MSS SP-83-2006

Class 3000
Steel Pipe Unions
Socket Welding and Threaded

Standard Practice

Developed and Approved by the
Manufacturers Standardization Society of the
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This MSS Standard Practice was developed under the consensus of MSS Technical Committee 105 and the MSS Coordinating Committee. The content of this Standard Practice is the result of the efforts of competent and concerned volunteers to provide an effective, clear, and non-exclusive specification that will benefit the industry as a whole. This MSS Standard Practice is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance is established only by reference in a code, specification, sales contract, or public law, as applicable.

Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. (See Annex A).

Originally Approved 1976

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CAUTIONARY NOTES REGARDING INSTALLATION OF STEEL UNIONS

a) Leakage from a union can result when joining pipe ends which are poorly aligned.

b) Care should be taken to avoid placing unions in lines subject to live loads and bending loads, which may cause leakage.

c) Care should be taken to prevent damage to the seating surfaces.

d) Due consideration should be given to the possibility of shock pressure in the system.

NOTE: UNION PARTS FROM DIFFERENT MANUFACTURERS ARE NOT FUNCTIONALLY INTERCHANGEABLE AND COMBINING PARTS FROM DIFFERENT MANUFACTURERS IS NOT RECOMMENDED.

STEEL PIPE UNIONS SOCKET WELDING AND THREADED

1. SCOPE

1.1 This Standard Practice establishes envelope and other essential dimensionals, finish, tolerances, testing, marking, material, and minimum performance requirements for forged carbon and stainless steel pipe unions, socket welding and threaded ends.

2. PRESSURE RATINGS

2.1 These unions shall be designated as Class 3000 socket welding or threaded and shall carry ratings shown in Table 1.

3. SIZE

3.1 The size of the union is identified by the nominal pipe size.

4. DESCRIPTION

4.1 The complete union shall consist of three parts: male end, female end, and, nut. Equivalent terms are tabulated in Table 2.

TABLE 1
Pressure-Temperature Service Rating
Class 3000 Carbon and Stainless Steel
Unions Socket Welding & Threaded Ends

SERVICE TEMP DEGREE ^{0}F	NON-SHOCK WORKING PRESSURE psig			
	ASTM A 105 CARBON STEEL	ASTM A 182 F316	ASTM A 182 F304L F316L	ASTM A 182 F304
100	3000	2915	2430	2915
200	2735	2510	2050	2430
300	2655	2265	1835	2140
400	2565	2080	1670	1905
500	2425	1935	1545	1770
600	2220	1830	1460	1680
650	2180	1800	1420	1650
700	2155	1750	1390	1630
750		1710	1360	1610
800		1680	1330	1595
850		1645	1300	1575
900		1595		1555
950		1565		1515
1000		1470		1300

TABLE 2 Terminology of Parts

Preferred Term	Equivalent Terms
Male	Male seat end Tail Piece – Nut Piece - Coupling – Ball End
Female	Female seat end Thread Piece - Body - Head - Cone End
Nut	Union Coupling Nut - Swivel – Ring

4.2 The seating surfaces of the joint will be steel-to-steel, ball-to-cone design. Male and Female ends shall be machined with sockets for socket welding or threaded with internal NPT pipe threads. Male and Female ends and Nuts may be round, polygon, or modified polygon with rounded corners, at the option of the manufacturer. The length of the union ends shall be sufficient to provide a suitable wrenching surface.

5. MARKING

5.1 Each union Nut shall be permanently marked in accordance with MSS SP-25. The marking shall include (but is not limited to) the following:

a) Manufacturer's name or trademark.
b) Material grade identification- in accordance with the requirements of the applicable ASTM specification listed in Section 6.
Note: Multiple material marking shall be allowed as covered in ASTM material specifications listed in Section 6.1.
c) Material lot or heat number for traceability.
d) Service designation: 3000 or 3M (M to designate units of 1000)
e) The nominal pipe size.

5.2 The Male and Female union ends shall be permanently marked with the following:

a) Manufacturer's name or trademark.
b) Material grade identification. (See Section 5.1b)
c) Material lot or heat number for traceability.

5.3 All three parts of a union, in compliance with all requirements of this SP, shall be marked SP83.

6. MATERIAL

6.1 The three parts of a union assembly shall be manufactured from materials which have the same requirements for chemical composition, mechanical properties, and applicable heat treatment, except that F304 and F316 union nuts may be used with F304L and F316L end pieces, respectively. Material specification ASTM A 182 applies for stainless steel, grades F304/F304L/F316/F316L. Stainless steel austenitic unions are suitable for use with ASTM A312/A312M pipe.

Note: Multiple Material Marking:
Stainless Steel unions, meeting the chemical and mechanical properties for more than one class or grade, may, at the manufacturer's option, be marked with more than one class or grade designation, such as F304/304L and F316 /316L.

Material specification ASTM A 105 applies for carbon steel. Carbon steel unions are suitable for use with ASTM A 106 Grade B pipe as well as lower grades.

6.2 Carbon steel and stainless steel union parts may be forged, formed, or made from wrought bars conforming to the requirements of the melting process, chemical composition, and mechanical property requirements of ASTM A 105 for carbon steel and ASTM A 182 for stainless steel grades.

6.3 Unions may be made from materials of other wrought material by agreement between the manufacturer and the purchaser, but shall not be marked SP83.

7. TESTS

7.1 Pressure testing is not required by this standard.

8. DESIGN AND DIMENSIONS

8.1 ***Socket Wall Thickness for Socket Welding Unions.*** The socket wall thickness shall be no less than the corresponding values, C, shown in Table 4.

8.2 ***Minimum Body Wall Thickness for Socket Welding Unions.*** The minimum body wall thickness, other than socket wall, must be equal to or greater than the nominal wall thickness of Schedule 80 pipe of the same size as the union, as established by ASME B36.10M.

8.3 ***Minimum Wall Thickness for Threaded Unions.*** (Dimension C in Table 5). The minimum wall thickness at the root of the pipe thread at the wrench tight plane, must equal or exceed the nominal wall thickness for Schedule 80 pipe.

8.4 ***Other Dimensions.*** The dimensions for unions capable of meeting this standard are shown in Table 4 for socket welding unions and Table 5 for threaded unions.

8.5 Union parts from different manufacturers are not functionally interchangeable and combining parts from different manufacturers is not recommended.

9. SOCKET WELDING UNIONS

9.1 To provide assembled union uniformity this Standard Practice establishes dimensions (Table 4 Column E) for the location of the bottom of the sockets. Socket welding union ends shall be faced at right angles to the axis to provide a flat surface against which to weld and the socket shall be counterbored or otherwise machined to insure uniform depth and circularity.

9.2 When installing socket weld end unions, to minimize the possibility of cracking of the fillet welds, it is recommended that the connecting pipe be withdrawn approximately 0.06 inches away from the bottom of the union socket bore before welding (see Figure 1).

10. THREADED UNIONS

10.1 Dimensions for threaded unions are shown in Table 5. Internal pipe threads shall be NPT in accordance with ASME B1.20.1. Gaging procedures and practice shall be in accordance with Section 8 of the same standard.

11. NUT THREADS

11.1 Internal threads of the nut and external threads of the (Threadpiece) Female part shall be American National Thread form made in accordance with the formulae for special threads appearing in ASME B1.1, Unified and American Screw Threads, Class 2A External and 2B Internal Tolerances and Clearances.

11.2 At manufacturer's option, changes to the values in Column H are permitted, provided the requirements of ASME B1.1 and all requirements of this Standard Practice are met.

12. FINISH

12.1 Surfaces must be free of sharp burrs and have a workmanlike finish.

13. TOLERANCES

13.1 ***General.*** Tolerances are listed in Tables 4 and 5.

13.2 ***Concentricity.*** The socket shall be concentric with the waterway bore within a tolerance of plus or minus 0.03 in. for all sizes.

13.3 ***Coincidence of Axis.*** The maximum allowable variation in the alignment of one threaded pipe end of the assembled union to the axis of the opposite threaded pipe end shall not exceed 0.19 in. in 1 foot. Figure 2 illustrates one method that may be used to check alignment.

14. NUT TIGHTENING TORQUE

14.1 Recommended minimum nut tightening torque values are listed in Table 3.

15. CORROSION PROTECTION

15.1 Unions shall be effectively protected against corrosion. Excess oils shall be considered unacceptable as corrosion protective media. Specialty protection shall be a matter of agreement between the manufacturer and purchaser.

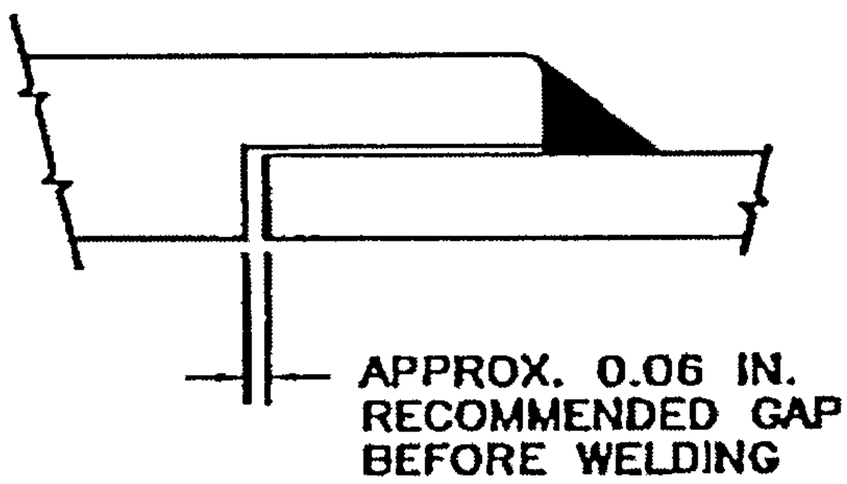
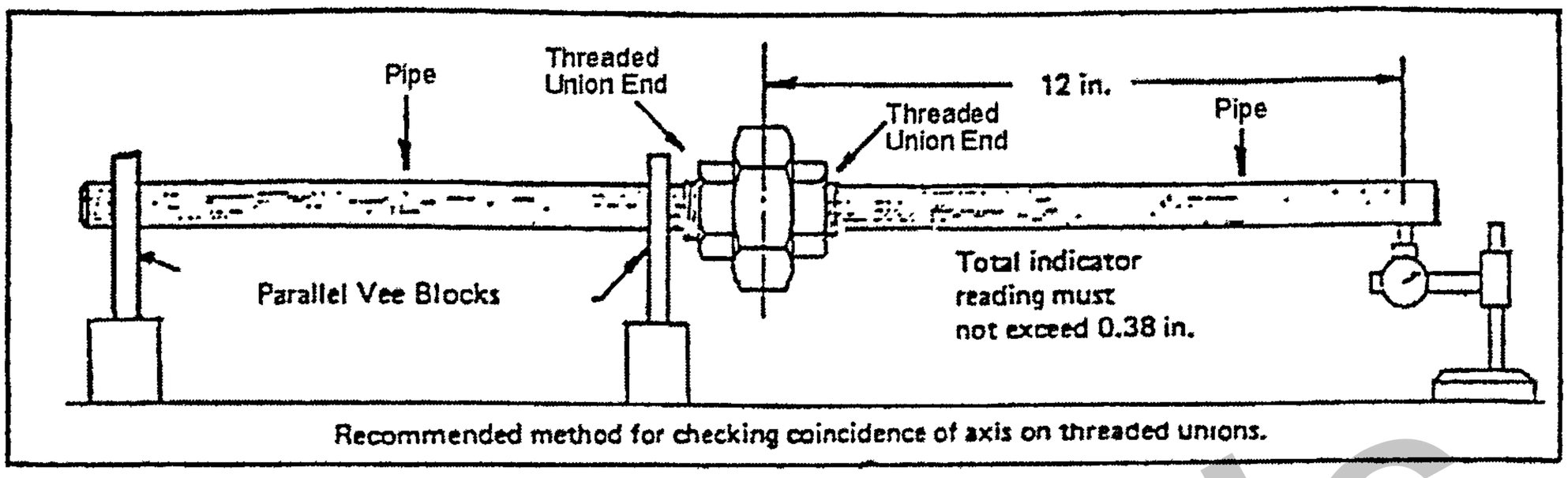


Figure 1 - Welding Gap

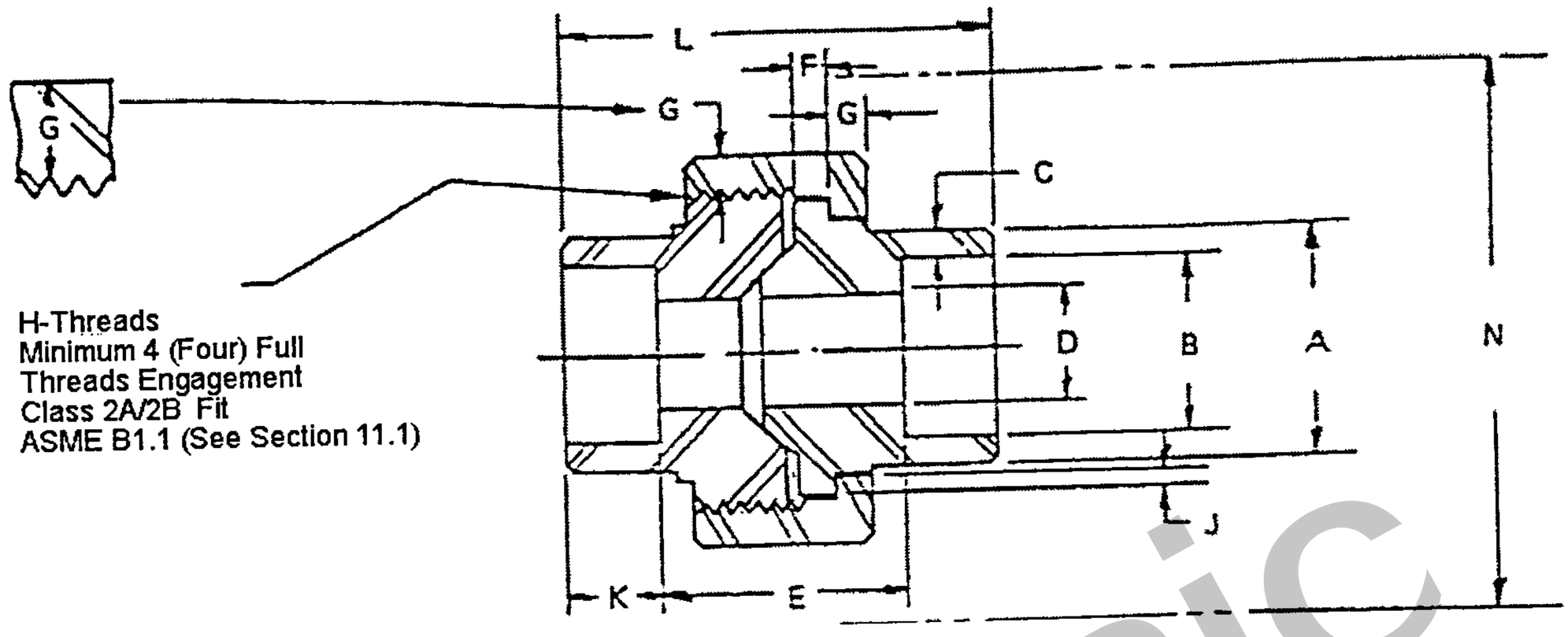


Recommended method for checking coincidence of axis on threaded unions.

Illustrative Only
FIGURE 2

TABLE 3
Minimum Recommended
Nut Tightening Torque

Nominal Pipe Size	Foot Pounds (Minimum)
1/8	85
1/4	85
3/8	100
1/2	100
3/4	120
1	120
1-1/4	130
1-1/2	130
2	130
2-1/2	150
3	150



H-Threads
Minimum 4 (Four) Full
Threads Engagement
Class 2A/2B Fit
ASME B1.1 (See Section 11.1)

TABLE 4 - Class 3000 Carbon and Stainless Steel Pipe Unions - Socket Welding Ends

Nom. Pipe Size	Pipe End Min.	Socket Bore Dia.	Socket Wall Min.	Water Way Bore[(a)]	Laying Length	Male Flange Min.	Nut Min.	Threads Per Inch	Bearing Min.	Depth Of Socket Min.	Length Assem. Nominal	Clear Assem. Nut
	A	B	C	D	E	F	G	H	J	K	L	N
1/8	0.86	0.440 0.420	0.125	0.299 0.239	0.88 0.75	0.125	0.125	16	0.049	0.38	1.63	2.0
1/4	0.86	0.575 0.555	0.130	0.394 0.334	0.88 0.75	0.125	0.125	16	0.049	0.38	1.63	2.0
3/8	1.02	0.710 0.690	0.138	0.523 0.463	1.06 0.81	0.135	0.135	14	0.054	0.38	1.81	2.2
1/2	1.23	0.875 0.855	0.161	0.652 0.592	1.06 0.81	0.145	0.145	14	0.059	0.38	1.93	2.3
3/4	1.46	1.085 1.065	0.168	0.854 0.794	1.25 1.00	0.160	0.160	11	0.066	0.50	2.24	2.6
1	1.79	1.350 1.330	0.196	1.079 1.019	1.35 1.03	0.180	0.175	11	0.073	0.50	2.44	3.1
1-1/4	2.16	1.695 1.675	0.208	1.410 1.350	1.60 1.28	0.210	0.205	10	0.084	0.50	2.80	3.7
1-1/2	2.42	1.935 1.915	0.218	1.640 1.580	1.66 1.34	0.230	0.220	10	0.091	0.50	3.01	4.4
2	2.96	2.426 2.406	0.238	2.097 2.037	1.79 1.47	0.260	0.250	10	0.106	0.62	3.39	5.2
2-1/2	3.61	2.931 2.906	0.302	2.529 2.409	2.43 2.05	0.295	0.280	8	0.121	0.62	4.03	5.9
3	4.30	3.560 3.535	0.327	3.128 3.008	2.51 2.11	0.325	0.315	8	0.139	0.62	4.29	6.9

NOTE: (a) The contact diameter of the male/female tailpiece is affected by the waterway bore (Col. D). The manufacturer shall consider the relationships between the contact point and waterway diameter in his design.

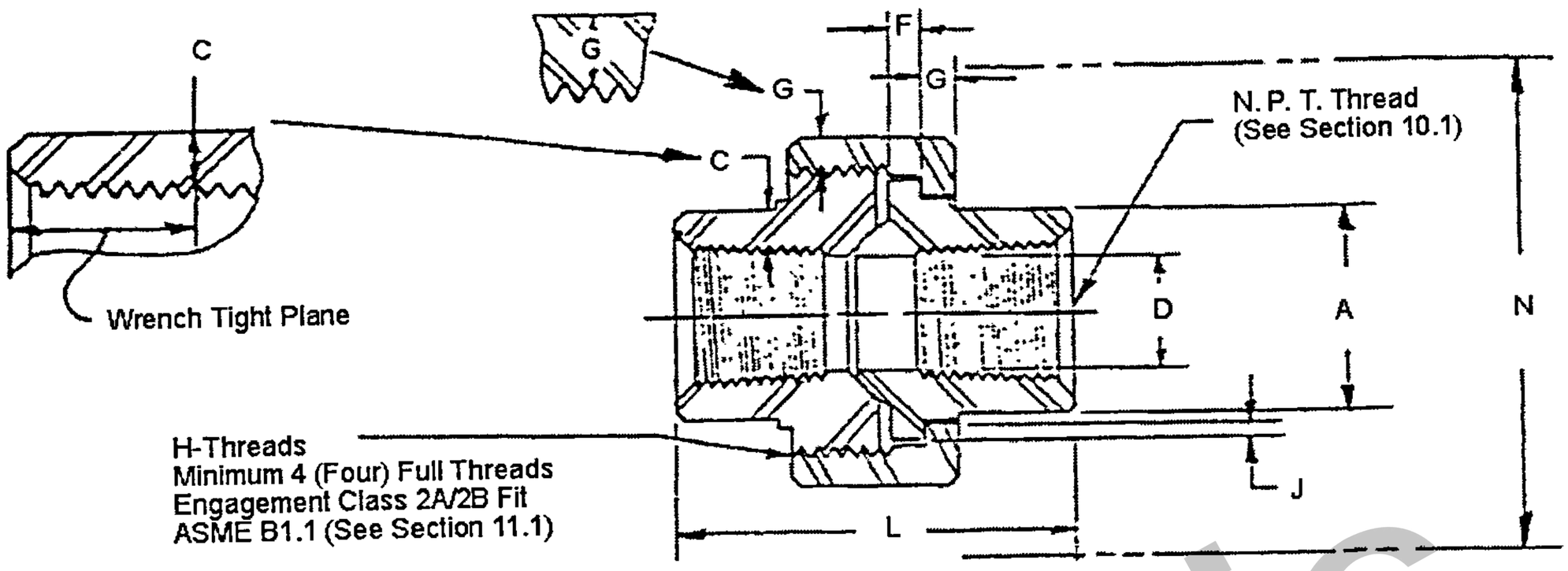


TABLE 5 - Class 3000 Carbon and Stainless Steel Pipe Unions - Threaded Ends

Nom. Pipe Size	Pipe End Min.	Wall Min.	Water Way Bore[(a)]	Male Flange Min.	Nut Min.	Threads Per Inch	Bearing Min.	Length Assem. Nominal	Clear Assem. Nut
	A	C	D	F	G	H	J	L	N
1/8	0.58	0.095	0.332 0.253	0.125	0.125	16	0.049	1.63	2.0
1/4	0.75	0.119	0.438 0.372	0.125	0.125	16	0.049	1.63	2.0
3/8	0.90	0.126	0.562 0.532	0.135	0.135	14	0.054	1.81	2.2
1/2	1.09	0.147	0.703 0.672	0.145	0.145	14	0.059	1.93	2.3
3/4	1.32	0.154	0.906 0.842	0.160	0.160	11	0.066	2.24	2.6
1	1.63	0.179	1.141 1.092	0.180	0.175	11	0.073	2.44	3.1
1-1/4	1.99	0.191	1.484 1.392	0.210	0.205	10	0.084	2.80	3.7
1-1/2	2.25	0.200	1.714 1.622	0.230	0.220	10	0.091	3.01	4.4
2	2.76	0.218	2.188 2.052	0.260	0.250	10	0.106	3.39	5.2
2-1/2	3.36	0.276	2.609 2.532	0.295	0.280	8	0.121	4.03	5.9
3	4.03	0.300	3.250 3.042	0.325	0.315	8	0.139	4.29	6.9

NOTE: (a) The contact diameter of the male/female tailpiece is affected by the waterway bore (Col. D). The manufacturer shall consider the relationships between the contact point and waterway diameter in his design.

ANNEX A
Referenced Standards and Applicable Dates

This Annex is an integral part of this Standard Practice and is placed after the main text for convenience.

Standard Name or Description.

ASME

B1.1-2003	Unified Inch Screw Threads
B1.20.1-1983 (R01)	Pipe Threads, General Purpose, Inch
B36.10M-2004	Welded and Seamless Wrought Steel Pipe

ASTM

A 105/A 105M-2005	Carbon Steel Forgings for Piping Applications
A 106/A 106M -04b-004b	Seamless Carbon Steel Pipe for High Temperature Service
A 234/A 234M-2005a	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
A 182/A 182M-2005	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
A 403/A 403M-2004	Wrought Austenitic Stainless Steel Pipe Fittings
A 312/A 312M-2005	Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipe

MSS

SP-25-1998	Standard Marking System for Valves, Fittings, Flanges and Unions

Publications of the following organizations appear in the above list:

ASME	ASME International 3 Park Ave., New York, NY 10016-5990
ASTM	ASTM International 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E., Vienna, VA 22180

List of MSS Standard Practices
(Price List Available Upon Request)

Number	
SP-6-2001	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-2001	(R 05) Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System For Valves, Fittings, Flanges and Unions
SP-42-2004	Class 150 Corrosion Resistant Gate, Glove, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	(R 01) Steel Pipeline Flanges
SP-45-2003	Bypass and Drain Connections
SP-51-2003	Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 02) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2001	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
SP-58-2002	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-2004	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-2003	Pressure Testing of Steel Valves
SP-65-2004	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-2002a	Butterfly Valves
SP-68-1997	(R 04) High Pressure Butterfly Valves with Offset Design
SP-69-2003	Pipe Hangers and Supports - Selection and Application (ANSI/MSS Edition)
SP-70-2006	Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-1997	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt-welding Ends for General Service
SP-73-2003	Brazing Joints for Cast Copper Alloy Solder Joint Pressure Fittings
SP-75-2004	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-1998	Cast Iron Plug Valves, Flanged and Threaded Ends
SP-79-2004	Socket-Welding Reducer Inserts
SP-80-2003	Bronze Gate, Globe, Angle and Check Valves
SP-81-2001	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
SP-83-2006	Class 3000 Steel Pipe Unions, Socket-Welding and Threaded
SP-85-2002	Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2002	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-88-1993	(R 01) Diaphragm Valves
SP-89-2003	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-2000	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operation of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	(R 04) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Liquid Penetrant Examination Method
SP-94-1999	(R 04) Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Ultrasonic Examination Method
SP-95-2000	Swage(d) Nipples and Bull Plugs
SP-96-2001	(R 05) Guidelines on Terminology for Valves and Fittings
SP-97-2001	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding,Threaded and Buttwelding Ends
SP-98-2001	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 05) Instrument Valves
SP-100-2002	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Type Valves
SP-101-1989	(R 01) Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	(R 01) Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-104-2003	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 05) Instrument Valves for Code Applications
SP-106-2003	Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	(R 06) Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1999	(R 04) Quality Standard for Evaluation of Cast Surface Finishes -Visual and Tactile Method. This SP must be sold with a 10-surface, three dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional Comparators may be sold separately at $77.00 each. Same quantity discounts apply on total order.
SP-113-2001	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-2001	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves 1 1/4 NPS and Smaller, for Fuel Gas Service
SP-116-2003	Service Line Valves and Fittings for Drinking Water Systems
SP-117-2006	Bellows Seals for Globe and Gate Valves
SP-118-2002	Compact Steel Globe & Check Valves - Flanged, Flangeless,Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-2003	Factory Made Belled End Socket Welding Fittings
SP-120-2002	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-1997	(R 02) Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-2005	Plastic Industrial Ball Valves
SP-123-1998	(R 06) Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
SP-124-2001	Fabricated Tapping Sleeves
SP-125-2000	Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
SP-126-2000	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
SP-129-2003	Copper-Nickel Socket-Welding Fittings and Unions
SP-130-2003	Bellows Seals for Instrument Valves
SP-131-2004	Metallic Manually Operated Gas Distribution Valves
SP-132-2004	Compression Packing Systems for Instrument Valves
SP-133-2005	Excess Flow Valves for Low Pressure Fuel Gas Appliances
SP-135-2006	High Pressure Steel Knife Gate Valves

(R-YEAR) Indicates year standard reaffirmed without substantive changes

A large number of former MSS Practices have been approved by the ANSI or ANSI Standards, published by others. In order to maintain a single source of authoritative information, the MSS withdraws its Standard Practices in such cases.

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