SURFACE VEHICLE STANDARD

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Metallic Connections for Fluid Power and General Use - Part 3: NPTF Pipe Adapters and NPSM Adapter Unions

RATIONALE

Revise Tables 6 and 11 to remove references to tube size. Dash size designation for SAE J1926-3 stud ends were also added to Table 11 for clarity.

FOREWORD

The January 2012 edition of SAE J514 was a single document specifying the requirements for the following;

- 37 degree flare adapters with SAE J1926-3 stud ends and NPTF pipe ends.
- Flareless bite type adapters with SAE J1926-3 stud ends and NPTF pipe ends.
- O-ring plugs with internal and external hex.
- NPTF pipe adapters.
- 30 degree NPSM adapter unions.

SAE J514-3 specifies NPTF adapters and 30 degree NPSM adapter unions. Formerly, SAE J514 was organized as a single document with ten clauses, which included six sections. SAE J514 has been organized into three sections as follows:

Part 1: 37 degree flared fittings.

Part 2: Flareless (bite type) fittings.

Part 3: NPTF pipe fittings and pipe unions.

It is important to note that this and all SAE J documents are intended for ground vehicle use only and are not intended for aerospace vehicles.

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1. SCOPE

This part of SAE J514 covers general and dimensional specifications for NPTF pipe adapters and 30 degree NPSM adapter unions. These fittings are intended for general application in hydraulic systems on industrial equipment and commercial products.

These fittings are capable of providing leak-proof, full-flow connections in hydraulic systems operating at working pressures as specified in Table 6. Since many factors influence the pressure at which a hydraulic system will or will not perform satisfactorily, the values shown in Table 6 should not be construed as a guaranteed minimum.

For any application, it is recommended that sufficient testing be conducted and reviewed by both the user and fitting manufacturer to assure that performance levels will be safe and satisfactory.

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 J403 Chemical Compositions of SAE Carbon Steels

SAE J405 Chemical Compositions of SAE Wrought Stainless Steels

SAE J476 Dryseal Pipe Threads

SAE J846 Coding Systems for Identification of Fluid Conductors and Connectors

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

SAE J2593 Information Report for the Installation of Fluid Conductors and Connectors

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ANSI B4.2 Preferred Metric Limits and Fits

2.1.3 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 B1.1 Unified Inch Screw Threads (UN, UNR, UNJ Thread Forms)

ASME B1.20.1 General Purpose Pipe Threads

ASME B1.20.3 Dryseal Pipe Threads - Inch

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

2.1.4 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 A380 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems

ASTM B117 Method of Salt Spray (Fog) Test

ASTM B633 Standard Specifications for Electrodeposited Coatings of Zinc on Iron and Steel

2.1.5 ISO Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ISO 725 ISO Inch Screw Threads - Basic Dimensions

ISO 2768-1 General Tolerances - Part 1: Tolerances for Linear and Angular Dimensions without Individual Tolerances Indications

ISO 3448 Industrial Liquid Lubricants - ISO Viscosity Classification

ISO 5598 Fluid Power Systems and Components - Vocabulary

ISO 6508 Metallic Materials - Hardness Test - Rockwell Test (Scales A - B - C - D - E - F - G - H - K)

ISO 9227 Corrosion Tests in Artificial Atmospheres - Salt Spray Tests

ISO 19879 Metallic Tube Connections for Fluid Power and General Use - Test Methods for Hydraulic Fluid Power Connections

3. DEFINITIONS

For this part of SAE J514, the definitions given in ISO 5598 and the following definitions shall apply:

3.1 FLUID POWER

(From ISO 5598) Means whereby signals and energy can be transmitted, controlled, and distributed using a pressurized fluid as the medium.

3.2 CONNECTOR

(From ISO 5598) Device that connects tubes, hoses, or pipes to each other or to components.

3.3 FASTENING THREAD

Terminal thread of a complete connector.

3.4 RUN

Two axially aligned outlets of a tee or cross. See Figure 1.

Figure 1 - Run and branch illustration

3.5 BRANCH

Side outlet of a tee or cross. See Figure 1.

3.6 CHAMFER/COUNTERSINK

Removal of a conical portion at the entrance (female) or end (male) of a thread to assist assembly and prevent damage to the start of the thread.

3.7 TORQUES

3.7.1 ASSEMBLY TORQUE

The recommended torque value to be applied in order to achieve a satisfactory final assembly.

3.7.2 QUALIFICATION TEST TORQUE

The torque used to verify conformance of the connector to the requirements of this standard.

3.7.3 OVERTORQUE

The torque the nut shall withstand without deformation that renders it unusable.

3.8 MAXIMUM WORKING PRESSURE

(From ISO 5598) Highest pressure at which a system or sub-system can operate in steady-state operating conditions.

3.9 JUMP SIZE CONNECTOR

Connectors with dissimilar size end connections, for example, -6 male flare with a -12 stud end.

3.10 SIZE DESIGNATION

Connector sizes are designated by the nominal outside diameter of the tubing or nominal inside diameter of hose. Refer to SAE J846 for specific size details.

3.11 CONTACT SURFACES

All mating interfaces within a connection including, but not limited to, threads, sealing seat, and shoulders of nut.

4. REQUIREMENTS - GENERAL SPECIFICATIONS

The following general specifications supplement the dimensional data contained in Tables 1 to 13 with respect to all unspecified detail.

4.1 Size Designations

Fitting sizes are designated by the corresponding pipe thread. Refer to SAE J846 for proper coding and call-out.

4.2 Dimensions and Tolerances

Except for nominal sizes and thread designations, dimensions and tolerances are given in SI units. Tabulated dimensions shall apply to the finished parts, plated or otherwise processed, as specified by the purchasers. Hex tolerances are listed in Table 1A. The minimum across corner hex dimensions shall be 1.092 times the nominal width across flats, and the minimum side flat shall be 0.43 times the nominal width across flats as shown in Figure 2. The minimum across-corners dimensions of external squares shall be 1.25 times the nominal width across flats, but shall not result in a side-flat width less than 0.75 times the nominal width across the flats.

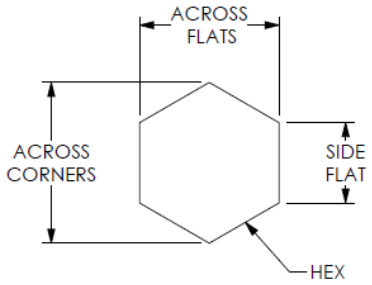

Figure 2 - Hex tolerances

Table 1A - Hex tolerances

Nominal Hex Size Across Flats mm Over	Nominal Hex Size Across Flats mm Include	Nominal Hex Size Across Flats Inches Over	Nominal Hex Size Across Flats Inches Include	Tolerance (Minus Only) mm	Tolerance (Minus Only) Inches
-	19.05	-	0.750	0.3	0.012
19.05	25.40	0.750	1.000	0.4	0.016
25.40	34.92	1.000	1.375	0.5	0.020
34.92	and up	1.375	and up	0.8	0.031

Tolerance on all dimensions not otherwise limited shall be ±0.4 mm. Fitting seats shall be concentric with straight thread pitch diameters within 0.25 mm full indicator movement (FIM).

Unless otherwise specified, tolerances on hole diameters in the dimensional tables shall be as tabulated in Table 1:

Table 1B - Hole tolerances

Hole Size Range mm	Tolerance mm
≤6	±0.1
>6, ≤30	±0.2
>30	±0.3

Other tolerances not specified shall be in accordance with ISO 2768-1 as shown in Tables 2 to 4 for designation m (medium).

Table 2 - Linear tolerances (except for broken edges)

>0.5 ≤6	>6 ≤30	>30 ≤120	>120 ≤400	>400 ≤1000	>1000 ≤2000	>2000 ≤4000
±0.1	±0.2	±0.3	±0.5	±0.08	±1.2	±2

For nominal sizes below 0.5, the tolerances shall be indicated adjacent to the relevant nominal sizes.

Table 3 - Broken edges tolerances (external radii and chamfer heights)

>0.5 ≤3	>3 ≤6	>6
±0.2	±0.5	±1

For nominal sizes below 0.5, the tolerances shall be indicated adjacent to the relevant nominal sizes.

Table 4 - Angular tolerances

≤10	>10 ≤50	>50 ≤120	>120 ≤400	>400
±1 degree	±0 degree 30 minutes	±0 degree 20 minutes	±0 degree 10 minutes	±0 degree 5 minutes

Tolerances for ranges of lengths, in millimeters, of the shorter side of the angle concerned.

Angular tolerance on axis of ends on elbows, tees, and crosses shall be ±2.50 degrees for -2 to -6 tube fittings and ±1.50 degrees for -8 to -32 OD tube fittings.

Where so illustrated and not otherwise specified, hexagon corners shall be chamfered 15 to 30 degrees to a diameter equal to the width across flats, with a minus tolerance of 0.4 mm; or, where design permits, corners may be chamfered to the diameter of the abutting surface providing the length of chamfer does not exceed that produced by the 30 degree chamfer previously described.

Alternatively, on connections other than SAE J1926-3 straight thread, a 5 degree chamfer starting at the undercut diameter behind the threads or outside diameter of the threads shall be allowed, providing the hex width at corners is not reduced below that produced by the 30 degree chamfer previously described.

4.3 Passages

Where passages in straight fittings are machined from opposite ends, the offset at the meeting point shall not exceed 0.4 mm. The cross-sectional area at the junction of passages in angle fittings shall not be less than that of the smallest passage.

4.4 Wall Thickness

Unless otherwise designated, the wall thickness at any point on fittings shall not be less than the thickness established by the specified dimensions, tolerances, and eccentricities for inner and outer surfaces.

4.5 Contour

Details of contour (e.g., body shape, construction type, etc.) shall be optional with the manufacturer, provided the dimensions and tolerances in this document are maintained.

4.6 Pipe Threads

Pipe threads, unless there is specific authorization to the contrary, shall conform to the dryseal American standard taper pipe thread (NPTF). Specifications are given in detail in SAE J476 (ASME B1.20.3).

The length of full form external thread shall not be shorter than L_2 plus one pitch (thread).

Where external pipe threads are produced by roll threading, the diameter of the unthreaded shank adjacent to shoulder may be reduced to the E_2 pitch diameter for brass fittings and to the root diameter on steel fittings.

External pipe threads shall be chamfered from the diameters tabulated below to produce the specified length of chamfer or partial thread. Internal pipe threads shall be countersunk 90 degrees, included angle, to the diameters tabulated in Table 5.

Table 5 - Pipe thread chamfer diameters

Nominal Pipe Thread Size	External Thread Chamfer Dia Max mm	External Thread Chamfer Dia Max Inches	External Thread Chamfer Dia Min mm	External Thread Chamfer Dia Min Inches	External Thread Length of Chamfer or Partial Thread Min mm	External Thread Length of Chamfer or Partial Thread Min Inches	External Thread Length of Chamfer or Partial Thread Max mm	External Thread Length of Chamfer or Partial Thread Max Inches	Internal Thread Countersink Dia Min mm	Internal Thread Countersink Dia Min Inches	Internal Thread Countersink Dia Max mm	Internal Thread Countersink Dia Max Inches
1/8	8.1	0.32	7.6	0.30	0.94	0.037	1.40	0.055	10.7	0.42	11.2	0.44
1/4	10.7	0.42	10.2	0.40	1.42	0.056	2.13	0.084	14.0	0.55	14.5	0.57
3/8	14.0	0.55	13.5	0.53	1.42	0.056	2.13	0.084	17.5	0.69	18.0	0.71
1/2	17.3	0.68	16.8	0.66	1.80	0.071	2.72	0.107	21.6	0.85	22.1	0.87
3/4	22.6	0.89	22.1	0.87	1.80	0.071	2.72	0.107	26.9	1.06	27.4	1.08
1	28.4	1.12	27.7	1.09	2.21	0.087	3.30	0.130	34.0	1.34	34.8	1.37
1-1/4	37.1	1.46	36.3	1.43	2.21	0.087	3.30	0.130	42.7	1.68	43.4	1.71
1-1/2	43.2	1.70	42.4	1.67	2.21	0.087	3.30	0.130	48.8	1.92	49.5	1.95
2	55.1	2.17	54.4	2.14	2.21	0.087	3.30	0.130	60.7	2.39	61.5	2.42

Tabulated diameters conform with Appendix A of SAE J476.

4.7 Material

Unless otherwise specified, fittings shall be made from carbon steel.

Stainless steel fittings shall be made from AISI Type 300 Series stainless steel in accordance with SAE J405. Unless otherwise specified by the purchaser, stainless steel fittings shall be passivated per ASTM A380. Carbon steel and stainless steel fittings fabricated from multiple components must be bonded together with materials having a melting point of not less than 996 °C (1825 °F).

Brass fittings shall be made from C36000 (CA360) one-half hard barstock or extruded shapes or C37700 (CA377) forgings or equivelant materials.

4.8 Corrosion Protection

The external surfaces and threads of all carbon steel parts shall be plated or coated with a suitable material that passes a salt spray test in accordance with ISO 9227, 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 may 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 specification shall not be cadmium plated and shall not use hexavalent chromate coatings. Internal fluid passages shall be protected from corrosion during storage and shipping. Changes in plating or coating shall be requalified to ensure assemby torque is not affected.

4.9 Workmanship

Workmanship shall conform to the best commercial practice to produce high-quality connectors. Connectors shall be free from all hanging burrs, loose scale, and slivers which might become dislodged in usage and all other defects which might affect their serviceability. All sealing surfaces must be smooth, except that annular tool marks up to 2.5 µm max Ra shall be permissible.

5. PERFORMANCE REQUIREMENTS

The following outlines the performance test requirements for NPTF Adapters and 30 degree NPSM adapter unions. Connectors and swivel nuts shall be tested in acccordance with ISO 19879, unless otherwise specified. In addition to the test requirements and procedures specified, all components must be able to pass the performance requirements in the as-shipped condition (e.g., annealed components, plating, coatings, rust preventative, etc.).

Consult the manufacturer for test torque recommendations.

Table 6 - Working pressure ratings[1] capable of 4-to-1 minimum burst

Nom Pipe Size	Dryseal Pipe Thread SAE J476 (ASME B1.20.3)	Fittings[2][3][4] with Rigid Pipe Threads Working Pressure MPa	Fittings[2][3][4] with Rigid Pipe Threads Working Pressure psi	[2][3][4][5][6] Straight Thread Pipe NPSM Working Pressure Mpa	[2][3][4][5][6] Straight Thread Pipe NPSM Working Pressure psi
1/8	1/8-27	34.5	5000	34.5	5000
1/4	1/4-18	27.5	4000	34.5	5000
3/8	3/8-18	21	3000	27.6	4000
1/2	1/2-14	21	3000	24.1	3500
3/4	3/4-14	17	2500	15.5	2250
1	1-11 1/2	14	2000	13.8	2000
1-1/4	1 1/4-11 1/2	8	1150	11.2	1625
1-1/2	1 1/2-11 1/2	7	1000	8.6	1250
2	2-11 1/2	7	1000	7.8	1125

(1) Working pressures given are for low carbon steel fittings only. Consult the manufacturer for values for other materials.
(2) Proof pressure = 2 x Working pressure.
(3) Burst pressure = 4 x Working pressure.
(4) Impulse pressure = 1.33 x Working pressure.
(5) Pressure ratings shown are the pressure ratings for the fitting and are not necessarily the pressure ratings applicable in an assembly with hydraulic hose. The applicable pressure rating for an assembly with hydraulic hose is the lower value specified for the hose and the fitting, unless otherwise agreed to by the supplier and user.
(6) Adapter unions with American standard straight pipe thread for mechanical joints.

Refer to ISO 19879 for minimum number of samples required for testing.

5.1 Working, Proof, and Burst Pressure

Working pressures for fittings, tube connections, and hose fittings shall be as listed in Table 6. Proof pressures shall be twice the working pressures and minimum burst pressures shall be four times the working pressures.

5.2 Proof Test

All fittings for tubing and adapters shall be capable of withstanding proof pressure per Table 6 for a period of 1 minute without failure or leakage. Lubrication and torque values shall be determined by the manufacturer unless otherwise specified by the customer. The test shall be conducted as specified in ISO 19879.

5.3 Burst Test

Burst test shall be conducted at the recommended torque, or flats from finger tight specified by the manufacturer and at pressures shown in Table 6. All contact surfaces shall be lubricated with SAE 10W hydraulic oil prior to assembly. Test blocks and other mating test components for burst testing shall be unplated and hardened to 45 to 55 HRC. The test shall be conducted as specified in ISO 19879.

5.4 Cyclic Endurance (Impulse) Test

Cyclic endurance test shall be conducted at at the recommended torque, or flats from finger tight specified by the manufacturer and at pressures shown in Table 6. All threads and contact surfaces shall be lubricated with SAE 10W hydraulic oil prior to assembly. Test blocks and other mating test components for cyclic endurance testing shall be unplated and hardened to 45 to 55 HRC. The test shall be conducted as specified in ISO 19879.

5.5 Test Data Form

Test data shall be reported on the test data form in ISO 19879.

6. PACKAGING AND MARKING

6.1 Marking

All connectors shall be permanently marked with individual suppliers trademark or code identifier, unless otherwise agreed upon by user and manufacturer.

6.2 Protection

By agreement between purchaser and supplier, the threads (both internal and external) may be protected by the manufacturer from nicks and scratches detrimental to their function.

6.3 SAE J846 Ordering Designation, Part Identification Number (PIN)

By agreement between the manufacturer and user, the ordering designation from SAE J846 may be used to abbreviate the ordering of NPTF adapters and 30 degree NPSM adapter unions. Refer to SAE J514-1 or SAE J846 for examples.

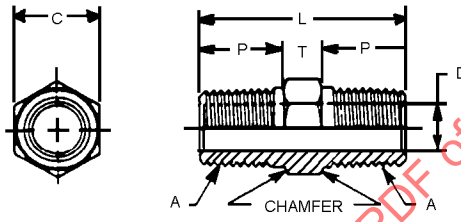

Figure 3 - Hexagon pipe nipple (140137)

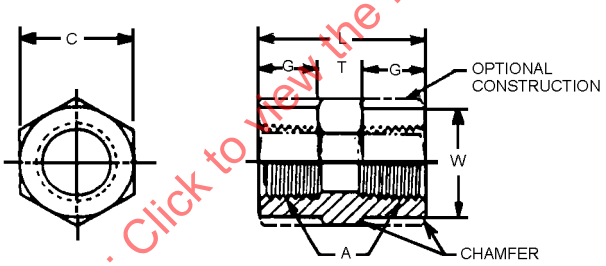

Figure 4 - Hexagon pipe coupling (140138)

Table 7 - Dimensions of hexagon pipe nipples (Figure 3)

A Dryseal Pipe Thread SAE J476 (ASME B1.20.3)	C Hex Nom	D[b] Drill mm	D[b] Drill Inches	L mm ±0.5	L Inches ±0.02	P Min mm	P Min Inches	T[a] Min mm	T[a] Min Inches
1/8-27	7/16	4.8	0.188	26.9	1.06	9.7	0.38	5.6	0.22
1/4-18	5/8	7.0	0.281	36.8	1.45	14.2	0.56	6.4	0.25
3/8-18	3/4	10.3	0.406	36.8	1.45	14.2	0.56	6.4	0.25
1/2-14	7/8	13.5	0.531	48.0	1.89	19.0	0.75	7.9	0.31
3/4-14	1-1/8	18.0	0.719	49.8	1.96	19.0	0.75	9.7	0.38
1-11-1/2	1-3/8	23.8	0.938	59.4	2.34	23.9	0.94	9.7	0.38
1-1/4-11-1/2	1-3/4	31.7	1.250	63.0	2.48	24.6	0.97	11.7	0.46
1-1/2-11-1/2	2	38.0	1.500	66.3	2.61	25.4	1.00	13.5	0.53
2-11-1/2	2-1/2	49.0	1.938	71.6	2.82	26.2	1.03	17.3	0.68

[a] Minimum design thickness, not subject to inspection.
[b] See Table 1B for tolerance.

Table 8 - Dimensions of hexagon pipe coupling (Figure 4)

A Dryseal Pipe Thread SAE J476 (ASME B1.20.3)	C Hex Nom	G[a] Ref mm	G[a] Ref Inches	L mm ±0.5	L Inches ±0.02	T Ref Min mm	T Ref Min Inches	W Dia mm +0.00 -0.5	W Dia Inches +0.00 -0.02
1/8-27	5/8	6.4	0.25	19.0	0.75	5.6	0.22	15.88	0.625
1/4-18	3/4	10.9	0.43	28.7	1.13	6.4	0.25	19.05	0.750
3/8-18	7/8	10.9	0.43	28.7	1.13	6.4	0.25	22.22	0.875
1/2-14	1-1/8	14.2	0.56	38.1	1.50	7.9	0.31	28.58	1.125
3/4-14	1-3/8	14.2	0.56	38.9	1.53	9.7	0.38	34.92	1.375
1-11-1/2	1-5/8	17.5	0.69	48.0	1.89	9.7	0.38	41.28	1.625
1-1/4-11-1/2	2	17.5	0.69	49.0	1.93	11.7	0.46	50.80	2.000
1-1/2-11-1/2	2-3/8	17.5	0.69	49.0	1.93	13.5	0.53	60.32	2.375
2-11-1/2	2-7/8	16.0	0.63	49.8	1.96	17.3	0.68	73.03	2.875

[a] Reference dimension, not subject to inspection.
[b] See Table 1B for tolerance.

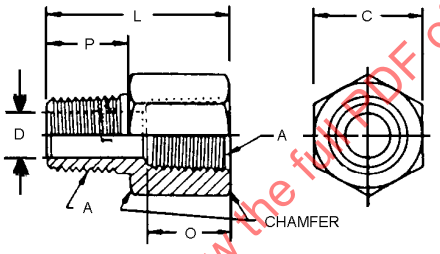

Figure 5 - Adapter (140139)

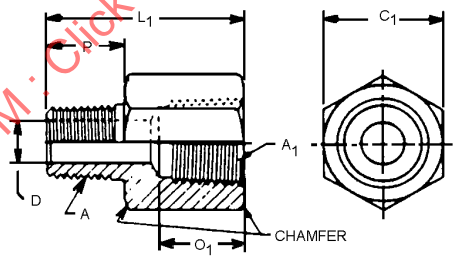

Figure 6 - Increase adapters (140139)

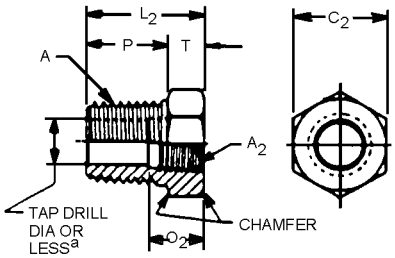

Figure 7 - Reducer bushings (140140)

Table 9 - Dimensions of adapters, increase adapters, and reducer bushings (Figures 5, 6, and 7)

Dryseal Pipe Thread SAE J476 (ASME B1.20.3) A Adapter	Dryseal Pipe Thread SAE J476 (ASME B1.20.3) A x A_1 Increase Adapter	Dryseal Pipe Thread SAE J476 (ASME B1.20.3) A x A_2 Reducer Bushing	C Hex Nom	C_1 Hex Nom	C_2 Hex Nom	D[c] Drill mm	D[c] Drill Inches	L mm ±0.5	L Inches ±0.02	L_1 mm ±0.5	L_1 Inches ±0.02	L_2 mm ±0.5	L_2 Inches ±0.02	O Min mm	O Min Inches	O_1 Min mm	O_1 Min Inches	O_2[a] Min mm	O_2[a] Min Inches	P Min mm	P Min Inches	T[b] Ref mm	T[b] Ref Inches
1/8-27	1/8 x 1/4	—	5/8	3/4	—	4.8	0.188	26.4	1.04	30.7	1.21	—	—	9.7	0.38	14.2	0.56	—	—	9.7	0.38	—	—
1/4-18	1/4 x 3/8	1/4 x 1/8	3/4	7/8	5/8	7.0	0.281	35.3	1.39	36.6	1.44	21.6	0.85	14.2	0.56	14.7	0.58	9.7	0.38	14.2	0.56	6.4	0.25
3/8-18	3/8 x 1/2	3/8 x 1/4	7/8	1-1/8	3/4	10.3	0.406	36.6	1.44	42.7	1.68	21.6	0.85	14.7	0.58	19.0	0.75	14.2	0.56	14.2	0.56	6.4	0.25
1/2-14	1/2 x 3/4	1/2 x 3/8	1-1/8	1-3/8	7/8	13.5	0.531	47.5	1.87	49.0	1.93	27.9	1.10	19.0	0.75	19.6	0.77	14.7	0.58	19.0	0.75	7.9	0.31
3/4-14	3/4 x 1	3/4 x 1/2	1-3/8	1-5/8	1-1/8	18.0	0.719	49.0	1.93	55.4	2.18	29.7	1.17	19.6	0.77	23.9	0.94	19.0	0.75	19.0	0.75	9.7	0.38
1-11-1/2	1 x 1-1/4	1 x 1-3/4	1-5/8	2	1-3/8	23.8	0.938	60.2	2.37	62.5	2.46	34.5	1.36	23.9	0.94	23.9	0.94	19.6	0.77	23.9	0.94	9.7	0.38
1-1/4-11-1/2	1-1/4 x 1-1/2	1-1/4 x 1	2	2-3/8	1-3/4	31.7	1.250	63.2	2.49	63.5	2.50	37.3	1.47	23.9	0.94	23.9	0.94	23.9	0.94	24.6	0.97	11.7	0.46
1-1/2-11-1/2	1-1/2 x 2	1-1/2 x 1-1/4	2-3/8	2-7/8	2	38.0	1.500	64.3	2.53	66.8	2.63	39.9	1.57	23.9	0.94	24.6	0.97	23.9	0.94	25.4	1.00	13.5	0.53
2-11-1/2	—	2 x 1-1/2	2-7/8	—	2-1/2	49.0	1.938	67.6	2.66	—	—	44.5	1.75	24.6	0.97	—	—	23.9	0.94	26.2	1.03	17.3	0.68

(a) Beyond top drill depth O_2, hole may be reduced below tap drill diameter, but shall not be less than D diameter in corresponding external pipe size adapter.
(b) Minimum design thickness, not subject to inspection.
(c) See Table 1B for tolerance.

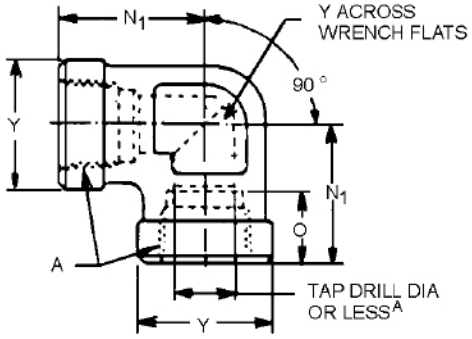

Figure 8 - 90 degree pipe elbow (140238)

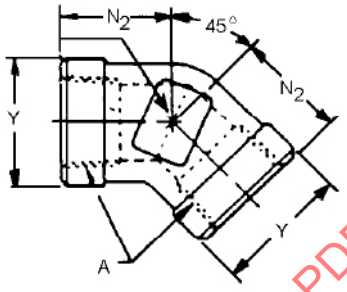

Figure 9 - 45 degree pipe elbow (140338)

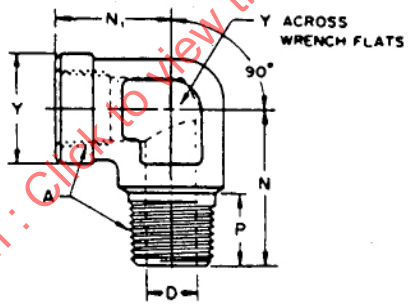

Figure 10 - 90 degree street elbow (140239)

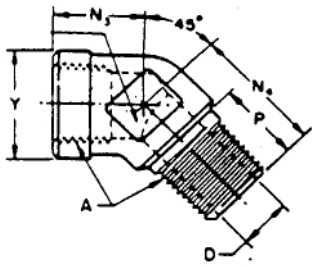

Figure 11 - 45 degree street elbow (140339)

NOTE: Figures 8 to 11 and Figures 19 to 21 depict forged construction and are optional with solid or fabricated bar stock construction depicted in Figures 12 to 18.

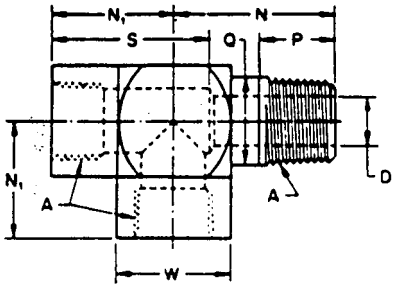

Figure 12 - Pipe tee internal, external, internal (140424)

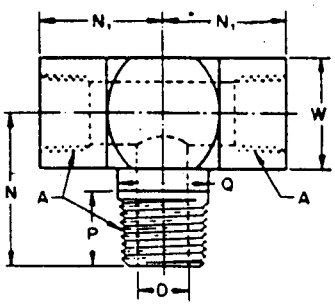

Figure 13 - Pipe tee internal, internal, external (14025)

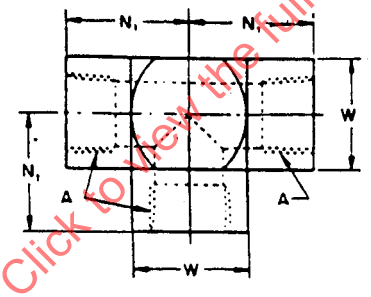

Figure 14 - Pipe tee internal, internal, internal (140438)

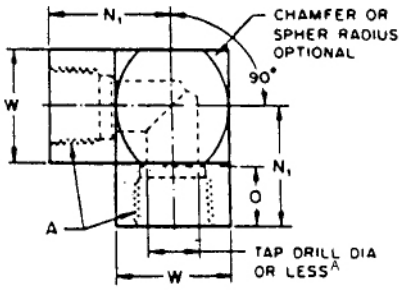

Figure 15 - 90 degree pipe elbow (140238)

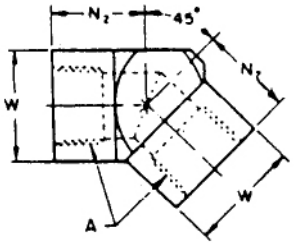

Figure 16 - 45 degree pipe elbow (140338)

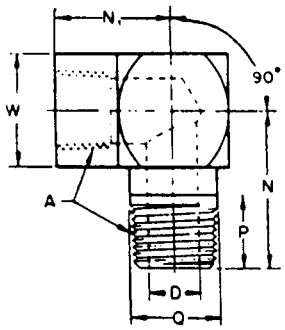

Figure 17 - 90 degree street elbow (140239)

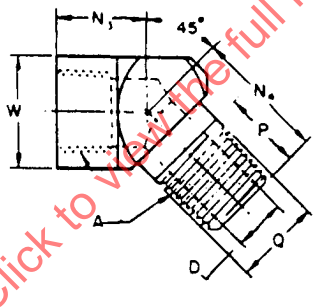

Figure 18 - 45 degree street elbow (140339)

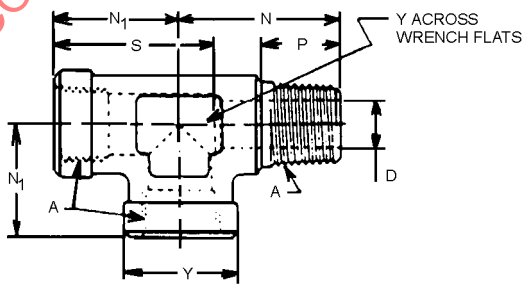

Figure 19 - Pipe tee internal, external, internal (140424)

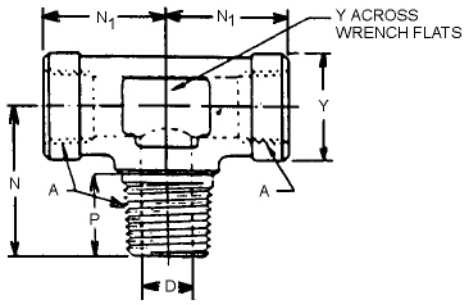

Figure 20 - Pipe tee internal, internal, external (140425)

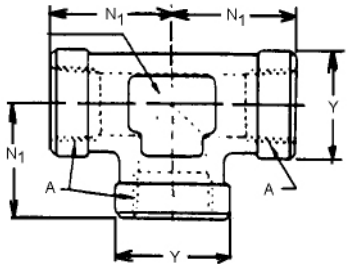

Figure 21 - Pipe tee internal, internal, internal (140438)

Table 10 - Dimensions of forged and barstock types of pipe elbows, street elbows, and pipe tees (Figures 8 to 21)

A Dryseal Pipe Thread SAE J476 (ASME B1.20.3)	D[a][d] Drill mm	D[a][d] Drill Inches	N mm ±0.8	N Inches ±0.03	N_1 mm ±0.8	N_1 Inches ±0.03	N_2 mm ±0.8	N_2 Inches ±0.03	N_3 mm ±0.8	N_3 Inches ±0.03	N_4 mm ±0.8	N_4 Inches ±0.03	O[a] Min mm	O[a] Min Inches
1/8-27	4.8	0.188	19.8	7.8	16.8	0.66	12.7	0.50	11.9	0.47	18.3	0.72	9.6	0.38
1/4-18	7.0	0.281	27.7	1.09	22.4	0.88	17.5	0.69	15.7	0.62	26.7	1.05	14.2	0.56
3/8-18	10.3	0.406	31.0	1.22	25.9	1.02	19.0	0.75	18.3	0.72	26.9	1.06	14.7	0.58
1/2-14	13.5	0.531	37.3	1.47	31.2	1.23	23.9	0.94	23.1	0.91	34.0	1.34	19.0	0.75
3/4-14	18.0	0.719	40.4	1.59	34.5	1.36	25.4	1.00	24.6	0.97	35.1	1.38	19.6	0.77
1-11-1/2	23.8	0.938	50.0	1.7	41.1	1.62	30.2	1.19	28.4	1.12	43.7	1.72	23.8	0.94
1-1/4-11-1/2	31.7	1.250	60.5	2.38	43.2	1.70	36.6	1.44	41.4	1.63	45.7	1.80	23.8	0.94
1-1/2-11-1/2	38.0	1.500	67.1	2.64	52.8	2.08	37.1	1.46	42.9	1.69	52.3	2.06	23.8	0.94
2-11-1/2	49.0	1.938	76.2	3.00	60.7	2.39	40.4	1.59	55.6	2.19	54.6	2.15	24.6	0.97

Table 10 - Dimensions of forged and barstock types of pipe elbows, street elbows, and pipe tees (Figures 8 to 21) (continued)

A Dryseal Pipe Thread SAE J476 (ASME B1.20.3)	P Min mm	P Min Inches	Q Dia Min mm	Q Dia Min Inches	S[b] Min mm	S[b] Min Inches	W Square or Dia Max mm	W Square or Dia Max Inches	Y[c] mm +0.0	Y[c] Inches +0.000
1/8-27	9.7	0.38	11.2	0.44	23.9	0.94	15.7	0.62	14.3-0.8	0.562-0.030
1/4-18	9.7	0.38	14.2	0.56	29.0	1.14	19.0	0.75	19.0-0.8	0.750-0.030
3/8-18	14.2	0.56	17.3	0.68	33.8	1.33	22.3	0.88	22.2-0.8	0.875-0.030
1/2-14	19.0	0.75	22.4	0.88	41.1	1.62	28.4	1.12	27.0-1.0	1.062-0.040
3/4-14	19.0	0.75	26.9	1.06	47.2	1.86	35.0	1.38	33.3-1.0	1.312-0.040
1-11-1/2	23.9	0.94	35.1	1.38	56.6	2.23	41.1	1.62	41.3-1.0	1.625-0.040
1-1/4-11-1/2	23.9	0.94	42.9	1.69	62.7	2.47	50.8	2.00	47.6-1.0	1.875-0.040
1-1/2-11-1/2	25.4	1.00	48.3	1.90	75.4	2.97	60.5	2.38	65.1-1.0	2.562-0.040
2-11-1/2	26.2	1.03	60.5	2.38	89.4	3.52	73.2	2.88	71.4-1.0	2.812-0.040

[a] Beyond tap drill depth O, hole may be reduced to below tap drill diameter, but shall not be less than D drill for corresponding size. See Figures 8 and 15.
[b] Maximum depth shall be optional with manufacturer provided that strength of fitting is not impaired.
[c] The basic dimension shown shall apply as minimum for boss diameter.
[d] See Table 1B for tolerance.

7. ADAPTER UNIONS

Adapter union fittings are shown in Figures 22 to 30 and Table 11.

NOTE: Unspecified detail with respect to dimensions, tolerances, contours, material workmanship, and so on must conform to general specifications for hydraulic hose fittings. The dimensional designations on the first figure in each group shall apply to all other figures in that group, except as shown otherwise. The design of and method of attaching swivel nut shall be optional with manufacturer, providing the dimensions shown are maintained and nut turns freely. Codes shown in brackets adjacent to figure numbers represent respective fitting identification in accordance with SAE J846.

7.1 Pressure ratings for adapter unions are specified in Table 6 and are based on a 4:1 safety factor. Variations from these values may be necessary, depending on the severity of the application, but shall be altered only with the consent of both the user and the fitting manufacturer.

7.2 Adapter union connectors specified in Figures 22 through 30 and Table 11 call out an optional 30 degree seat on the male NPTF end. This 30 degree seat is required when connecting a male NPTF end to an adapter union NPSM swivel nut to obtain a proper seal. This can be machined on any male NPTF end specified in this standard. End users should specify this feature when crucial to individual applications.

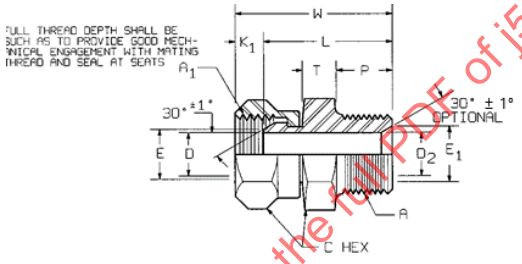

Figure 22 - Female adapter union to male pipe (140130)

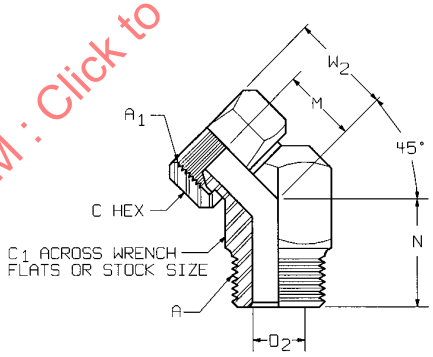

Figure 23 - 45 degree female adapter union to male pipe (140330)

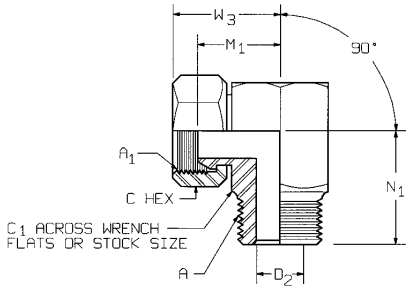

Figure 24 - 90 degree female adapter union to male pipe (140230)