SAE International™ SURFACE VEHICLE STANDARD

SAE J2244-4

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Connections for Fluid Power and General Use—Ports and Stud Ends with ISO 261 Threads and O-Ring Sealing—Part 4: Heavy-Duty (S Series) External Hex Port Plugs—Dimensions, Design, Test Methods, and Requirements

Foreword—SAE J2244 was prepared by the SAE FCCTC-SC1, Automotive and Hydraulic Tube and Fitting Subcommittee and ISO/TC 131, Fluid power systems. SAE J2244 consists of the following parts under the general title: Connections for Fluid Power and General Use—Ports and Stud Ends with ISO 261 Threads and O-ring Sealing:

Part 1: Port with O-Ring Seal in Truncated Housing
Part 2: Heavy-Duty (S Series) Stud Ends—Dimensions, Design, Test Methods, and Requirements
Part 3: Light-Duty (L Series) Stud Ends—Dimensions, Design, Test Methods, and Requirements
Part 4: Heavy-Duty (S-Series) External Hex Port Plugs—Dimensions, Design, Test Methods, and Requirements

The four parts of SAE J2244 constitute a revision of ISO 6149:1980. This part defines performance requirements, dimensions, and designs for 13 port plugs. Significant testing was conducted to confirm the performance requirements of stud ends made from carbon steel. SAE J2244-2 (ISO 6149-2) applies to fittings detailed in SAE J1453-2 (ISO 8434 parts 1, 3, and 4), and SAE J2244-3 (ISO 6149-3) applies to fittings in SAE J514 (ISO 8434-2).

SAE J2244 Parts 1, 2, and 3 are technically equivalent to ISO 6149 parts 1, 2, and 3, respectively. Parts produced to either standard will interchange with parts produced to the other standard. Two main differences exist between the SAE standards and the ISO standards: size M30 x 2 is included in the SAE standard but not in the ISO standard and the tube ODs have been shown in the SAE standard for the stud ends.

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. In general applications, a fluid may be conveyed under pressure. Components are connected through their threaded ports by stud ends on fluid conductor fittings to tubes and pipes or to hose fittings and hoses.

1. *Scope*—

This part of SAE J2244 specifies dimensions, performance requirements, and test procedures for metric external hex O-rings port plugs.

Port plugs in accordance with this part of SAE J2244 may be used at working pressures up to 63 MPa. The permissible working pressure depends upon materials, design, working conditions, applications, etc.

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For threaded ports and stud ends for use in new designs in hydraulic fluid power applications, only SAE J2244 shall be used. Threaded ports and stud ends in accordance with ISO 1179, ISO 9974, and SAE J1926 (ISO 11926) shall not be used in new designs in hydraulic fluid power applications.

Conformance to the dimensional information in this document does not guarantee rated performance. Each manufacturer shall perform testing according to the specification contained in this document to ensure that components made to this document comply with the performance ratings.

1.1 Rationale—All parts of SAE J2244 are being cancelled. SAE J2244 was published to provide users and manufacturers access to metric port and stud end dimensions. ISO 6149 is more recognized in the industry as the preferred metric port and stud end standard, thus the SAE FCCTC SC1 committee has approved cancelling SAE J2244-4 and superseding it with ISO 6149-4.

2. References

2.1 Applicable Publications—The following standards contain provisions which through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated as follows.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J515—Hydraulic O-Rings
SAE J1644—Metallic Tube Connections for Fluid Power and General Use—Test Methods for Threaded Hydraulic Fluid Power Connectors
SAE J2244-3—Connections for Fluid Power and General Use—Ports and Stud Ends with ISO 261 Threads and O-Ring Sealing—Part 3: Light-Duty (L Series) Stud Ends—Dimensions, Design, Test Methods, and Requirements

2.1.2 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 261—ISO general-purpose metric screw threads—General plan
ISO 965-1—ISO general purpose metric screw threads—Tolerances—Part 1: Principles and basic data
ISO 1302—Technical drawings—Method of indicating surface texture on drawings
ISO 4579-1—Tolerances for fasteners—Part 1: Bolts, screws and nuts with thread diameters between 1,6 (inclusive) and 150 mm (inclusive) and product grades A, B, and C
ISO 4755—Hexagon nuts for high-strength structural bolting with large width across flats—Product grade B—Property classes 8 and 10
ISO 5598—Fluid power systems and components—Vocabulary
ISO 6149-3—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and O-ring sealing—Part 3: Light-duty (L) series stud ends—Dimensions, design, test methods and requirements
ISO 7789—Hydraulic fluid power—Two–, three– and four–port screw-in cartridge valve cavaties
ISO 9227—Corrosion tests in artificial atmosphere—Salt spray tests

2.1.3 ASME PUBLICATION—Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2330.

ASME B46.1—Surface Texture (Surface Roughness, Waviness and Lay)

2.1.4 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 633—Standard Specifications for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM B 117—Method of Salt Spray (Fog) Test

3. Definitions—For the purposes of this document, the definitions given in ISO 5598 and the following definitions apply.

3.1 Plug—A stud end with no through hole for fluid passage, used to contain hydraulic fluid.

4. Requirements

4.1 Performance—Plugs shall meet the following performance requirements when tested per Section 5.

4.1.1 APPLICATION TEMPERATURE—Carbon steel plugs shall meet the working pressures when used at temperatures between –40 °C and +121 °C. For pressures or temperatures outside these ranges, the manufacturer shall be consulted.

4.1.2 WORKING PRESSURE—External hex and internal hex plugs made of low carbon steel shall be designated for use at the working pressures given in Table 1.

TABLE 1—PRESSURES FOR EXTERNAL HEX, (S SERIES) PORT PLUGS

UNITS IN MEGAPASCALS(1)

Thread	Port Plug Style External Hex Working Pressure(2)	Port Plug Style External Hex Test Pressure Burst	Port Plug Style External Hex Test Pressure Impulse(3)
M8x1	63	252	83.8
M10x1	63	252	83.8
M12x1.5	63	252	83.8
M14x1.5	63	252	83.8
M16x1.5	63	252	83.8
M18x1.5	63	252	83.8
M20x1.5(4)	40	160	53.2
M22x1.5	63	252	83.8
M27x2	40	160	53.2
M30x2	40	160	53.2
M33x2	40	160	53.2
M42x2	25	100	33.2
M48x2	25	100	33.2
M60x2	25	100	33.2

1. 10^5 N/m^2 = 10^5 Pa = 0.1 MPa = 14.5 psi. (To convert from MPa to psi multiply by 145, for example, 63 MPa = 9135 psi.)
2. These pressures were established using plugs made of low carbon steel when tested in accordance with Section 5.
3. Cyclic endurance test pressure.
4. For plug for cartridge valve cavity only. (See ISO 7789.)

4.1.3 CYCLIC ENDURANCE (IMPULSE) TEST—Plugs shall exceed one million impulse cycles when tested at 133% of the working pressure shown in Table 1 to verify the minimum fatigue strength of the fitting.

4.1.4 PROOF TEST—Plugs shall meet the minimum required proof pressures to verify a minimum of a 2:1 Proof to Working pressure ratio.

4.1.5 BURST TEST—Plugs shall meet the minimum required burst pressures to verify a minimum of a 4:1 Burst to Working pressure ratio to determine the minimum ultimate strength of the plug.

4.1.6 VACUUM TEST—Plugs shall be capable of withstanding a vacuum of 95 kPa (0.95 bar) negative pressure for 5 min without leakage.

4.1.7 TEST METHODS—Port plug tests shall be conducted in accordance with SAE J1644 for burst, cyclic endurance (impulse) and vacuum. Test results are to be reported on the form in SAE J1644.

4.2 Design

4.2.1 PLUG DIMENSIONS—Heavy-duty external hex (S series) plugs shall conform to the dimensions shown in Figure 1 and Table 2.

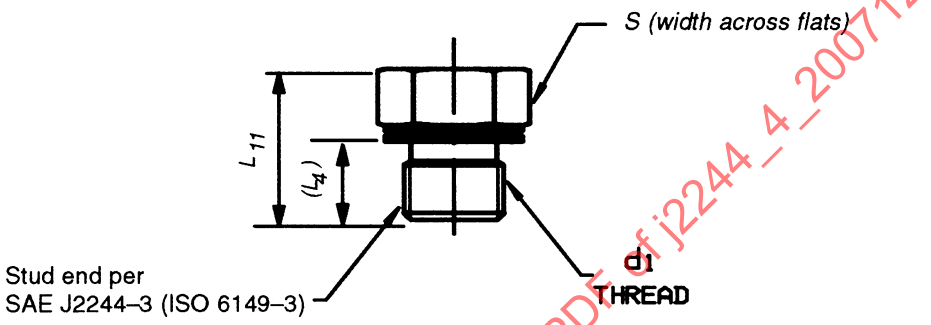

FIGURE 1—Heavy-Duty (S Series) Port Plug

TABLE 2—DIMENSIONS OF HEAVY-DUTY EXTERNAL (S SERIES) PORT PLUGS

Tube OD	d_1 (1)	L_{11} ±0.5	(L_4) (2)	S (3) Hex
4	M8x1	16.2	8.5	12
5	M10x1	16.2	8.5	14
6	M12x1.5	18.5	11	17
8	M14x1.5	19.5	11	19
10	M16x1.5	21.5	11.5	22
12	M18x1.5	23.5	12.5	24
14	M20x1.5	24	12.5	27
16	M22x1.5	25.5	13	27
20	M27x2	32	16	32
22	M30x2	32	16	36
25	M33x2	32	16	41
30	M42x2	34	16	50
38	M48x2	35.5	17.5	55
50	M60x2	33	17.5	65

1. Thread class 6g per ISO 261.
2. L_4 dimension for M30x2 is the specification for the stud length since it isn't given in either the SAE or ISO standards; the tolerance is ±0.2 mm.
3. See Section 5 for tolerance.

4.2.2 HEX TOLERANCES—Hex tolerances across flats shall be in accordance with ISO 4759-1, product grade B. Minimum across corner dimensions are 1.092 times the nominal width across flats. The minimum side flat is 0.43 times the nominal width across flats. Unless otherwise specified or shown, hex corners shall be chamfered 15 to 30 degrees to a diameter equal the width across flats, with a tolerance of 0/–0.4 min.

4.2.3 SCREW THREADS—The screw threads on the plug shall be metric screw threads to ISO 261 class 6g.

4.2.4 METRIC IDENTIFICATION—Port plugs shall be identified according to SAE J2244-3. In addition to this identification, the manufacturer may mark the plug screw with the word "metric."

4.3 Manufacture

4.3.1 CONSTRUCTION—Plugs may be made from low carbon steel forging, cold forming, or machined from bar stock.

4.3.2 WORKMANSHIP—Workmanship shall conform to the best commercial practice to produce high-quality plugs. Plugs shall be free from visual contaminants, all hanging burrs, loose scale and slivers which might be dislodged in use, and any other defects that might affect the function of the parts.

4.3.3 SURFACE FINISH—Unless otherwise specified, surface finish on all surfaces shall be $R_a \leq 6.3$ µm.

4.3.4 PLATING—The external surfaces and threads of all carbon steel parts shall be plated or coated with a suitable material that passes a 72 h salt spray test in accordance with ASTM B 117 (ISO 9227). Any appearance of red rust during the 72 h salt spray test shall be considered failure.

NOTE— CADMIUM PLATING—Cadmium plating is not preferred due to environmental reasons. Parts manufactured to this document after January 1, 1997, shall not be Cadmium plated. Changes in plating may affect assembly torques and require requalification, where applicable.

4.3.4.1 Exceptions—The following exceptions to the plating requirement apply:

a. Edges such as hex points, serrations, and crests of threads where there may be mechanical deformation of the plating or coating typical of mass-produced parts or shipping effects.
b. Areas where there is mechanical deformation of the plating or coating caused by crimping, flaring, bending or other post-plate metal forming operations.
c. Areas where the parts are suspended or affixed in the test chamber where condensate can accumulate. Corrosion protection requirements do not apply to corners or edges such as hex points, serrations and the crest of threads.

5. Test Requirements and Quality Procedures

5.1 Test Procedures—Port plugs shall be tested per SAE J1644.

5.2 Test Frequency—Qualification testing shall be required when there is a change in design, material, or process.

5.3 O-rings—O-rings for testing shall conform to SAE J515 Type 1 (90 durometer nitrile) and the size given in SAE J515. See Figure 2 and Table 3.

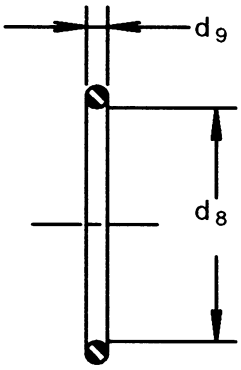

FIGURE 2—O-Ring

TABLE 3—DIMENSIONS OF O-RING
DIMENSIONS IN MILLIMETERS

Thread	Inside Diameter d_8 nom.	Inside Diameter d_8 tol.	Cross-Section Diameter d_9 nom.	Cross-Section Diameter d_9 tol.
M8x1	6.1	±0.2	1.6	±0.08
M10x1	8.1	±0.2	1.6	±0.08
M12x1.5	9.3	±0.2	2.2	±0.08
M14x1.5	11.3	±0.2	2.2	±0.08
M16x1.5	13.3	±0.2	2.2	±0.08
M18x1.5	15.3	±0.2	2.2	±0.08
M20x1.5	17.3	±0.22	2.2	±0.08
M22x1.5	19.3	±0.22	2.2	±0.08
M27x2	23.6	±0.24	2.9	±0.09
M30x2	26.6	±0.26	2.9	±0.09
M33x2	29.6	±0.29	2.9	±0.09
M42x2	38.6	±0.37	2.9	±0.09
M48x2	44.6	±0.43	2.9	±0.09
M60x2	56.6	±0.51	2.9	±0.09

5.4 Test Torque—Plugs shall be tested per Table 4 values.

TABLE 4—TORQUES FOR HEAVY-DUTY (S SERIES) EXTERNAL HEX PLUG SCREWS

Port or Plug Thread Size	Torque (N•m) +10/–0%
M8x1	10
M10x1	20
M12x1.5	35
M14x1.5	45
M16x1.5	55
M18x1.5	70
M20x1.5	80
M22x1.5	100
M27x2	170
M30x2	215
M33x2	310
M42x2	330
M48x2	420
M60x2	500

6. Packaging and Marking

6.1 Marking—Plugs shall be permanently marked with the individual supplier's trademark or code identifier, unless otherwise agreed upon by the user and manufacturer.

6.2 Plug Protection—By a method agreed between manufacturer and user, the face of the port plug, threads shall be protected by the manufacturer from nicks and scratches which would be detrimental to the fitting's function. Paper caps and plugs are not permitted.

6.3 Size and Style Designation—Plugs are designated according to SAE J846. The size is indicated by the nominal outside diameter of the tubing or nominal inside diameter of the hose and the port end size for stud fittings. The style designation consist of a basic six-digit code made up of three groups of two digits each symbolizing in sequence the following: (a) the plug type, (b) the plug shape, and (c) the plug connecting end. An 'M' is inserted after the plug type to indicate a metric hex or wrench flat. Fitting style example (see Figure 3):