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SURFACE VEHICLE STANDARD

SAE J2244-3

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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

This document is technically equivalent to ISO 6149-3, except as noted in the Foreword.

Foreword—SAE J2244/ISO 6149 was prepared by 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

The three parts of SAE J2244 constitute a revision of ISO 6149:1980. This part defines performance requirements, dimensions, and designs for light-duty (L series) stud ends. SAE J2244-2 (ISO 6149-2) applies to fittings detailed in ISO 8434-3 and SAE J2244-3 applies to fittings detailed 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 this SAE standard and the ISO standard: (a) the tube ODs have been shown for the port sizes and (b) the test requirements have been referenced to SAE J1644. SAE J1644 test requirements are identical to those in ISO 6149-3.** Size M30X2 is included in SAE J2244-2 and is scheduled for addition to this standard at a later date.

Appendix A of this standard is normative.

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 adjustable and nonadjustable light-duty (L series) stud ends and O-rings.

   Stud ends in accordance with this part of SAE J2244 may be used at working pressures up to 40 MPa for nonadjustable stud ends and 31.5 MPa for adjustable stud ends. The permissible working pressure depends upon materials, design, working conditions, applications, etc.

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 SAE Standard 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.

2. References

2.1 Applicable Documents—The following standards contain provisions which, through reference in this text, constitute provisions of this document. All standards are subject to revision, and parties to agreements based on this document shall apply the most recent edition of the standards. Members of IEC and ISO maintain registers of currently valid International Standards.

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

SAE J1644—Metallic Tube Connections for Fluid Power and General Use—Test Methods for Threaded Hydraulic Fluid Power Connectors

SAE J1926-2—Connections for General Use and Fluid Power—Ports and Stud Ends with ISO 725 Threads and O-ring Sealing—Part 2: Heavy-duty (S Series) Stud Ends

SAE J2244/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 Seal in Truncated Housing

SAE J2244-2/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

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 1179-1—Connections for fluid power and general use—Ports and stud ends with ISO 228-1 threads with elastomeric and metal-to-metal sealing—Part 1: Threaded port

ISO 1179-2—Connections for fluid power and general use—Ports and stud ends with ISO 228-1 threads with elastomeric and metal-to-metal sealing—Part 2: Heavy duty (S series) and light duty (L series) stud ends with elastomeric sealing (type E)

ISO 1179-3—Connections for fluid power and general use—Ports and stud ends with ISO 228-1 threads with elastomeric and metal-to-metal sealing—Part 3: Light duty (L series) stud ends with sealing by O-ring with retaining ring (types G and H)

ISO 1179-4—Connections for fluid power and general use—Ports and stud ends with ISO 228-1 threads with elastomeric and metal-to-metal sealing—Part 4: Stud end for general use only with metal-to-metal sealing (type B)

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—Terminology

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 8434-2—Metallic tube connections for fluid power and general use—Part 2: 37° flared fittings
ISO 8434-3—Metallic tube connections for fluid power and general use—Part 3: O-ring face seal fittings
ISO 9974-1—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and elastomeric sealing ring and metal-to-metal sealing—Part 1: Threaded port
ISO 9974-2—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and elastomeric sealing ring and metal-to-metal sealing—Part 2: Stud end with elastomeric sealing (type E)
ISO 9974-3—Connections for fluid power and general use—Ports and stud ends with ISO 261 threads and elastomeric sealing ring and metal-to-metal sealing—Part 3: Stud end with metal-to-metal sealing (type B)
ISO 11926-1—Connections for fluid power and general use—Ports and stud ends with ISO 725 threads and O-ring sealing—Part 1: Threaded port
ISO 11926-2—Connections for fluid power and general use—Ports and stud ends with ISO 725 threads and O-ring sealing—Part 2: Heavy duty (S series) stud end
ISO 11926-3—Connections for fluid power and general use—Ports and stud ends with ISO 725 threads and O-ring sealing—Part 3: Light duty (L series) stud end

2.2 Related 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.

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

SAE J343—Test and Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies
SAE J514—Hydraulic Tube Fittings
SAE J515—Hydraulic O-Ring
SAE J1926-1—Connections for General Use and Fluid Power—Ports and Stud Ends with ISO 725 Threads and O-ring Sealing—Part 1: Threaded Port with O-ring Seal in Truncated Housing

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

ANSI/ASME B1.13M-83—Metric Screw Threads—M Profile

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

ISO 48—Vulcanized rubbers—Determination of hardness (Hardness between 30 and 85 IRHD)
ISO 1302—Technical drawings—Method of indicating surface texture on drawings
ISO 3448—Industrial liquid lubricants—ISO viscosity classification
ISO 3601-3—Fluid systems—Sealing devices—O-rings—Part 3: Quality acceptance criteria
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 seal in truncated housing
ISO 6803—Rubber or plastic hoses and hose assemblies—Hydraulic pressure impulse test without flexing
ISO 7789—Hydraulic fluid power—Two, three- and four-port screw-in cartridge valve cavities

3. Definitions—For the purposes of this part of SAE J2244, the definitions given in ISO 5598 and the following definitions shall apply:

3.1 Adjustable Stud End—Stud end connector that allows for fitting orientation through final tightening of the locknut to complete the connection. This type of stud end is typically used on shape fittings (e.g., tees, crosses, and elbows).

3.2 **Nonadjustable Stud End**—Stud end connector that does not require specific orientation before final tightening of the connection because it is only used on straight fittings.

4. Stud End Size—The stud ends shall be specified by SAE J2244-3 and the thread size, separated by a colon, for example,

SAE J2244-3:M18 x 1.5

5. Requirements

5.1 **Dimensions**—Light-duty (L series) stud ends shall conform to the dimensions given in Figures 1A and 1B and Table 1. Hex tolerances across flats shall be according to ISO 4759-1, product grade C.

5.2 **Working Pressure**—Light-duty (L series) stud ends made of carbon steel shall be designed for use at the working pressures given in Table 2.

5.3 **Performance**—Light-duty (L series) stud ends made of carbon steel shall meet or exceed the burst and impulse pressures given in Table 2, when tested according to Section 7.

5.4 **Identification**—Light-duty (L series) stud ends shall be identified according to the detail shown in Figures 1A and 1B and the dimensions given in Table 1. Nonadjustable (straight) stud ends shall be identified by a turn diameter, d_2, and a notch on the turn diameter. Adjustable stud ends shall be identified by only a turn diameter, d_2, on the locknut. In addition to this identification, for both the nonadjustable and adjustable stud ends, the manufacturer may mark the stud end with the word "metric."

5.5 **Adjustable Stud End Washer Fit and Flatness**—The washer shall be clinched to the stud end with a tight slip fit to an interference fit. The slip fit shall be tight enough so that the washer cannot be shaken loose to cause it to drop from its uppermost position by its own weight. The locknut torque needed to move the washer at the maximum washer interference fit shall not exceed the torques given in Table 3.

Any washer surface that is out of flatness shall be uniform (i.e., not wavy) and concave with respect to the stud end and shall conform to the allowance given in Table 3.

6. O-rings—O-rings for use with light-duty (L series) stud ends shall conform to the dimensions given in Figure 2 and Table 4.

7. Test Methods

NOTE—Parts used for cyclic endurance or burst test shall not be tested further, used, or returned to stock.

7.1 Performance Tests

7.1.1 Parts shall be tested according to SAE J1644 for burst and cyclic endurance (impulse).

7.2 Test O-rings

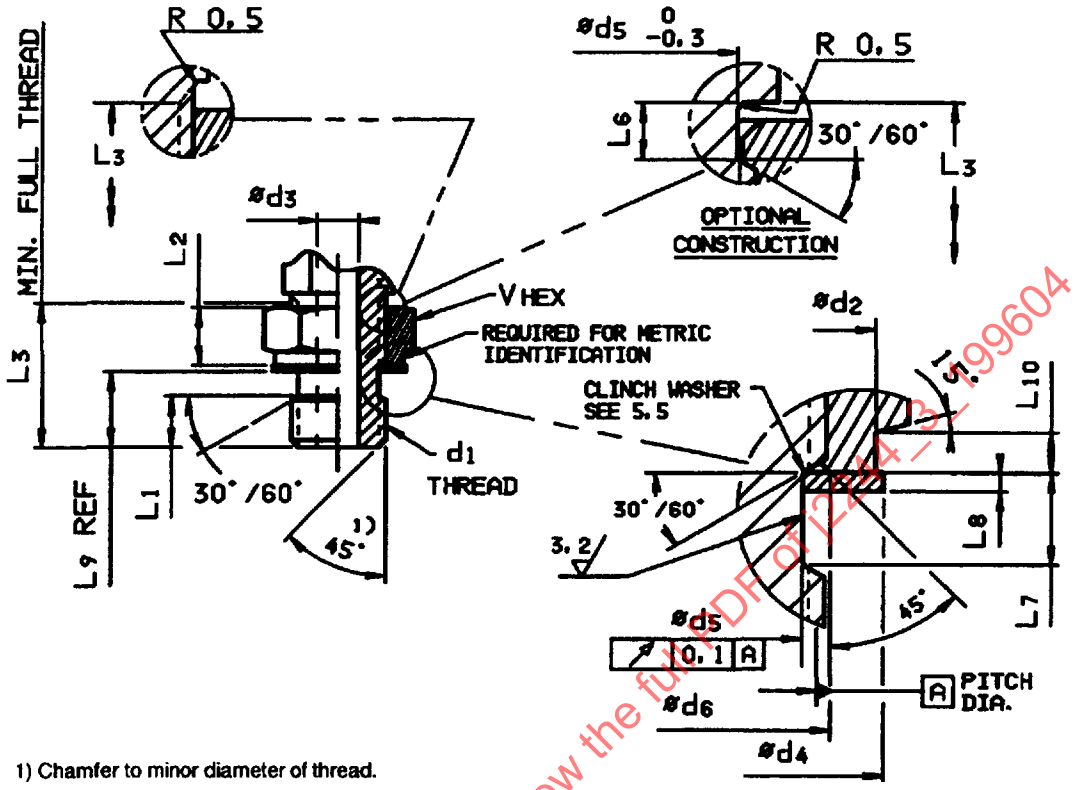
7.2.1 Test O-rings shall meet the requirements of SAE/ASTM Type CH according to SAE J515 and shall conform to the dimensions specified in Table 4.

8. ***Identification Statement***—Use the following statement in test reports, catalogues, and sales literature when electing to comply with this part of SAE J2244-3 (ISO 6149-3):

   Light-duty (L series) stud end conforms to SAE J2244-3 (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.

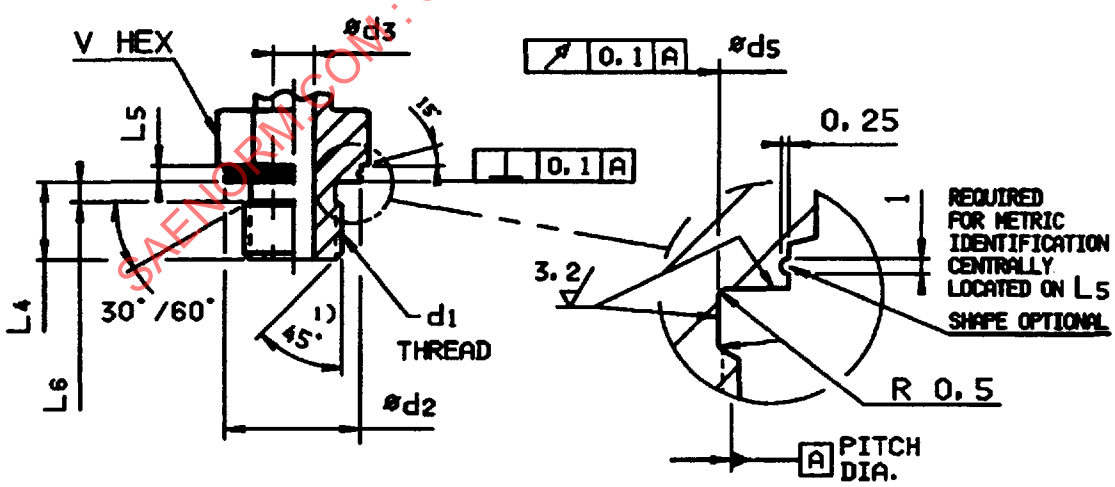
9. ***Key Words***—Fluid power, pipe fittings, standard connection, standard coupling, pipe joints, ports, stud ends, specifications, design, operating requirements, dimensions, designation, test methods, metric, straight thread, O-ring seal, high pressure

PREPARED BY THE SAE FLUID CONDUCTORS AND CONNECTORS TECHNICAL COMMITTEE SC1—AUTOMOTIVE AND HYDRAULIC TUBE AND FITTING



1) Chamfer to minor diameter of thread.

FIGURE 1A—ADJUSTABLE (L SERIES) STUD DETAIL



1) Chamfer to minor diameter of thread.

FIGURE 1B—NONADJUSTABLE (L SERIES) STUD DETAIL

TABLE 1—METRIC LIGHT-DUTY (L SERIES) STUD DIMENSIONS

Dimensions in millimeters

Tube OD	d_1[1]	d_2 ±0.2	d_3	d_4 ±0.4	d_5 0 −0.1	d_6 +0.4 0	L_1 ±0.2	L_2 ±0.2	L_3 Min	L_4[3] ±0.2	L_5 ±0.1	L_6 +0.3 0	L_7 ±0.1	L_8 ±0.08	L_9 Ref	L_{10} ±0.1	V Hex
4	M8X1	11.8	3 +0.14/0	12.5	6.4	8.1	5.5	6	16	8.5	2.5	2	4	0.9	8.6	1.5	12
5	M10X1	13.8	4.5+0.18/0	14.5	8.4	10.1	5.5	6	16	8.5	2.5	2	4	0.9	8.6	1.5	14
6	M12X1.5	16.8	6 +0.18/0	17.5	9.7	12.1	7.5	7.5	20	11	2.5	3	4.5	0.9	11.1	2	17
8	M14X1.5[2]	18.8	7.5+0.22/0	19.5	11.7	14.1	7.5	7.5	20	11	2.5	3	4.5	0.9	11.1	2	19
10	M16X1.5	21.8	9 +0.22/0	22.5	13.7	16.1	8	7.5	20.5	11.5	2.5	3	4.5	0.9	11.6	2	22
12	M18X1.5	23.8	11 +0.27/0	24.5	15.7	18.1	9	7.5	21.5	12.5	2.5	3	4.5	0.9	12.6	2.5	24
16	M22X1.5	26.8	14 +0.27/0	27.5	19.7	22.1	9	8	22.5	13	2.5	3	5	1.25	12.8	2.5	27
20	M27X2	31.8	18 +0.27/0	32.5	24	27.1	11	10	27.5	16	2.5	4	6	1.25	15.8	2.5	32
25	M33X2	40.8	23 +0.33/0	41.5	30	33.1	11	10	27.5	16	3	4	6	1.25	15.8	3	41
30	M42X2	49.8	30 +0.33/0	50.5	39	42.1	11	10	27.5	16	3	4	6	1.25	15.8	3	50
38	M48X2	54.8	36 +0.39/0	55.5	45	48.1	12.5	10	29	17.5	3	4	6	1.25	17.3	3	55
50	M60X2	64.8	44 +0.39/0	65.5	57	60.1	12.5	10	29	17.5	3	4	6	1.25	17.3	3	65

[1] Thread class 6g per ISO 261.

[2] Preferred for diagnostic port applications.

[3] Optional length L_4 in accordance with SAE J2244-2.

TABLE 2—LIGHT-DUTY (L SERIES) STUD END PRESSURE RATINGS[1]

Units in megapascals[2]

Thread Size	Stud End Style Nonadjustable Working[1] Pressure	Stud End Style Nonadjustable Test Pressure Burst	Stud End Style Nonadjustable Test Pressure Impulse[3]	Stud End Style Adjustable Working[1] Pressure	Stud End Style Adjustable Test Pressure Burst	Stud End Style Adjustable Test Pressure Impulse[3]
M8X1	40	160	53.2	31.5	126	41.9
M10X1	40	160	53.2	31.5	126	41.9
M12X1.5	40	160	53.2	31.5	126	41.9
M14X1.5	40	160	53.2	31.5	126	41.9
M16X1.5	31.5	126	41.9	25	100	33.2
M18X1.5	31.5	126	41.9	25	100	33.2
M22X1.5	31.5	126	41.9	25	100	33.2
M27X2	20	80	26.6	16	64	21.3
M33X2	20	80	26.6	16	64	21.3
M42X2	20	80	26.6	16	64	21.3
M48X2	20	80	26.6	16	64	21.3
M60X2	16	64	21.3	10	40	13.3

[1] These pressure ratings were established using fittings made of low carbon steel and O-rings per 7.2.1.

[2] To convert from MPa to bar multiply by 10 (10 bar/MPa).

[3] Cyclic endurance test pressure.

TABLE 3—ADJUSTABLE STUD END WASHER TORQUE AND FLATNESS ALLOWANCE

Thread Size	Maximum Nut Torque to Move Washer N·m	Maximum Washer Flatness Allowance mm
M8X1	1	0.25
M10X1	3	0.25
M12X1.5	4	0.25
M14X1.5	5	0.25
M16X1.5	7	0.25
M18X1.5	10	0.25
M22X1.5	12	0.25
M27X2	15	0.40
M33X2	20	0.40
M42X2	25	0.50
M48X2	30	0.50
M60X2	40	0.50

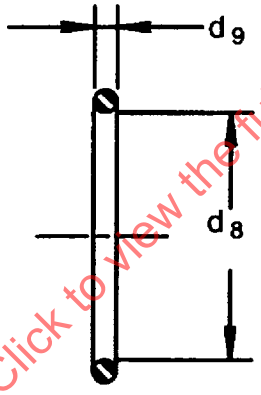


FIGURE 2—O-RING DETAIL

TABLE 4—STUD O-RING DIMENSIONS

Dimensions in millimeters

Thread Size	d_8 Inside Diameter	d_9 Section Diameter
M8X1	6.1 ± 0.20	1.6 ± 0.08
M10X1	8.1 ± 0.20	1.6 ± 0.08
M12X1.5	9.3 ± 0.20	2.2 ± 0.08
M14X1.5	11.3 ± 0.20	2.2 ± 0.08
M16X1.5	13.3 ± 0.20	2.2 ± 0.08
M18X1.5	15.3 ± 0.20	2.2 ± 0.08
M22X1.5	19.3 ± 0.22	2.2 ± 0.08
M27X2	23.6 ± 0.24	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

TABLE 5—STUD QUALIFICATION TEST TORQUE REQUIREMENTS

Thread Size	Torque N·m +10% 0
M8X1	8
M10X1	15
M12X1.5	25
M14X1.5	35
M16X1.5	40
M18X1.5	45
M22X1.5	60
M27X2	100
M33X2	160
M42X2	210
M48X2	260
M60X2	315

APPENDIX A
(NORMATIVE)

Stud Specifications:

Manufacturer _____ Test Facility _____

Stud End Type _____ Size _____

Minimum Material Tensile Strength _____ MPa

Stud Working Pressure (Table 2) _____ MPa

Stud Impulse Test Pressure (Table 2) _____ MPa

Stud Burst Test Pressure (Table 2) _____ MPa

Qualification Test Assembly Torque (Table 5) _____ N·m

Burst Test Results: (Three Samples minimum burst tested.)

Sample No.	Pressure @ Failure	Torque	Hardness	Type of Failure
1.	_____ MPa	_____ N·m	_____	_____
2.	_____ MPa	_____ N·m	_____	_____
3.	_____ MPa	_____ N·m	_____	_____

Cycle Endurance Test Results (Six Samples minimum impulse tested.)

Sample No.	Cycles @ Failure	Torque	Hardness	Type of Failure
1.	_____	_____ N·m	_____	_____
2.	_____	_____ N·m	_____	_____
3.	_____	_____ N·m	_____	_____
4.	_____	_____ N·m	_____	_____
5.	_____	_____ N·m	_____	_____
6.	_____	_____ N·m	_____	_____

Oil Temperature _____ 5C

Conclusions: _____

_____

Dimensions: List Any Exception _____

_____

_____

Printed Name of Person Certifying This Report: _____

Signature of Person Certifying This Report: _____

Date _____

FIGURE A1—METRIC PORT AND STUD TEST DATA FORM