



# SURFACE VEHICLE RECOMMENDED PRACTICE

**SAE****J1926-4 JUL2009**

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Connector for Fluid Power and General Use—Ports and Stud End with ASME B1.1 Threads and O-Ring Seal—Part 4: External Hex and Internal Hex Inch Port Plugs—Dimensions, Design, Test Methods and Requirements

## RATIONALE

SAE J1926-4 port plugs were originally in SAE J514 along with flare fittings. This document moves them from SAE J514 to a stand-alone standard as a part of the inch port and stud end standards and provides a performance based standard for the industry.

### 1. SCOPE

This part defines performance requirements, dimensions, and designs for –2 through –32 internal and external hex port plugs for use in SAE J1926-1 ports. Testing and usage through many years confirm the performance requirements of port plugs made from carbon steel. The port plugs were specified in SAE J514 without any performance requirements. They have been developed and tested to gain a 4:1 working pressure rating for industrial applications.

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.

For threaded ports and stud ends specified in new designs in hydraulic fluid power applications, only ISO 6149 shall be used. Threaded ports and stud ends in accordance with ISO 1179, ISO 9974, and ISO 11926 are not to be used in new designs in hydraulic fluid power applications.

Conformance to the dimensional information in this part of SAE J1926 does not guarantee rated performance. Each manufacturer should perform testing according to the specification contained in this part of SAE J1926 to assure that components comply with the performance ratings.

### 2. REFERENCES

#### 2.1 Applicable Publications

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

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### 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 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 J1926-3 Connections for General Use and Fluid Power—Ports and Stud Ends with ASME B1.1 Threads and O-Ring Sealing—Part 3: Light-Duty (L Series) Stud Ends

### 2.1.2 ASME Publications

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

ASME B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)

### 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](http://www.astm.org).

ASTM B 117 Method of Salt Spray (Fog) Test

### 2.1.4 ISO Publications

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

ISO 48 Rubber, vulcanized or thermoplastic—Determination of hardness (hardness between 10 IRHD and 100 IRHD)

ISO 68-2 ISO General Purpose Screw Threads—Basic profile—Part 2: inch screw threads

ISO 263 ISO inch screw threads—General plan and selection for screws, bolts, and nuts—Diameter range 0.06 to 6 in

ISO 922 Corrosion tests in artificial atmosphere—Salt spray tests

ISO 1302 Technical drawings—Method of indicating surface texture on drawings

ISO 3601-3 Fluid power systems O-rings Part 3: Quality acceptance criteria—Second edition

ISO 4759-1 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 5598 Fluid power systems and components—Vocabulary

ISO 5864 ISO inch screw threads—Allowances and tolerances

ISO 9927 Corrosion tests in artificial atmospheres—Salt Spray

ISO 19879 Metallic tube connections for fluid power and general use—Test methods for hydraulic fluid power

## 2.2 Related Publications

The following publications are for information purposes only and are not a required part of this document.

### 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 J1926-1 Connections for General Use and Fluid Power—Ports and Stud Ends with ASME B1.1 Threads and O-Ring Sealing—Part 1: Threaded Port with O-Ring Seal in Truncated Housing

SAE J1926-2 Connections for General Use and Fluid Power—Ports and Stud Ends with ASME B1.1 Threads and O-Ring Sealing—Part 2: Heavy-Duty (S Series) Stud Ends

### 2.2.2 ISO Publications

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

ISO 263 ISO inch screw threads—General plan and selection for screws, bolts, and nuts—Diameter range 0.06 to 6 in

ISO 1179 Pipe connections, threaded to ISO 228/1, for plain end steel and other metal tubes in industrial applications

ISO 3601-1 O-rings: Part 1: Inside diameters, cross-sections, tolerances and size identification code

ISO 6149-1 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 in truncated housing

ISO 6149-2 Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and O-ring sealing—Part 2: Heavy-duty (S series) stud ends—Dimensions, design, test methods and requirements

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 9974 Connections for general use and fluid power—Ports and stud ends with ISO 261 threads with elastomeric or metal to metal sealing

ISO 10683 Fasteners—Non-electrolytically applied zinc flake coatings

ISO 11926-1 Connections for fluid power and general use—Ports and stud ends with ISO 263 threads and O-ring sealing—Part 1: Ports with O-ring seal in truncated housing

ISO 11926-2 Connections for fluid power and general use—Ports and stud ends with ISO 263 threads and O-ring sealing—Part 2: Heavy-duty (S series) stud ends—Dimensions, design, test methods and requirements

ISO 11926-3 Connections for fluid power and general use—Ports and stud ends with ISO 263 threads and O-ring sealing—Part 3: Light-duty (L series) stud ends—Dimensions, design, test methods and requirements

## 3. DEFINITIONS

For the purposes of this standard, 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. DIMENSIONS

### 4.1 Plug Dimensions

External hex and internal hex plugs shall conform to the dimensions shown in Figures 1 and 2 and given in Tables 1 and 2 respectively.

### 4.2 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° to a diameter equal the width across flats, with a tolerance of 0/-0.4 mm.

Hexagon tolerance for internal hexagon sockets shall be in accordance to ISO 4759-1 product grade A. Minimum across corner hex dimensions are 1.14 times the minimum width across flats.

### 4.3 Screw Threads

The screw threads on the plug shall be inch screw threads to ASME B1.1 tolerance class 2A or ISO 68-2, ISO 263, and ISO 5864. External class 2A threads which are plated or coated may exceed 2A diameters but shall not exceed maximum 3A diameters.

## 5. REQUIREMENTS

### 5.1 Working Pressure and Working Temperatures

External hex and internal hex plugs conforming to this part of SAE J1926 shall be suitable for use at the working pressures given in Table 3 when used at -40 °C and +120 °C. For use at pressures and or temperatures outside this range, the manufacturer shall be consulted.

### 5.2 Performance

External hex and internal hex plugs conforming to this part of SAE J1926 shall meet the burst and impulse pressures given in Table 3, and shall be capable of withstanding a vacuum of 6.5 kPa (0.065 bar) absolute pressure when tested in accordance with clause 7

## 6. O-RINGS

Unless otherwise specified, for use at the pressure and temperature requirements of 5.1 and Table 3 and for testing, the O-rings shall

- be made of NBR (nitrile) with a hardness of  $(90 \pm 5)$  IRHD, measured in accordance with ISO 48.
- conform to the dimensions shown in SAE J515.
- meet or exceed the O-ring quality acceptance criteria for grade N of ISO 3601-3.

Tolerances on O-ring dimensions shall be in accordance with SAE J515.

## 7. TEST METHODS

Port plug tests shall be conducted in accordance with ISO 19879 for burst, cyclic endurance (impulse) and vacuum. The qualification test torques given in Table 5 shall be used in testing. Test results shall be reported on the test data form in ISO 19879.

## 8. DESIGNATION OF PORT PLUGS

For ordering information see SAE J846 and Appendix B for detailed ordering examples.

## 9. MANUFACTURE

### 9.1 Construction

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

### 9.2 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.

### 9.3 Surface Finish

Unless otherwise specified, surface finish on all surfaces shall be  $R_a < 6.3 \mu\text{m}$ .

### 9.4 Plating

The external surfaces and threads of all carbon steel parts shall be plated or coated with a suitable material that passes a 96 h salt spray test in accordance with ASTM B 117 or ISO 9227. Any appearance of red rust during the 96 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 may be mechanical deformation of the plating or coating typical of mass-produced parts or shipping effects.
- c. 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 may affect torque and require re-qualification, when applicable

## 10. PROCUREMENT INFORMATION

The purchaser should supply a description of the plug using the designation in accordance with clause 8 when making an inquiry or placing an order. Deviations from the requirements of this part of SAE J1926, such as materials, pressures and temperatures, shall be agreed upon by the supplier and the purchaser.

### 10.1 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.

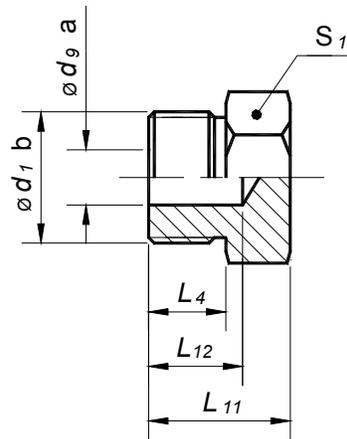
### 10.2 Marking

Port plugs shall be permanently marked with the manufacturer's name or trademark

## 11. IDENTIFICATION STATEMENT (REFERENCE TO THIS PART OF SAE J1926-4)

Use the following statement in test reports, catalogues and sales literature when electing to comply with this standard.

*"Port plugs conform to SAE J1926-4, Connector for Fluid Power and General Use—Ports and Stud End with ASME B1.1 Threads and O-Ring Seal—Part 4: External Hex and Internal Hex Inch Port Plugs—Dimensions, Design, Test Methods and Requirements."*



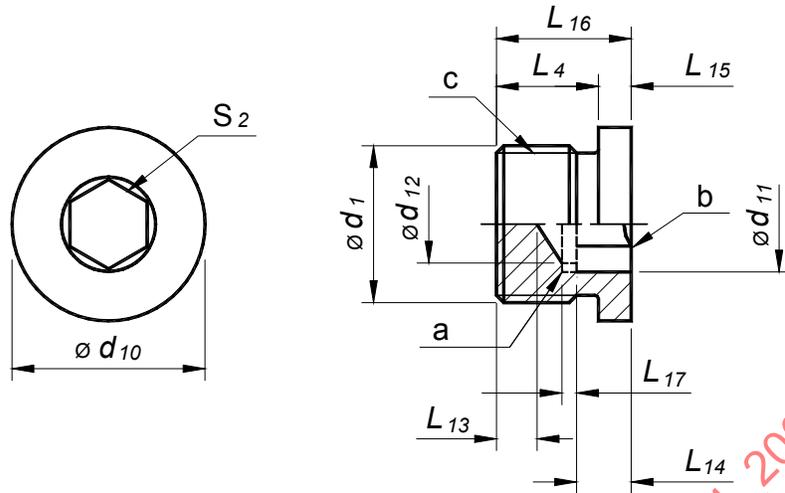
a = Optional drill (Included angle should be 118° minimum)  
 b = Stud end in accordance with SAE J1926-3

FIGURE 1 - EXTERNAL HEX PORT PLUG (090109A)

TABLE 1 - DIMENSIONS OF EXTERNAL HEX PORT PLUGS

Dash Size	$d_1^{(1)}$ Thread Inch	$d_9$		$L_4$ ref.	$L_{11}$ $\pm 0.5$	$L_{12}$ Max	$S_1^{(2)}$ Inch Hex
			Tol. $\pm$				
-2	5/16 -24	2.4	0.1	7.5	15.2	12.4	11.11
-3	3/8 -24	3.2	0.1	7.5	15.2	11.7	12.70
-4	7/16 -20	5.2	0.1	9.1	17	12.4	14.26
-5	1/2 -20	6	0.1	9.1	17	11.7	15.88
-6	9/16 -18	7.6	0.2	10	18.5	11.5	17.46
-8	3/4 -16	10.8	0.2	11.1	20.3	10.9	22.22
-10	7/8 -14	12.8	0.2	12.7	23.6	12.8	25.40
-12	1 1/16 -12	16.7	0.2	15.1	27.7	15.7	31.75
-14	1 3/16 -12	18.3	0.2	15.1	27.7	15.2	34.93
-16	1 5/16 -12	22.3	0.2	15.1	28.4	14.7	38.10
-20	1 5/8 -12	27.8	0.2	15.1	30.5	15.2	47.63
-24	1 7/8 -12	34.3	0.3	15.1	32.3	15	53.98
-32	2 1/2 -12	46.2	0.3	15.1	36.3	14.2	69.85

1. Thread size 5/16 through 7/8 are UNF-2A, sizes 1 1/16 through 2 1/2 are UN-2A.
2. Hex tolerance per ISO 4759-1, product Grade B. For metric hex see ISO 11926-4.



- a = Optional, Socket undercut  $d_{14}$  diameter X  $L_{17}$  width  
 b = Socket countersink  $90^\circ$  X  $d_{11}$  dia.  
 c = Stud end in accordance with SAE J1926-3

FIGURE 2 - INTERNAL HEX PORT PLUG (090109B)

TABLE 2 - DIMENSIONS OF INTERNAL HEX PORT PLUGS

Dash Size	$d_1^{(1)}$ Thread Inch	Dimensions in millimetres										
		$d_{10}$ $\pm 0.15$	$d_{11}$ $\pm 0.25$	$d_{12}$ $+0.13$ 0	$d_{14}$ Optional $+0.25$	$L_4$ ref.	$L_{13}$ min.	$L_{14}$ min.	$L_{15}$ $+0.00$ $-0.25$	$L_{16}$ ref.	$L_{17}$ Optional $\pm 0.5$	$S_2$ Inch Hex
-2	5/16 -24	11.1	4	3.18	4	7.5	2	4	2.75	10.3	1.6	3.18
-3	3/8 -24	12.7	4.8	3.96	4.8	7.5	2	5	2.75	10.3	1.6	3.96
-4	7/16 -20	14.3	5.7	4.76	5.7	9.1	2	5.5	2.9	12	2	4.76
-5	1/2 -20	15.85	6.6	5.56	6.6	9.1	2	6	2.9	12	2	5.56
-6	9/16 -18	17.45	7.6	6.35	7.6	10	2.5	7.5 <sup>(2)</sup>	2.9	12.9	2	6.35
-8	3/4 -16	22.2	9.4	7.95	9.4	11.1	3	7.5	3.75	14.9	2	7.95
-10	7/8 -14	25.4	11.2	9.52	11.2	12.7	3	7.5	3.95	16.7	2.4	9.52
-12	1 1/16 -12	31.75	16.7	14.30	16.7	15.1	3.8	8	4.60	19.7	3.2	14.30
-14	1 3/16 -12	34.9	16.7	14.30	16.7	15.1	3.8	8 <sup>(2)</sup>	4.60	19.7	3.2	14.30
-16	1 5/16 -12	38.1	18.5	15.88	18.5	15.1	4.8	9.5	4.60	19.7	3.2	15.88
-20	1 5/8 -12	47.6	22.2	19.05	22.2	15.1	4.8	9.5	4.60	19.7	3.2	19.05
-24	1 7/8 -12	53.95	22.2	19.05	22.2	15.1	6.4	9.5	4.60	19.7	3.2	19.05
-32	2 1/2 -12	69.85	22.2	19.05	22.2	15.1	6.4	9.5	4.60	19.7	3.2	19.05

1. Thread size 5/16 through 7/8 are UNF-2A, sizes 1 1/16 through 2 1/2 are UN-2A.
2. Special bottoming drills may be required for dimensions.

TABLE 3 - PRESSURES FOR EXTERNAL HEX, AND INTERNAL HEX PORT PLUGS<sup>(1)</sup>Units in Megapascals<sup>(2)</sup>

Dash Size	Thread	External Hex			Internal Hex		
		Working Pressure	Test Pressure		Working Pressure	Test Pressure	
			Burst	Impulse <sup>(3)</sup>		Burst	Impulse <sup>(3)</sup>
-2	5/16 -24	64	256	85	42	168	56
-3	3/8 -24	64	256	85	42	168	56
-4	7/16 -20	64	256	85	42	168	56
-5	1/2 -20	64	256	85	42	168	56
-6	9/16 -18	64	256	85	64	256	85
-8	3/4 -16	64	256	85	64	256	85
-10	7/8 -14	64	256	85	64	256	85
-12	1 1/16 -12	42	168	56	42	168	56
-14	1 3/16 -12	42	168	56	42	168	56
-16	1 5/16 -12	42	168	56	42	168	56
-20	1 5/8 -12	25	100	33.2	25	100	33.2
-24	1 7/8 -12	25	100	33.2	25	100	33.2
-32	2 1/2 -12	25	100	33.2	20.7	82.8	27.5

1. Pressures were established using plugs made of low carbon steel.

2. Cyclic endurance test pressure.

3. 1 bar = 105 N/m<sup>2</sup> = 105 Pa = 0,1 MPa=14.5 psi. (To convert from MPa to psi multiply by 145, for example, 64 MPa equals 9280 psi.)

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

Dash Size	Port or Plug Thread Size	Torque [N•m] +10% 0
-2	5/16 -24	12
-3	3/8 -24	20
-4	7/16 -20	35
-5	1/2 -20	40
-6	9/16 -18	45
-8	3/4 -16	85
-10	7/8 -14	110
-12	1 1/16 -12	170
-14	1 3/16 -12	235
-16	1 5/16 -12	270
-20	1 5/8 -12	340
-24	1 7/8 -12	420
-32	2 1/2 -12	510

TABLE 5 - TEST TORQUES FOR INTERNAL HEX PORT PLUGS

Dash Size	Port or Plug Thread Size	Torque [N•m] +10% 0
-2	5/16 -24	7
-3	3/8 -24	14
-4	7/16 -20	20
-5	1/2 -20	27
-6	9/16 -18	45
-8	3/4 -16	85
-10	7/8 -14	110
-12	1 1/16 -12	170
-14	1 3/16 -12	235
-16	1 5/16 -12	310
-20	1 5/8 -12	340
-24	1 7/8 -12	420
-32	2 1/2 -12	510

## 12. NOTES

## 12.1 Marginal Indicia

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY THE SAE FLUID CONDUCTORS AND CONNECTORS TECHNICAL STEERING COMMITTEE C1—  
HYDRAULIC TUBE FITTINGS

## APPENDIX A - PART ORDERING INFORMATION (PIN)

## A.1 SCOPE

Appendix A outlines the SAE J846 Part Ordering Information code to use when ordering a plug to this specification.

## A.2 PART IDENTIFICATION NUMBER (PIN) FOR PLUGS TO THIS STANDARD

Plugs to this SAE document shall be identified by a part identification number consisting of the following:

- a. The standard, SAE J1926-4
- b. The style designation code
- c. The plug size

## A.2.1 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 connection end. An "M" is inserted after the plug type to indicate a metric hex or wrench flat. Plug style examples

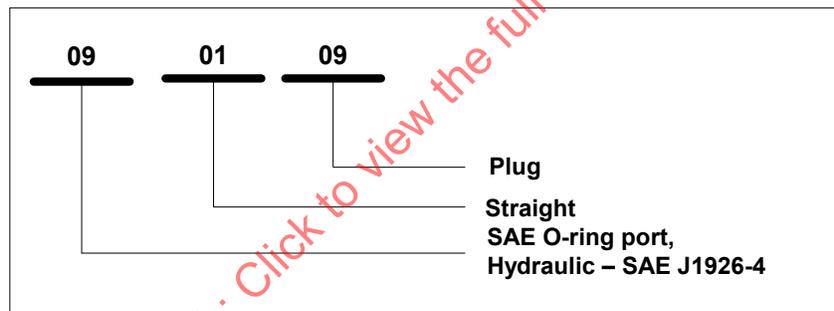


FIGURE A1 - FITTING STYLE EXAMPLE

## A.2.2 Size and Style Designation Modifiers

Modifiers are added to the code to provide additional information. An "M" is inserted after the plug type to indicate a metric hex or wrench flat. Suffixes are added to indicate the style and material. (See SAE J846 for more complete information.)