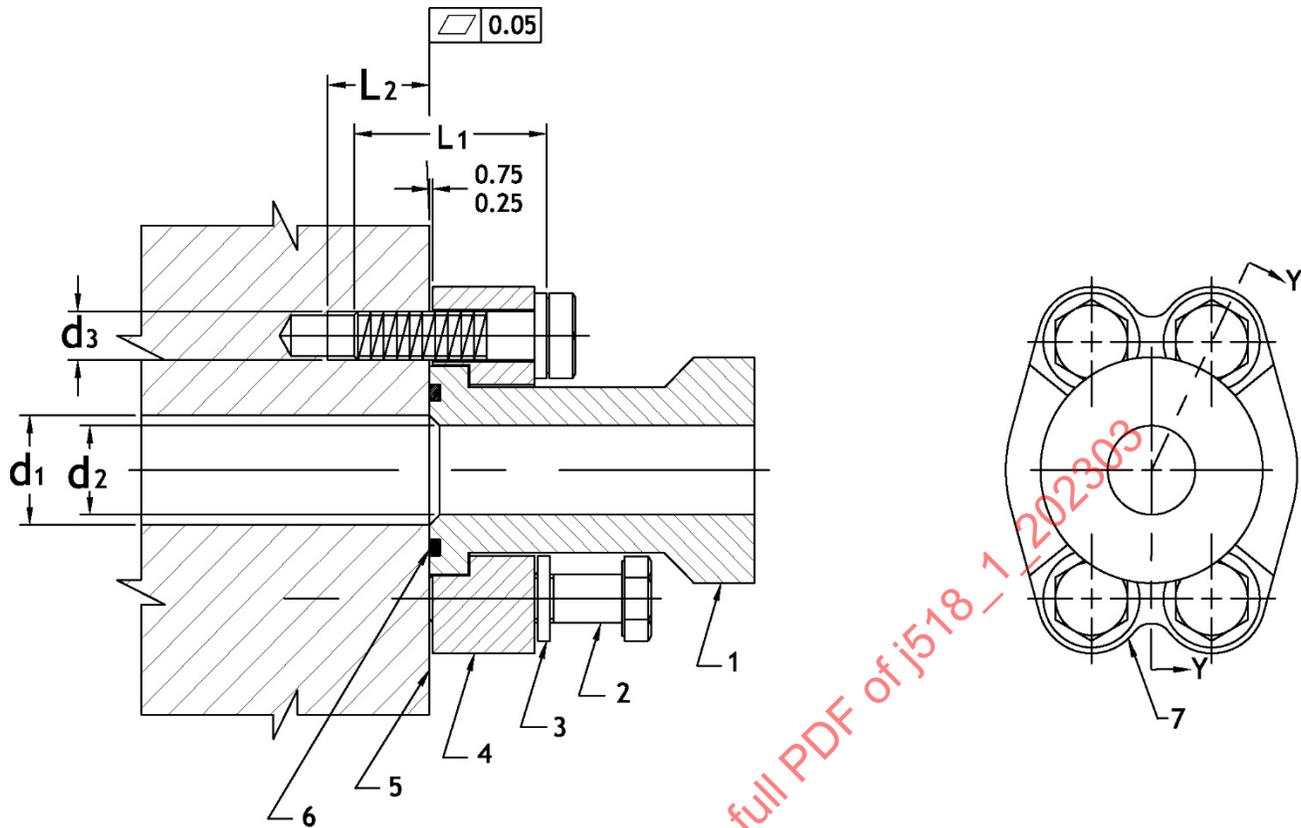


Figure 1A - Assembly drawing split flange clamp, flanged head, screws, washers, and port



SECTION Y-Y

Key:

1	Flange head fitting	5	Face of port on adapter, pump, etc.
2	Type 1 or Type 2 screw size (d3)	6	O-ring seal
3	Hardened washer - recommended	7	Shape optional
4	Flange clamp		

Figure 1B - Assembly drawing flange clamp, flanged head, screws, washers, and port

Table 1A - Dimensions, torques, and pressures for Code 61 assemblies - Type 1 (metric)

Dimensions in mm and basic unless noted.

Nominal Size		Type 1 (Metric Screw) Class 10.9									
Metric Size	Dash Size	O-Ring Size	Flat Washer ^a (Recommended)	d ₁ +0/-1.5	d ₂ Max	d ₃ Screw Thread ^b	L ₁ Screw Length ^c	Screw Torque ^d Nm +10% -0	L ₂ Minimum Full Thread	Maximum Working Pressure ^e MPa	Minimum Burst Pressure ^e MPa
13	-8	210	M8	13.0	13.0	M8	25	32	16	35	140
19	-12	214	M10	19.2	19.2	M10	30	70	18	35	140
25	-16	219	M10	25.6	25.6	M10	30	70	18	32	128
32	-20	222	M10	32.0	32.0	M10	30	70	18	28	112
38	-24	225	M12	38.2	38.2	M12	35	130	23	21	84
51	-32	228	M12	51.0	51.0	M12	35	130	23	21	84
64	-40	232	M12	63.5	63.5	M12	40	130	23	17.5	70
76	-48	237	M16	76.2	76.2	M16	50	295	30	16	64
89	-56	241	M16	89.0	89.0	M16	50	295	30	3.5	14
102	-64	245	M16	101.6	101.6	M16	50	295	30	3.5	14
127	-80	253	M16	127.0	127.0	M16	55	295	30	3.5	14
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.											

- a. ASME B18.22.1 Type B Narrow (HV300) washers sized by matching to the inch screw can be substituted except for the DN 32 (-20) size. To avoid possible interferences, do not substitute for the DN 32 (-20) size. Use of the specified washers might not be compatible with older version of this standard.
- b. Coarse pitch thread in accordance with ISO 261 and ISO 724.
- c. Screw thread lengths calculated for steel into steel; use of other materials can require different screw lengths.
- d. 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.
- e. Minimum burst pressure = Working pressure x 4.
- f. Type 2 connections shall not be used for new design.
- g. Coarse pitch thread in accordance with ISO 263 and ISO 725 (UNC-2A for screw threads, UNC-2B for port threads).

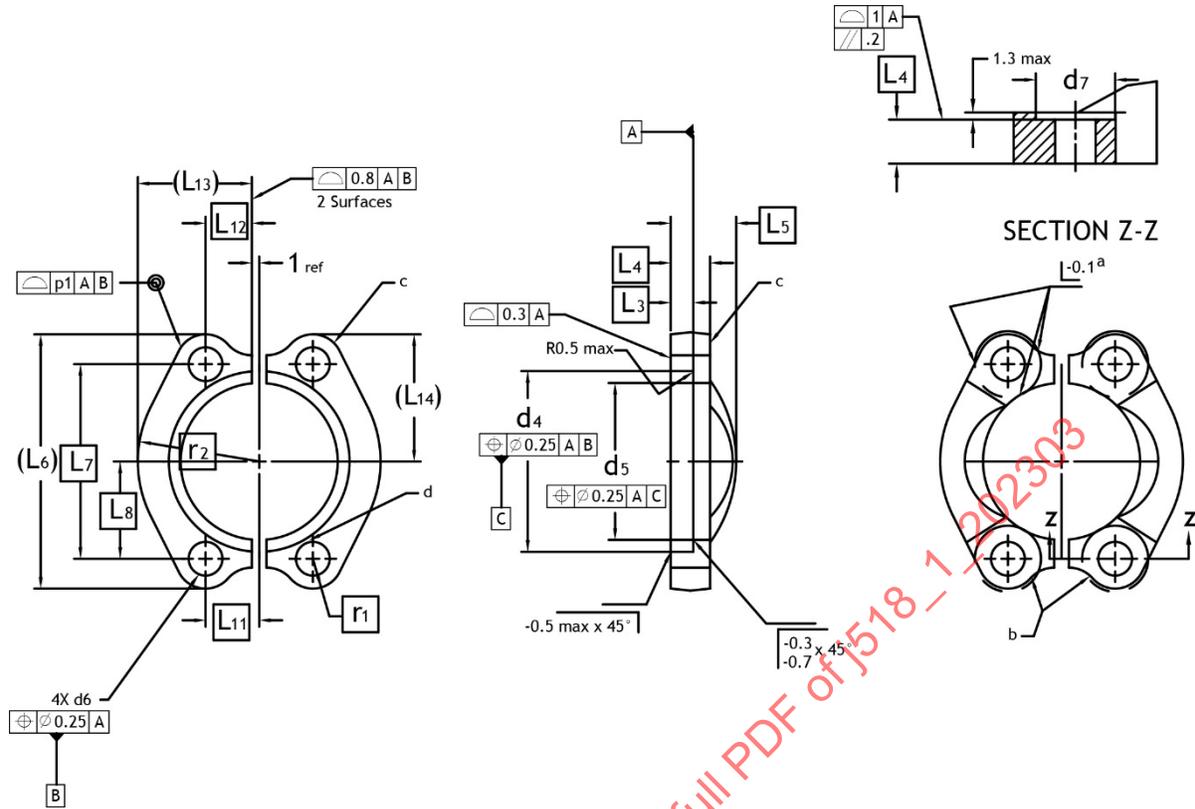
**Table 1B - Dimensions, torques, and pressures for Code 61 assemblies - Type 2 (inch)
not for new design**

Dimensions in mm and basic unless noted.

Nominal Size		Type 2 (Inch Screw) ^f Grade 8									
Metric Size	Dash Size	O-Ring Size	Flat Washer ^a (Recommended)	d ₁ +0/-1.5	d ₂ Max	d ₃ Screw Thread ^g (UNC)	L ₁ Nominal Screw Length ^c	Screw Torque ^d Nm +10% -0	L ₂ Minimum Full Thread	Maximum Working Pressure ^e MPa	Minimum Burst Pressure ^e MPa
13	-8	210	M8	13.0	13.0	5/16-18	32	32	20	35	140
19	-12	214	M10	19.2	19.2	3/8-16	32	60	22	35	140
25	-16	219	M10	25.6	25.6	3/8-16	32	60	22	32	128
32	-20	222	7/16 ^a	32.0	32.0	7/16-14	38	92	25	28	112
38	-24	225	M12	38.2	38.2	1/2-13	38	150	27	21	84
51	-32	228	M12	51.0	51.0	1/2-13	38	150	27	21	84
64	-40	232	M12	63.5	63.5	1/2-13	44	150	27	17.5	70
76	-48	237	M16	76.2	76.2	5/8-11	44	295	30	16	64
89	-56	241	M16	89.0	89.0	5/8-11	51	295	30	3.5	14
102	-64	245	M16	101.6	101.6	5/8-11	51	295	30	3.5	14
127	-80	253	M16	127.0	127.0	5/8-11	57	295	30	3.5	14

**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.**

- ASME B18.22.1 Type B Narrow (HV300) washers sized by matching to the inch screw can be substituted except for the DN 32 (-20) size. To avoid possible interferences, do not substitute for the DN 32 (-20) size. Use of the specified washers might not be compatible with older version of this standard.
- 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.
- Minimum burst pressure = Working pressure x 4.
- Type 2 connections shall not be used for new design.
- Coarse pitch thread in accordance with ISO 263 and ISO 725 (UNC-2A for screw threads, UNC-2B for port threads).



Key:			
a	No burrs or sharp edges allowed	c	Metric marking; see 9.2
b	Shape optional	d	No breakthrough or sharp edge allowed

Figure 2A - Split flange clamp (FCS and FCSM)

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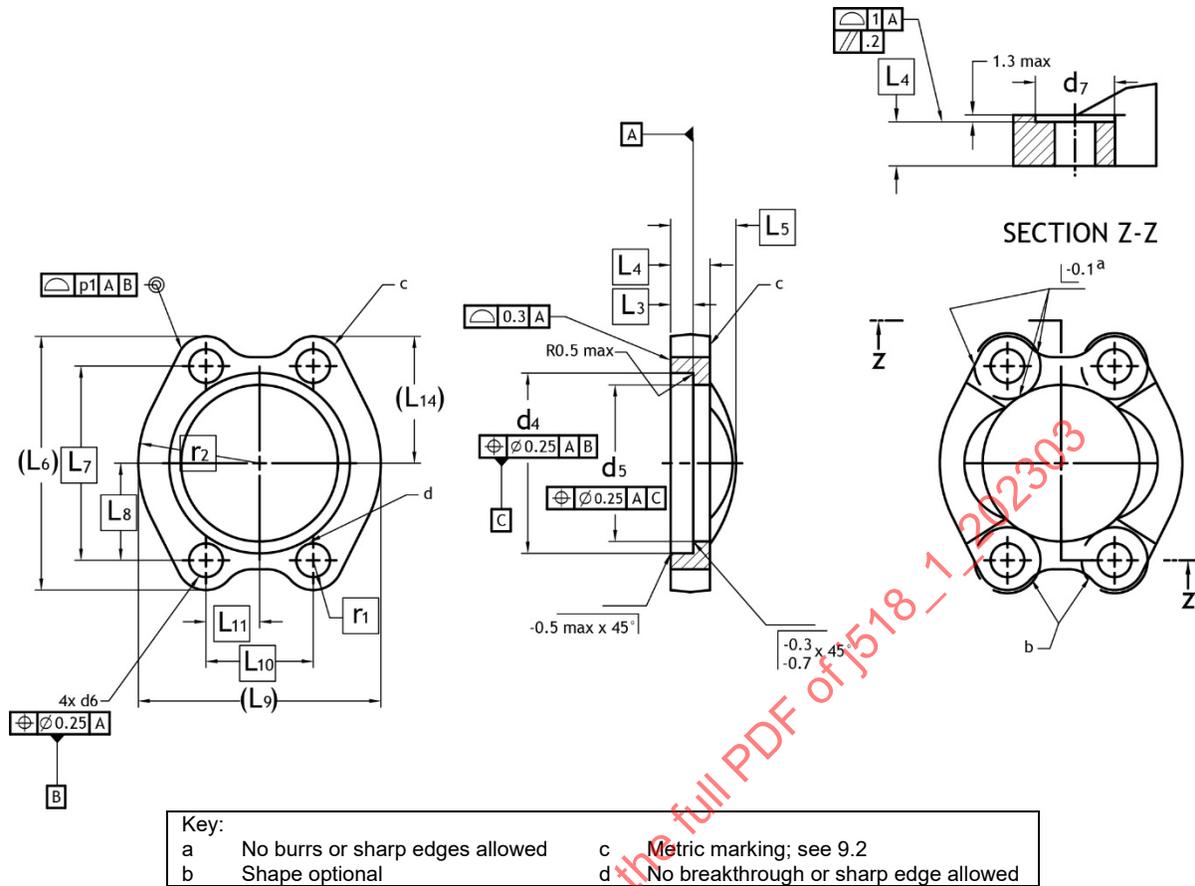


Figure 2B - Flange clamp (FC and FCM)

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Table 2 - Flange clamp - split flange clamp dimensions

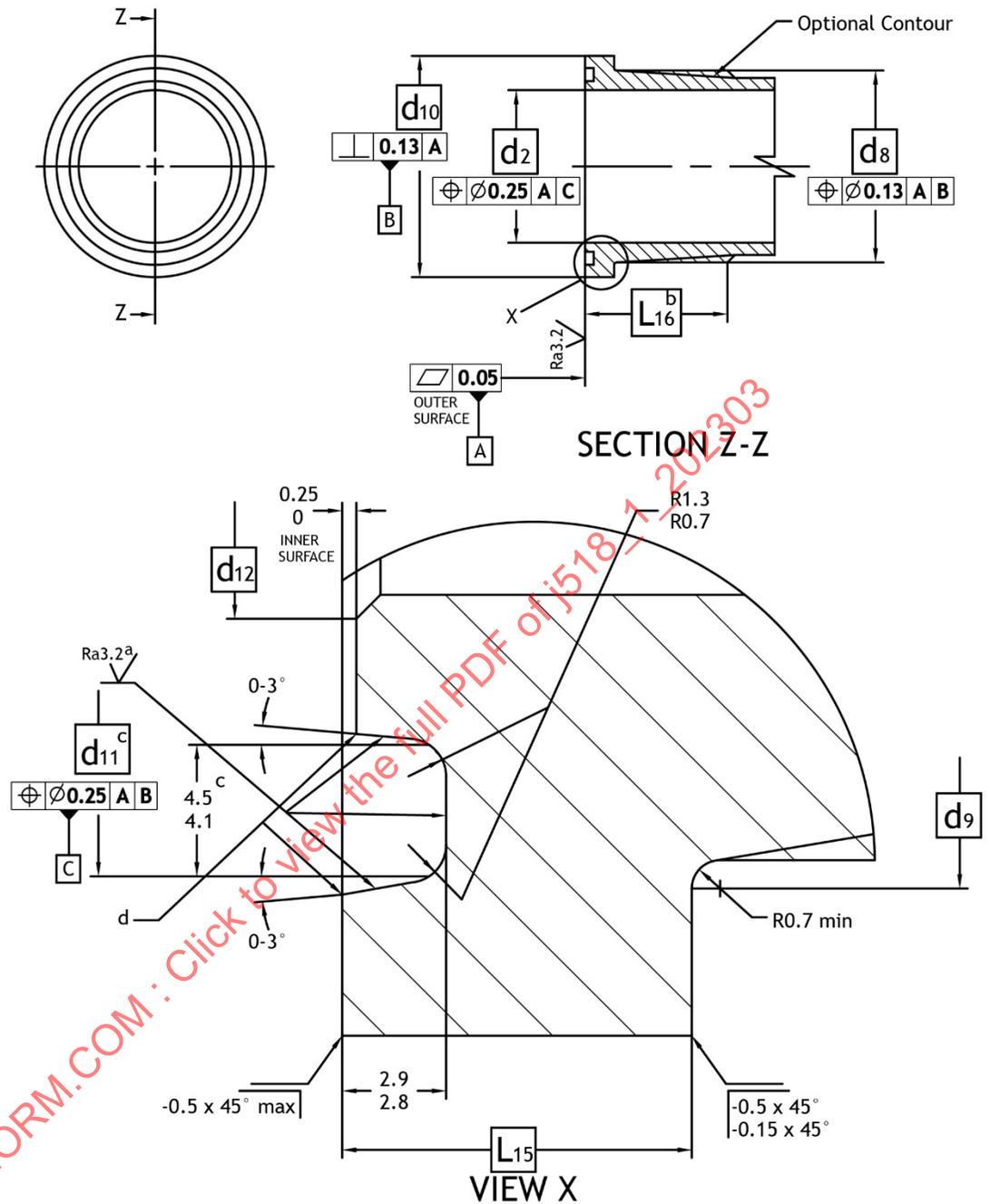
Dimensions in mm and basic unless noted.

Nominal Size		d ₄	d ₅	d ₆	d ₇	L ₃	L ₄	L ₅	L ₆	L ₇	
Metric Size	Dash Size	±0.25	±0.25	±0.15	Min						
13	-8	30.95	24.25	8.9	16.5	6.2	12.7	19.0	54.1	38.1	
19	-12	38.90	32.15	10.6	20.5	6.2	14.2	22.5	64.6	47.6	
25	-16	45.25	38.50	10.6	20.5	7.5	15.8	24.0	69.4	52.4	
32	-20	51.60	43.70	10.6 ^a	24.5	7.5	14.2 ^b	22.5 ^c	79.7	58.7	
38	-24	61.10	50.80	13.3	26.0	7.5	15.8	25.5	93.9	69.9	
51	-32	72.25	62.75	13.3	26.0	9.0	15.8	26.0	101.8	77.8	
64	-40	84.95	74.95	13.3	26.0	9.0	19.1	38.0	113.9	88.9	
76	-48	102.40	90.95	16.7	32.5	9.0	22.4	41.0	134.4	106.4	
89	-56	115.10	102.40	16.7	32.5	10.7	22.4	28.5	151.7	120.7	
102	-64	127.80	115.10	16.7	32.5	10.7	25.4	35.0	161.2	130.2	
127	-80	153.20	140.50	16.7	32.5	10.7	28.5	41.0	183.4	152.4	
Nominal Size		L ₈	L ₉	L ₁₀	L ₁₁	L ₁₂	L ₁₃	L ₁₄	p ₁	r ₁	r ₂
Metric Size	Dash Size						Ref	Ref	Profile Tol	Ref	Ref
13	-8	19.05	46	17.5	8.75	7.75	22.0	27.05	1.5	8.0	23.0
19	-12	23.80	52	22.2	11.10	10.10	25.0	32.3	1.5	8.5	26.0
25	-16	26.20	59	26.2	13.10	12.10	28.5	34.7	1.5	8.5	29.5
32	-20	29.35	73	30.2	15.10	14.10	35.5	39.85	1.5	10.5	36.5
38	-24	34.95	83	35.7	17.85	16.85	40.5	46.95	1.5	12.0	41.5
51	-32	38.90	97	42.9	21.45	20.45	47.5	50.9	3.0	12.0	48.5
64	-40	44.45	109	50.8	25.40	24.40	53.5	56.95	3.0	12.5	54.5
76	-48	53.20	131	61.9	30.95	29.95	64.5	67.2	3.0	14.0	65.5
89	-56	60.35	140	69.9	34.95	33.95	69.0	75.85	3.0	15.5	70.0
102	-64	65.10	152	77.8	38.90	37.90	74.9	80.6	3.0	15.5	76.0
127	-80	76.20	181	92.1	46.05	45.05	89.4	91.7	3.0	15.5	90.5

a. Type 2 (inch) to be 12 mm ± 0.25 mm.

b. 15.8 is acceptable.

c. 24 is acceptable.



- Key:
- a Annular (circumferential) tool marks up to a surface roughness value of ISO 21920-1 MRR Ra max 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. Tool marks with no depth or height are acceptable.
 - b Fitting design beyond the L16 length is optional, provided adequate clearance for installing screws is maintained.
 - c The d11 measurement is to the intersection of the radii and the wall angle.
 - d Sharp edge or burr not allowed. Break corner 0.1 ± 0.05 .

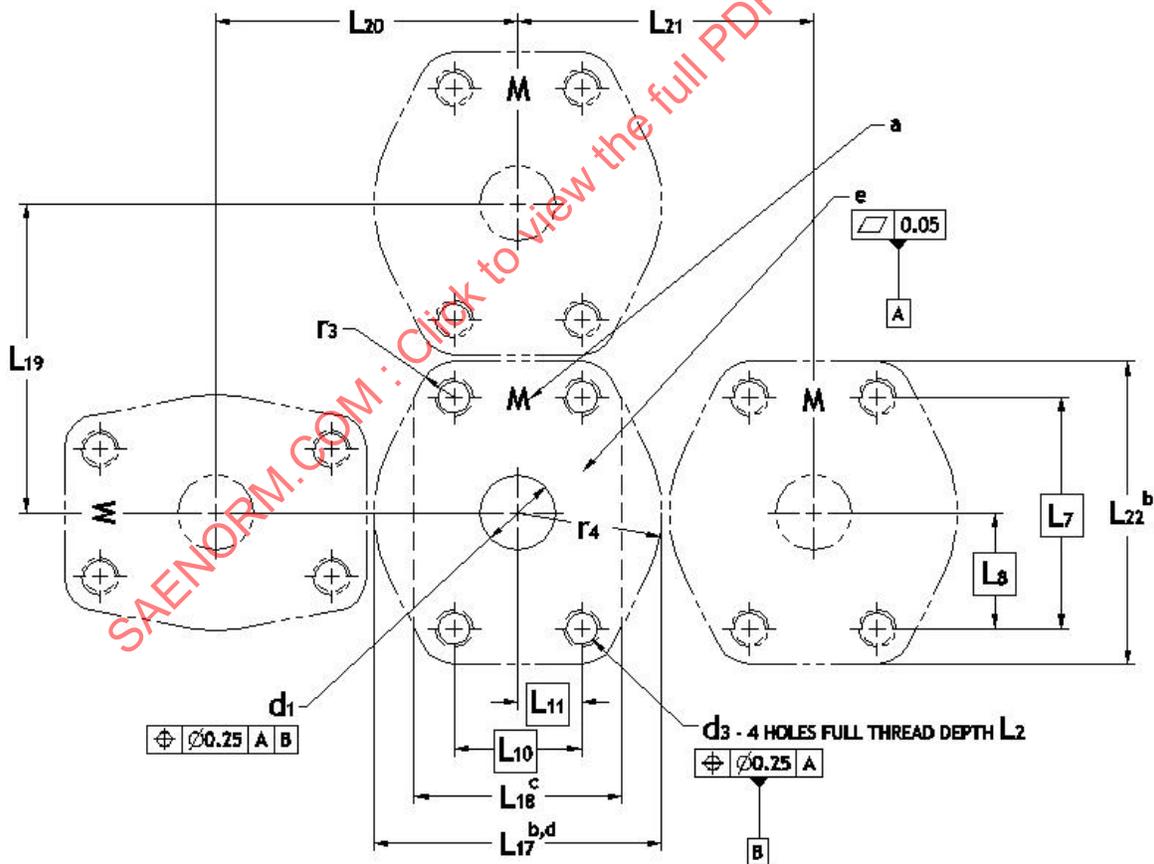
Figure 3 - Flanged head

Table 3 - Flanged head dimensions

Dimensions in millimeters and basic unless noted.

Nominal Size		d ₂	d ₈	d ₉	d ₁₀	d ₁₁	d ₁₁	d ₁₂	L ₁₅	L ₁₆
Metric Size	Dash Size	Max	Max	Max	±0.25	Max	Min	Max	±0.15	Ref
13	-8	See Table 1	23.9	25.3	30.20	25.53	25.40	14.2	6.8	13
19	-12		31.8	33.2	38.10	31.88	31.75	21.0	6.8	14
25	-16		38.1	39.5	44.45	39.75	39.62	27.0	8.0	14
32	-20		43.2	44.6	50.80	44.58	44.45	33.3	8.0	14
38	-24		50.3	51.7	60.35	53.98	53.72	39.6	8.0	16
51	-32		62.2	63.6	71.40	63.50	63.25	52.3	9.6	16
64	-40		74.2	75.6	84.10	76.33	76.07	65.0	9.6	18
76	-48		90.2	91.6	101.60	92.08	91.82	77.7	9.6	19
89	-56		101.6	103.0	114.30	104.52	104.01	90.4	11.3	22
102	-64		114.3	115.7	127.00	117.22	116.71	103.1	11.3	25
127	-80	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 pressures and the d₂ diameter.



Key:			
a	Metric marking for Type 1 port; raised surface not allowed	d	Recommended pad width
b	Projections within this area can cause interferences	e	Surface texture of face of port - Ra Max = 3.2 μm
c	Minimum pad width		

Figure 4 - Port