



SURFACE VEHICLE STANDARD

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Hydraulic Flange Clamps, 2-Screw Flange Connection to be used with SAE J518-1
(Code 61) Connections where Only Low Pressure is Required

RATIONALE

Standardize 2-Screw Flange connections currently being used in conjunction with low pressure SAE J518-1 connections.

FOREWORD

The hydraulic industry currently utilizes 2-Screw Flange Clamps in conjunction with SAE J518-1 (4-Screw) connections, where only low pressure is required. This document will establish standard design criteria for this product category on future designs.

1. SCOPE

This SAE standard outlines general and dimensional specifications for Code 61 flange clamps for use in low pressure applications with J518-1 connections. For port dimensions, port design considerations, and flange head dimensions, please refer to SAE J518-1.

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 also compatible with ISO 6162-1 port connections and flange heads.

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 J518-1 Hydraulic Flanged Tube, Pipe, and Hose Connections, 4-Screw Flange Connection Part 1: 3.5 MPa to 35 MPa (Code 61)

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

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http://www.sae.org/technical/standards/J518/3_201511**

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 B18.22.1 Plain Washers

ASME B18.3 2003 Socket Cap, Shoulder, and Set Screws, Hex and Spline 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 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

Copies of these documents are available online at <http://webstore.ansi.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 6162-1	Hydraulic fluid power – Flange connections 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 35MPa (350 bar), DN 13 to DN 127
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 +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 Screw Threads

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

ISO 22 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 6162-2 Hydraulic fluid power – Flange connections with split or one-piece flange clamps and metric or inch screws – Part 2: Flange connectors for use at pressures of 42 MPa (400 bar), DN 13 to DN 73

3. SIZE DESIGNATION

Two-screw flange connections 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 not otherwise specified shall be $\pm 0.4\text{mm}$. A maximum draft angle of 6° from surface B as show in Figure 2 or from the middle of the side each way is allowed.

5. MATERIAL

5.1 Flange Clamps

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

- Min yield strength: 415 MPa
- Min elongation at fracture 3%

5.2 Screws

Unless otherwise specified, use hexagon head screws or socket head screws of property class 10.9 (minimum), as specified in ISO 898-1, or equivalent inch (SAE 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.

5.3 Washers

The use of hardened washers is recommended. 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 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 32 (-20) size. The ISO 7089 washer might cause interferences if used with the inch screw in the DN 32 (-20) size.

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 ± 5 IRHD measured in accordance with ISO 48.

6. CORROSION PROTECTION

6.1 External Surfaces

The external surfaces of all carbon steel flanges 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 environment 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 is not affected.

6.2 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

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.

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 $+120^\circ\text{C}$. Such connectors shall be suitable for use in hydraulic systems at ambient temperatures from -40°C to $+150^\circ\text{C}$.

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 $+50^\circ\text{C}$. Working pressure for connectors made from stainless steel and used at elevated temperatures shall be reduced:

4% above $+50^\circ\text{C}$
11% above $+100^\circ\text{C}$
20% above $+200^\circ\text{C}$ to $+250^\circ\text{C}$

Contact manufacturer concerning instructions for assembly at temperatures below -20°C .

9. MARKING

Size DN 32 (-20) type 1 (metric) clamp 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.

10. INSTALLATION

Refer to SAE J2593 for installation instructions. Follow procedure for SAE J518 four screw installation instructions.

11. ORDERING INFORMATION

11.1 Flange Clamp

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

SAE Code 61 flange clamp, carbon steel Type 1 (metric) – SAE J518 - ** - 05MB6C; ** represents the dash size.

EXAMPLE: A code 61 flange clamp for use with metric screws made of carbon steel size DN 32 (-20) is:

SAE J518-20-05MB6C

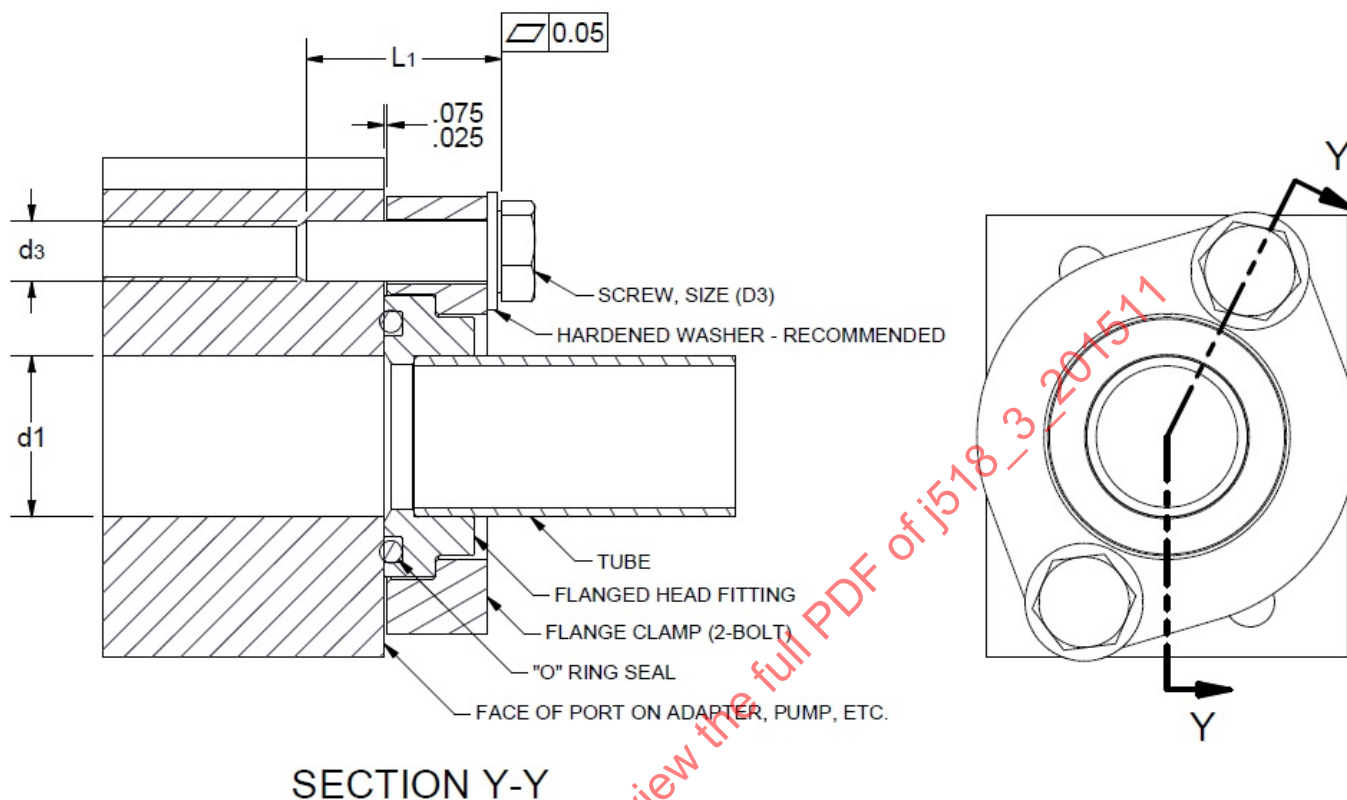


Figure 1 – Assembly drawing – flange clamp, flange head, screws, washer, and port

Table 1A – Dimensions, torques, and pressures for code 61 assemblies – type 1

Nominal Size		Dimensions in mm unless noted								
Metric Size	Dash Size	O-ring Size	Flat Washer (optional)	d ₁ ref	Clamp Load ^h N	Type 1 (Metric Screw) Class 10.9			Maximum Working Pressure ^b MPa	Minimum Burst Pressure ^b MPa
						d ₃ Screw Thread ^c	L ₁ Screw Length ^d	Screw Torque ^e Nm +10% / -0%		
13	-8	210	M8	13.0	23500	M8	25	32	2.0	8.0
19	-12	214	M10	19.2	41200	M10	30	70	2.0	8.0
25	-16	219	M10	25.6	41200	M10	30	70	2.0	8.0
32	-20	222	M10	32.0	41200	M10	30	70	2.0	8.0
38	-24	225	M12	38.2	63700	M12	35	130	2.0	8.0
51	-32	228	M12	51.0	63700	M12	35	130	2.0	8.0
64	-40	232	M12	63.5	63700	M12	40	130	2.0	8.0
76	-48	237	M16	76.2	108000	M16	50	295	2.0	8.0
89	-56	241	M16	89.0	108000	M16	50	295	2.0	8.0
102	-64	245	M16	101.6	108000	M16	50	295	2.0	8.0
127	-80	253	M16	127.0	108000	M16	55	295	2.0	8.0

**Table 1B – dimensions, torques, and pressures for code 61 assemblies – type 2
not for new design**

Nominal Size		Dimensions in mm unless noted								
Metric Size	Dash Size	O-ring Size	Flat Washer (optional)	d ₁ ref	Clamp Load ^h N	Type 2 (Inch Screw) ^a Grade 8			Maximum Working Pressure ^b MPa	Minimum Burst Pressure ^b MPa
						d ₃ Screw Thread ^f	L ₁ Screw Length ^d	Screw Torque ^e Nm +10% / -0%		
13	-8	210	M8	13.0	23500	5/16-18	32	32	2.0	8.0
19	-12	214	M10	19.2	41200	3/8-16	32	60	2.0	8.0
25	-16	219	M10	25.6	41200	3/8-16	32	60	2.0	8.0
32	-20	222	7/16 ^g	32.0	63700	7/16-14	38	92	2.0	8.0
38	-24	225	M12	38.2	63700	1/2-13	38	150	2.0	8.0
51	-32	228	M12	51.0	63700	1/2-13	38	150	2.0	8.0
64	-40	232	M12	63.5	63700	1/2-13	44	150	2.0	8.0
76	-48	237	M16	76.2	108000	5/8-11	44	295	2.0	8.0
89	-56	241	M16	89.0	108000	5/8-11	51	295	2.0	8.0
102	-64	245	M16	101.6	108000	5/8-11	51	295	2.0	8.0
127	-80	253	M16	127.0	108000	5/8-11	57	295	2.0	8.0

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 recommended torque values were arrived at by using lubricated screws with a torque coefficient ($T = KDF$) 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 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 versions of SAE J518.
- Clamp Load is the design preload necessary to achieve a minimum 4:1 design factor. Torque values are influenced by many factors such as variations of friction (both thread and under the head) which may vary due to both design and application conditions.