# Class 3000 and 6000 Pipe Unions, Socket Welding and Threaded (Carbon Steel, Alloy Steel, Stainless Steels, and Nickel Alloys)

**Standard Practice**
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> **This Standard Practice has been substantially revised from the previous 2006 edition. It is suggested that if the user is interested in knowing what changes have been made, that direct page by page comparison should be made of this document and that of the previous edition.**

Non-toleranced dimensions in this Standard Practice are nominal unless otherwise specified.



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## FOREWORD

This Standard Practice was originally approved in 1976; providing coverage for Class 3000 Carbon Steel Unions primarily for use in high-pressure industrial, oil-field, and petrochemical industries. In 1987, austenitic stainless steel grades 304/304L and 316/316L were added for use in process chemical, pharmaceutical, power generation, and other industries where corrosion resistance was a major concern.

In 1995, socket-welding union dimensions for socket diameters, socket wall thicknesses, and union "water-way" bores were aligned to correspond with dimensions of the ASME B16.11 Class 3000 fittings specification. In the 2001 edition, the waterways of threaded unions were adapted to allow the use of the larger diameters of the drills used for NPT threading, which is in line with practices for threaded fittings use within the same piping systems. In 2006, the Standard Practice was essentially reaffirmed with minor editorial changes.

The 2014 revision represents a substantive revision for SP-83. The committee reviewed and confirmed the basis for the original pressure-temperature ratings contained in the Standard Practice and pressure-temperature tables were updated as a result. Based on formula, test, and field experience, coverage for numerous alloy steel, stainless steel and nickel alloy grades were added to the Standard Practice. In addition, on the same basis, dimensions, materials, and pressure-temperature ratings were added for the new inclusion of Class 6000 socket-welding and threaded unions. The revisions contained in this edition provide for a more robust and comprehensive standard for pipe unions, intended for commercial and industrial applications of a wide variety.

### CAUTIONARY NOTES REGARDING INSTALLATION OF PIPE 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.

e) Installation techniques or instructions are outside the scope of this Standard Practice.

**NOTE:** Union parts from different manufacturers are not functionally interchangeable and combining parts from different manufacturers is not recommended.

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# CLASS 300 AND 6000 PIPE UNIONS, SOCKET WELDING AND THREADED (CARBON STEEL, ALLOY STEEL, STAINLESS STEELS, AND NICKEL ALLOYS)

## 1. SCOPE

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

## 2. PRESSURE RATINGS

2.1 These unions shall be designated as Class 3000 or Class 6000, socket welding or threaded and shall carry ratings shown in Table 4 for Class 3000 or Table 5 for Class 6000.

2.2 Class designations of these unions are correlated with ASME B36.10 Pipe Schedule Thicknesses as shown in Table 1.

**TABLE 1**
**Correlation of Class Designation with Pipe Schedule**

| Class Designation of Union | Pipe Used in Wall Thickness Calculations [(a)] |
|---|---|
| 3000 | Schedule 80 |
| 6000 | Schedule 160 |

**NOTE:** (a) This table is not intended to restrict the use of pipe of thinner or thicker wall with unions. The pipe actually used may be thinner or thicker in nominal wall than that shown in this table. The rating of the pipe, or the rating of the union as shown in Tables 4 or 5, whichever is less, may govern the rating of the system.

2.3 Since ASME B36.10 does not include Schedule 160 thickness for NPS 1/8, 1/4 and 3/8, the values in Table 2 shall be used as the nominal wall thicknesses of the pipe.

**TABLE 2**
**Nominal Wall Thickness of Schedule 160 Pipe**

| NPS of Union | Schedule 160 Nominal Wall |
|---|---|
| 1/8 | 0.124 |
| 1/4 | 0.145 |
| 3/8 | 0.158 |

## 3. SIZE

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

## 4. DESCRIPTION

4.1 The complete union shall consist of three parts: male end, female end, and, nut. Equivalent terms are tabulated in Table 3.

**TABLE 3**
**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 shall be integral metal-to-metal, 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 part 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 specifications listed in Tables 4 or 5.

**Note:** Multiple material markings shall be allowed as covered in ASTM material specifications listed in Tables 4 or 5.

c) Material lot or heat number for traceability.

d) Service designation: 3000 or 3M or 6000 or 6M (M to designate units of 1000).

e) The nominal pipe size.

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

5.3 Unions manufactured from materials meeting all the ASTM material specification requirements for more than one specification, class or grade, may, at the manufacturer's option, be marked with more than one specification, class or grade designation, such as F304/304L and F316/316L, or A105/A234 WPB.

## 6. MATERIAL

6.1 Unions shall conform to the requirements of the material specifications, grades and classes listed in Tables 4 and 5.

6.2 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.

6.3 Union parts may be forged, seamlessly formed, or made from wrought bars conforming to the requirements for the grades and classes of the ASTM material specifications listed in Tables 4 and 5.

6.4 Unions may be made from other wrought seamless materials 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 Tables 7 and 8.

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 for Class 3000 or Schedule 160 pipe for Class 6000 of the same size as the union, as established by ASME B36.10M.

8.3 ***Minimum Wall Thickness for Threaded Unions*** (See Dimension C in Table 9 for Class 3000 and Table 10 for Class 6000) 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 for Class 3000 or Schedule 160 pipe for Class 6000.

8.4 ***Other Dimensions*** The dimensions for unions capable of meeting this standard are shown in Tables 7 and 8 for socket welding unions and Tables 9 and 10 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 counter-bored 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).

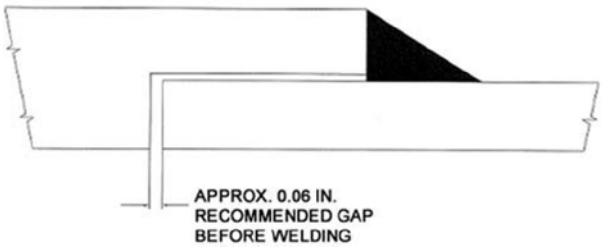



**Figure 1 – Welding Gap**

## 10. THREADED UNIONS

10.1 Dimensions for threaded unions are shown in Tables 9 and 10. Internal pipe threads shall be NPT in accordance with ASME B1.20.1. Gaging procedures and practice shall be in accordance with Section 3.1 of the same ASME 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 7, 8, 9, and 10.

13.2 ***Concentricity*** The socket shall be concentric with the waterway bore within a tolerance of plus or minus 0.03 (±0.03) inches 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 inches in 1 foot. Figure 2 illustrates one method that may be used to check alignment. Recommended minimum nut tightening torque values for checking coincidence of axis are listed in Table 6.

## 14. CORROSION PROTECTION

14.1 Carbon and alloy steel unions shall be effectively protected against corrosion. Excess forming, machining or processing oils shall be considered unacceptable as corrosion protective media. Specialty protection shall be a matter of agreement between the manufacturer and purchaser.

## TABLE 4
### Pressure-Temperature Service Rating, Class 3000 Pipe Unions – Socket Welding and Threaded Ends

| SERVICE TEMPERATURE (° F) | NON SHOCK WORKING PRESSURE (psig) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A105 A234 WPC[S] | A182 F1 A234 WP1[S] | A182 F5 A234 WP5[S] | A182 F5A | A182 F9 | A182 F11 CL2 A234 WP11[S] CL2 | A182 F22 CL3 A234 WP22[S] CL3 | A182 F304 A403 WP304[S] | A182 F304L A403 WP304L[S] | A182 F304H A403 WP304H[S] | A182 F316 A403 WP316[S] | A182 F316L A404 WP316L[S] | A182 F316H A403 WP316H[S] |
| 100 | 3000 | 2820 | 3000 | 3000 | 3000 | 2960 | 3000 | 2915 | 2430 | 2915 | 2915 | 2430 | 2915 |
| 200 | 2750 | 2820 | 2980 | 3000 | 3000 | 2960 | 3000 | 2430 | 2070 | 2430 | 2510 | 2070 | 2510 |
| 300 | 2650 | 2780 | 2830 | 2950 | 2950 | 2875 | 2950 | 2180 | 1850 | 2180 | 2265 | 1850 | 2265 |
| 400 | 2565 | 2680 | 2710 | 2860 | 2860 | 2760 | 2860 | 2010 | 1700 | 2010 | 2080 | 1700 | 2080 |
| 500 | 2445 | 2600 | 2615 | 2695 | 2695 | 2660 | 2695 | 1885 | 1595 | 1885 | 1935 | 1595 | 1935 |
| 600 | 2300 | 2450 | 2450 | 2450 | 2450 | 2450 | 2450 | 1790 | 1505 | 1790 | 1830 | 1505 | 1830 |
| 650 | 2225 | 2380 | 2380 | 2380 | 2380 | 2380 | 2380 | 1750 | 1480 | 1750 | 1790 | 1480 | 1790 |
| 700 | 2150 | 2300 | 2300 | 2300 | 2300 | 2300 | 2300 | 1710 | 1460 | 1710 | 1760 | 1460 | 1760 |
| 750 | 2055 | 2155 | 2155 | 2155 | 2155 | 2155 | 2155 | 1675 | 1430 | 1675 | 1730 | 1430 | 1730 |
| 800 | – | 2060 | 2060 | 2060 | 2060 | 2060 | 2060 | 1645 | 1400 | 1645 | 1710 | 1400 | 1710 |
| 850 | – | 1970 | 1970 | 1970 | 1970 | 1970 | 1970 | 1605 | 1370 | 1605 | 1695 | 1370 | 1695 |
| 900 | – | – | 1515 | 1515 | 1820 | 1820 | 1820 | 1575 | – | 1575 | 1680 | – | 1680 |
| 950 | – | – | 1110 | 1110 | 1525 | 1240 | 1565 | 1545 | – | 1545 | 1565 | – | 1565 |
| 1000 | – | – | 805 | 805 | 1030 | 800 | 1080 | 1435 | – | 1435 | 1475 | – | 1475 |

| SERVICE TEMPERATURE (° F) | NON SHOCK WORKING PRESSURE (psig) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A182 F317 A403 WP317[S] | A182 F321 A403 WP321[S] | A182 F321H A403 WP321H[S] | A182 F317L A403 WP317L[S] | A182 F347 A403 WP347[S] | A182 F347H A403 WP347H[S] | A182 F44 A403 WPS31254[S] | A182 F51 | A182 F53 | A182 F55 | A182 F91 A234 WP91[S] | B564 UNS N04400 B366 WPNICU[S] | B564 UNS N10276 B366 WPHC276[S] |
| 100 | 2915 | 2915 | 2915 | 2430 | 2915 | 2915 | 3000 | 3000 | 3000 | 3000 | 3000 | 2430 | 3000 |
| 200 | 2510 | 2625 | 2625 | 2070 | 2680 | 2680 | 3000 | 3000 | 3000 | 3000 | 3000 | 2130 | 3000 |
| 300 | 2265 | 2410 | 2410 | 1850 | 2500 | 2500 | 2700 | 2700 | 2700 | 2700 | 2950 | 1985 | 2950 |
| 400 | 2080 | 2235 | 2235 | 1700 | 2335 | 2335 | 2490 | 2490 | 2490 | 2490 | 2860 | 1915 | 2825 |
| 500 | 1935 | 2090 | 2090 | 1595 | 2195 | 2195 | 2350 | 2350 | 2350 | 2350 | 2695 | 1915 | 2695 |
| 600 | 1830 | 1970 | 1970 | 1505 | 2090 | 2090 | 2255 | – | – | – | 2450 | 1915 | 2450 |
| 650 | 1790 | 1925 | 1925 | 1480 | 2050 | 2050 | 2215 | – | – | – | 2380 | 1915 | 2380 |
| 700 | 1760 | 1885 | 1885 | 1460 | 2010 | 2010 | 2195 | – | – | – | 2300 | 1905 | 2300 |
| 750 | 1730 | 1855 | 1855 | 1430 | 1990 | 1990 | 2155 | – | – | – | 2155 | 1885 | 2155 |
| 800 | 1710 | 1830 | 1830 | 1400 | 1970 | 1970 | 1970 | – | – | – | 2060 | 1855 | 2060 |
| 850 | 1695 | 1805 | 1805 | 1370 | 1965 | 1965 | 1965 | – | – | – | 1970 | 1525 | 1970 |
| 900 | 1680 | 1790 | 1790 | – | 1820 | 1820 | 1820 | – | – | – | 1820 | 1110 | 1820 |
| 950 | 1565 | 1565 | 1565 | – | 1565 | 1565 | 1565 | – | – | – | 1565 | – | 1565 |
| 1000 | 1475 | 1475 | 1475 | – | 1475 | 1475 | 1475 | – | – | – | 1475 | – | 1475 |

## TABLE 5
### Pressure-Temperature Service Rating, Class 6000 Pipe Unions – Socket Welding and Threaded Ends

| SERVICE TEMPERATURE (° F) | NON SHOCK WORKING PRESSURE (psig) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A105 A234 WPC[S] | A182 F1 A234 WP1[S] | A182 F5 A234 WP5[S] | A182 F5A | A182 F9 | A182 F11 CL2 A234 WP11[S] CL2 | A182 F22 CL3 A234 WP22[S] CL3 | A182 F304 A403 WP304[S] | A182 F304L A403 WP304L[S] | A182 F304H A403 WP304H[S] | A182 F316 A403 WP316[S] | A182 F316L A404 WP316L[S] | A182 F316H A403 WP316H[S] |
| 100 | 6000 | 5645 | 6000 | 6000 | 6000 | 6000 | 6000 | 5835 | 4860 | 5835 | 5835 | 4860 | 5835 |
| 200 | 5500 | 5645 | 5965 | 6000 | 6000 | 6000 | 6000 | 4860 | 4140 | 4860 | 5020 | 4140 | 5020 |
| 300 | 5300 | 5565 | 5670 | 5900 | 5900 | 5850 | 5900 | 4355 | 3695 | 4355 | 4530 | 3695 | 4530 |
| 400 | 5135 | 5370 | 5415 | 5720 | 5720 | 5615 | 5720 | 4025 | 3405 | 4025 | 4160 | 3405 | 4160 |
| 500 | 4885 | 5200 | 5235 | 5385 | 5385 | 5385 | 5385 | 3775 | 3190 | 3775 | 3870 | 3190 | 3870 |
| 600 | 4600 | 4900 | 4900 | 4900 | 4900 | 4900 | 4900 | 3580 | 3015 | 3580 | 3655 | 3015 | 3655 |
| 650 | 4450 | 4770 | 4770 | 4770 | 4770 | 4770 | 4770 | 3500 | 2955 | 3500 | 3580 | 2955 | 3580 |
| 700 | 4305 | 4600 | 4600 | 4600 | 4600 | 4600 | 4600 | 3425 | 2915 | 3425 | 3520 | 2915 | 3520 |
| 750 | 4115 | 4310 | 4310 | 4310 | 4310 | 4310 | 4310 | 3345 | 2860 | 3345 | 3460 | 2860 | 3460 |
| 800 | – | – | 4115 | 4115 | 4115 | 4115 | 4115 | 3285 | – | 3285 | 3425 | 2800 | 3425 |
| 850 | – | – | 3950 | 3950 | 3950 | 3950 | 3950 | 3210 | – | 3210 | 3385 | 2740 | 3385 |
| 900 | – | – | 3030 | 3030 | 3640 | 3640 | 3640 | 3150 | – | 3150 | 3365 | – | 3365 |
| 950 | – | – | 2220 | 2220 | 3060 | 2580 | 3130 | 3090 | – | 3090 | 3130 | – | 3130 |
| 1000 | – | – | 1610 | 1610 | 2055 | 1750 | 2170 | 2870 | – | 2870 | 2945 | – | 2945 |

| SERVICE TEMPERATURE (° F) | NON SHOCK WORKING PRESSURE (psig) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A182 F317 A403 WP317[S] | A182 F321 A403 WP321[S] | A182 F321H A403 WP321H[S] | A182 F317L A403 WP317L[S] | A182 F347 A403 WP347[S] | A182 F347H A403 WP347H[S] | A182 F44 A403 WPS31254[S] | A182 F51 | A182 F53 | A182 F55 | A182 F91 A234 WP91[S] | B564 UNS N04400 B366 WPNICU[S] | B 564 UNS N10276 B366 WPHC276[S] |
| 100 | 5835 | 5835 | 5835 | 4860 | 5835 | 5835 | 6000 | 6000 | 6000 | 6000 | 6000 | 4860 | 6000 |
| 200 | 5020 | 5250 | 5250 | 4140 | 5370 | 5370 | 6000 | 6000 | 6000 | 6000 | 6000 | 4260 | 6000 |
| 300 | 4530 | 4825 | 4825 | 3695 | 5000 | 5000 | 5405 | 5405 | 5405 | 5405 | 5900 | 3970 | 5900 |
| 400 | 4160 | 4475 | 4475 | 3405 | 4670 | 4670 | 4980 | 4980 | 4980 | 4980 | 5720 | 3830 | 5660 |
| 500 | 3870 | 4180 | 4180 | 3190 | 4395 | 4395 | 4705 | 4705 | 4705 | 4705 | 5385 | 3830 | 5385 |
| 600 | 3655 | 3950 | 3950 | 3015 | 4180 | 4180 | 4510 | – | – | – | 4900 | 3830 | 4900 |
| 650 | 3580 | 3850 | 3850 | 2955 | 4105 | 4105 | 4435 | – | – | – | 4770 | 3830 | 4770 |
| 700 | 3520 | 3775 | 3775 | 2915 | 4025 | 4025 | 4395 | – | – | – | 4600 | 3810 | 4600 |
| 750 | 3460 | 3715 | 3715 | 2860 | 3985 | 3985 | 4310 | – | – | – | 4310 | 3775 | 4310 |
| 800 | 3425 | 3655 | 3655 | 2800 | 3950 | 3950 | 3950 | – | – | – | 4115 | 3715 | 4115 |
| 850 | 3385 | 3615 | 3615 | 2740 | 3930 | 3930 | 3930 | – | – | – | 3950 | 3060 | 3950 |
| 900 | 3365 | 3580 | 3580 | – | 3640 | 3640 | 3640 | – | – | – | 3640 | 2220 | 3640 |
| 950 | 3130 | 3130 | 3130 | – | 3130 | 3130 | 3130 | – | – | – | 3130 | – | 3130 |
| 1000 | 2945 | 2945 | 2945 | – | 2945 | 2945 | 2945 | – | – | – | 2945 | – | 2945 |

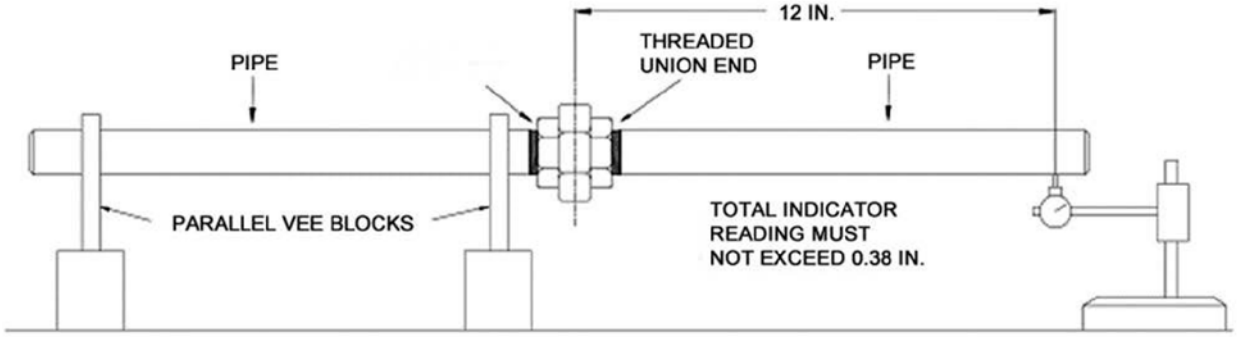
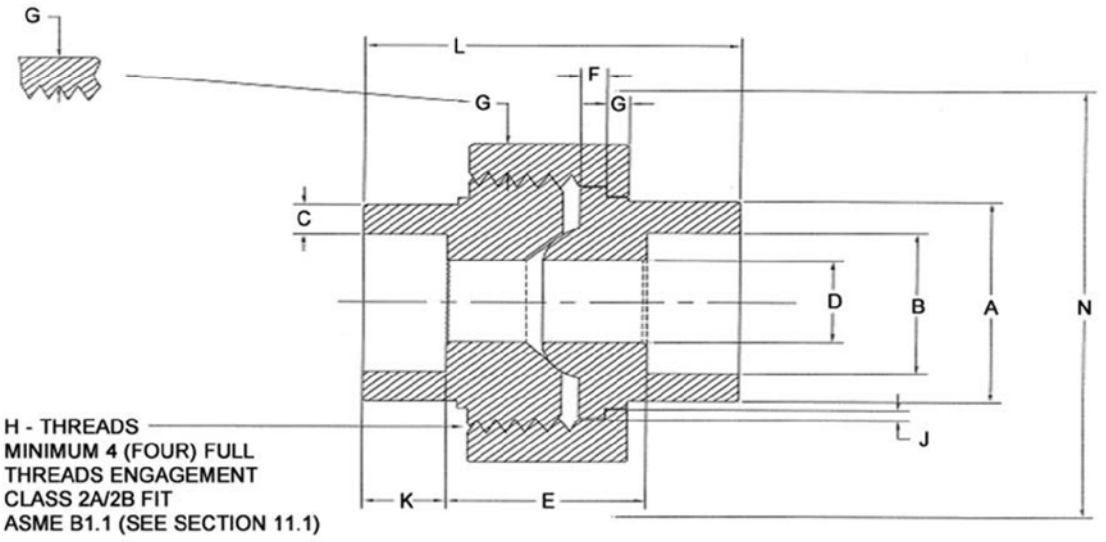



**FIGURE 2**
**Recommended Method for Checking Coincidence of Axis on Threaded Unions**
(For Illustration Only)

**TABLE 6**
**Minimum Recommended Nut Tightening Torque for Checking Coincidence of Axis**

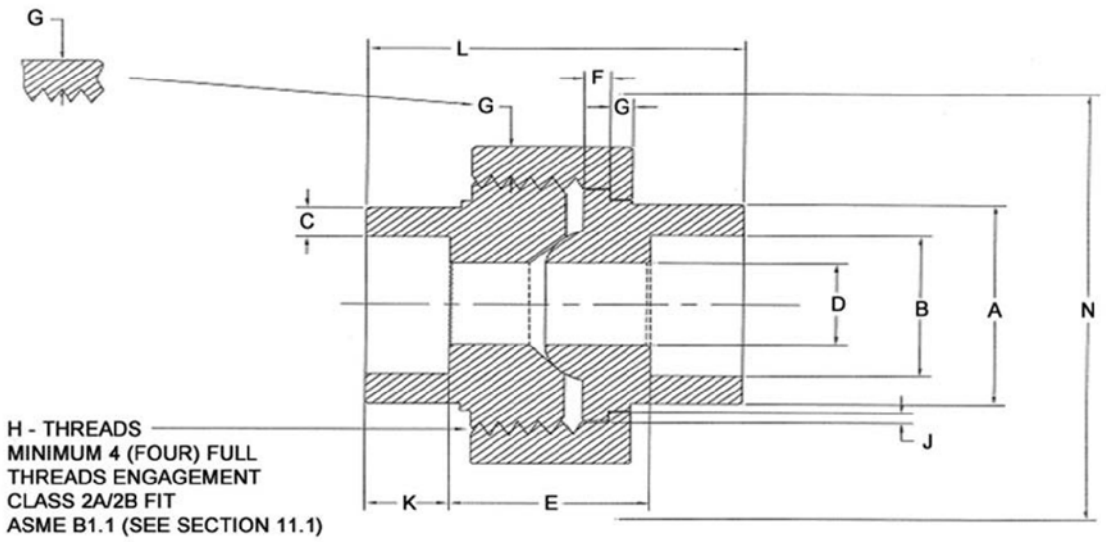
| NPS | Foot Pounds (minimum) |
|---|---|
| 1/8 | 85 |
| 1/4 | 85 |
| 3/8 | 100 |
| 1/2 | 100 |
| 3/4 | 120 |
| 1 | 120 |
| $1^1/_4$ | 130 |
| $1^1/_2$ | 130 |
| 2 | 130 |
| $2^1/_2$ | 150 |
| 3 | 150 |




## TABLE 7
### Class 3000 Pipe Unions – Socket Welding Ends

| NPS | 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<br>0.420 | 0.125 | 0.299<br>0.239 | 0.88<br>0.75 | 0.125 | 0.125 | 16 | 0.049 | 0.38 | 1.63 | 2.0 |
| 1/4 | 0.86 | 0.575<br>0.555 | 0.130 | 0.394<br>0.334 | 0.88<br>0.75 | 0.125 | 0.125 | 16 | 0.049 | 0.38 | 1.63 | 2.0 |
| 3/8 | 1.02 | 0.710<br>0.690 | 0.138 | 0.523<br>0.463 | 1.06<br>0.81 | 0.135 | 0.135 | 14 | 0.054 | 0.38 | 1.81 | 2.2 |
| 1/2 | 1.23 | 0.875<br>0.855 | 0.161 | 0.652<br>0.592 | 1.06<br>0.81 | 0.145 | 0.145 | 14 | 0.059 | 0.38 | 1.93 | 2.3 |
| 3/4 | 1.46 | 1.085<br>1.065 | 0.168 | 0.854<br>0.794 | 1.25<br>1.00 | 0.160 | 0.160 | 11 | 0.066 | 0.50 | 2.24 | 2.6 |
| 1 | 1.79 | 1.350<br>1.330 | 0.196 | 1.079<br>1.019 | 1.35<br>1.03 | 0.180 | 0.175 | 11 | 0.073 | 0.50 | 2.44 | 3.1 |
| 1 1/4 | 2.16 | 1.695<br>1.675 | 0.208 | 1.410<br>1.350 | 1.60<br>1.28 | 0.210 | 0.205 | 10 | 0.084 | 0.50 | 2.80 | 3.7 |
| 1 1/2 | 2.42 | 1.935<br>1.915 | 0.218 | 1.640<br>1.580 | 1.66<br>1.34 | 0.230 | 0.220 | 10 | 0.091 | 0.50 | 3.01 | 4.4 |
| 2 | 2.96 | 2.426<br>2.406 | 0.238 | 2.097<br>2.037 | 1.79<br>1.47 | 0.260 | 0.250 | 10 | 0.106 | 0.62 | 3.39 | 5.2 |
| 2 1/2 | 3.61 | 2.931<br>2.906 | 0.302 | 2.529<br>2.409 | 2.43<br>2.05 | 0.295 | 0.280 | 8 | 0.121 | 0.62 | 4.03 | 5.9 |
| 3 | 4.30 | 3.560<br>3.535 | 0.327 | 3.128<br>3.008 | 2.51<br>2.11 | 0.325 | 0.315 | 8 | 0.139 | 0.62 | 4.29 | 6.9 |

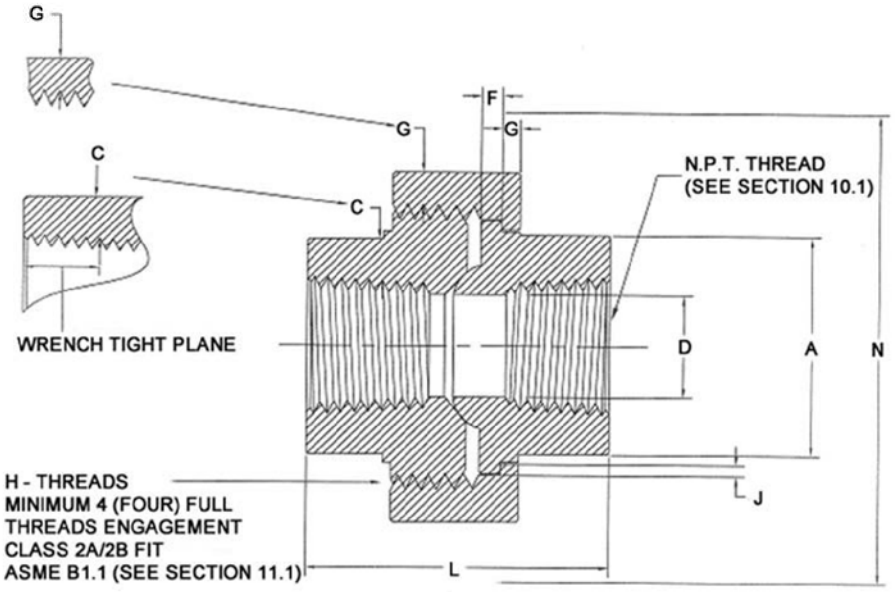
**NOTE:** (a) The contact diameter of the male/female tailpiece is affected by the waterway bore (Col. D). The manufacturer shall consider the relationships between the contact point and waterway diameter in his design.




## TABLE 8
### Class 6000 Pipe Unions – Socket Welding Ends

| NPS | 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<br>0.420 | 0.135 | 0.189<br>0.126 | 0.88<br>0.75 | 0.125 | 0.125 | 16 | 0.049 | 0.38 | 1.63 | 2.0 |
| 1/4 | 1.02 | 0.575<br>0.555 | 0.158 | 0.280<br>0.220 | 1.06<br>0.81 | 0.135 | 0.135 | 14 | 0.054 | 0.38 | 1.81 | 2.2 |
| 3/8 | 1.23 | 0.710<br>0.690 | 0.172 | 0.389<br>0.329 | 1.06<br>0.81 | 0.145 | 0.145 | 14 | 0.059 | 0.38 | 1.93 | 2.3 |
| 1/2 | 1.46 | 0.875<br>0.855 | 0.204 | 0.494<br>0.434 | 1.25<br>1.00 | 0.160 | 0.160 | 11 | 0.066 | 0.38 | 2.24 | 2.6 |
| 3/4 | 1.79 | 1.085<br>1.065 | 0.238 | 0.642<br>0.582 | 1.35<br>1.03 | 0.180 | 0.175 | 11 | 0.073 | 0.50 | 2.44 | 3.1 |
| 1 | 2.16 | 1.350<br>1.330 | 0.273 | 0.845<br>0.785 | 1.60<br>1.28 | 0.210 | 0.205 | 10 | 0.084 | 0.50 | 2.80 | 3.7 |
| $1^1/_4$ | 2.42 | 1.695<br>1.675 | 0.273 | 1.190<br>1.130 | 1.66<br>1.34 | 0.230 | 0.220 | 10 | 0.091 | 0.50 | 3.01 | 4.4 |
| $1^1/_2$ | 2.96 | 1.935<br>1.915 | 0.307 | 1.368<br>1.308 | 1.79<br>1.47 | 0.260 | 0.250 | 10 | 0.106 | 0.50 | 3.39 | 5.2 |
| 2 | 3.61 | 2.426<br>2.406 | 0.374 | 1.717<br>1.657 | 2.43<br>2.05 | 0.295 | 0.280 | 8 | 0.121 | 0.62 | 4.03 | 5.9 |
| $2^1/_2$ | 4.30 | 2.931<br>2.906 | 0.409 | 2.155<br>2.095 | 2.51<br>2.11 | 0.325 | 0.315 | 8 | 0.139 | 0.62 | 4.29 | 6.9 |

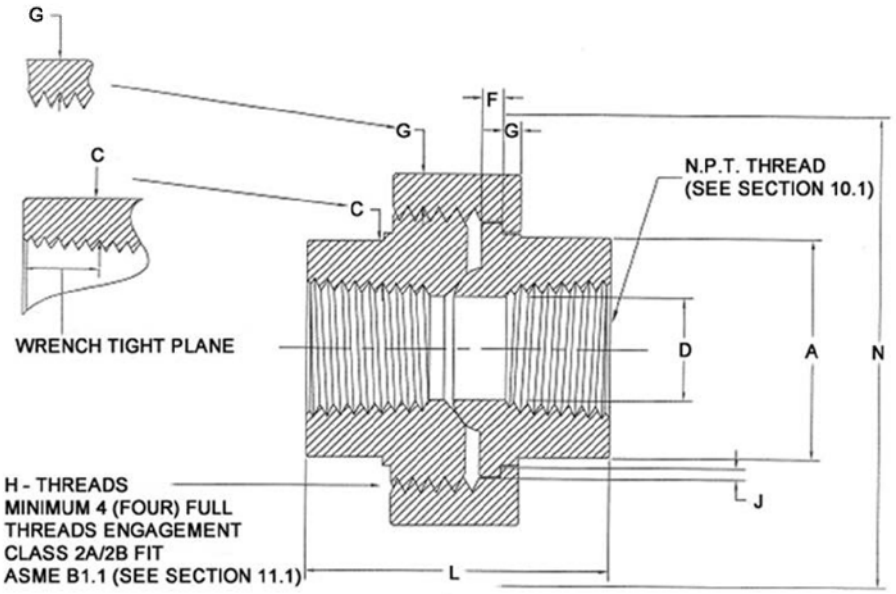
**NOTE:** (a) The contact diameter of the male/female tailpiece is affected by the waterway bore (Col. D). The manufacturer shall consider the relationships between the contact point and waterway diameter in his design.




## TABLE 9
### Class 3000 Pipe Unions – Threaded Ends

| NPS | 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<br>0.253 | 0.125 | 0.125 | 16 | 0.049 | 1.63 | 2.0 |
| 1/4 | 0.75 | 0.119 | 0.438<br>0.372 | 0.125 | 0.125 | 16 | 0.049 | 1.63 | 2.0 |
| 3/8 | 0.90 | 0.126 | 0.562<br>0.532 | 0.135 | 0.135 | 14 | 0.054 | 1.81 | 2.2 |
| 1/2 | 1.09 | 0.147 | 0.703<br>0.672 | 0.145 | 0.145 | 14 | 0.059 | 1.93 | 2.3 |
| 3/4 | 1.32 | 0.154 | 0.906<br>0.842 | 0.160 | 0.160 | 11 | 0.066 | 2.24 | 2.6 |
| 1 | 1.63 | 0.179 | 1.141<br>1.092 | 0.180 | 0.175 | 11 | 0.073 | 2.44 | 3.1 |
| $1^1/_4$ | 1.99 | 0.191 | 1.484<br>1.392 | 0.210 | 0.205 | 10 | 0.084 | 2.80 | 3.7 |
| $1^1/_2$ | 2.25 | 0.200 | 1.714<br>1.622 | 0.230 | 0.220 | 10 | 0.091 | 3.01 | 4.4 |
| 2 | 2.76 | 0.218 | 2.188<br>2.052 | 0.260 | 0.250 | 10 | 0.106 | 3.39 | 5.2 |
| $2^1/_2$ | 3.36 | 0.276 | 2.609<br>2.532 | 0.295 | 0.280 | 8 | 0.121 | 4.03 | 5.9 |
| 3 | 4.03 | 0.300 | 3.250<br>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.




## TABLE 10
### Class 6000 Pipe Unions – Threaded Ends

| NPS | 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 | 0.65 | .124 | 0.332<br>0.126 | 0.125 | 0.125 | 16 | 0.049 | 1.63 | 2.0 |
| 1/4 | 0.83 | .145 | 0.438<br>0.220 | 0.135 | 0.135 | 14 | 0.054 | 1.81 | 2.2 |
| 3/8 | 0.99 | .158 | 0.562<br>0.329 | 0.145 | 0.145 | 14 | 0.059 | 1.93 | 2.3 |
| 1/2 | 1.22 | .188 | 0.703<br>0.434 | 0.160 | 0.160 | 11 | 0.066 | 2.24 | 2.6 |
| 3/4 | 1.49 | .219 | 0.906<br>0.582 | 0.180 | 0.175 | 11 | 0.073 | 2.44 | 3.1 |
| 1 | 1.82 | .250 | 1.141<br>0.785 | 0.210 | 0.205 | 10 | 0.084 | 2.80 | 3.7 |
| $1^1/_4$ | 2.16 | .250 | 1.484<br>1.130 | 0.230 | 0.220 | 10 | 0.091 | 3.01 | 4.4 |
| $1^1/_2$ | 2.46 | .281 | 1.714<br>1.308 | 0.260 | 0.250 | 10 | 0.106 | 3.39 | 5.2 |
| 2 | 3.06 | .344 | 2.188<br>1.657 | 0.295 | 0.280 | 8 | 0.121 | 4.03 | 5.9 |
| $2^1/_2$ | 3.63 | .375 | 2.609<br>2.095 | 0.325 | 0.315 | 8 | 0.139 | 4.29 | 6.9 |
| 3 | 4.38 | .438 | 3.250<br>2.594 | 0.401 | 0.401 | 8 | 0.160 | 7.50 | 7.9 |

**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 | Description |
|---|---|
| **ASME** | |
| B1.1-2003 (2008) | Unified Inch Screw Threads (UN and UNR Thread Form) |
| B1.20.1-2013 | Pipe Threads, General Purpose (Inch) |
| B36.10M-2004 (R2010) | Welded and Seamless Wrought Steel Pipe |
| **ASTM** | **Standard Specification for:** |
| A105/A105M-13 | Carbon Steel Forgings for Piping Applications |
| A106/A106M-13 | Seamless Carbon Steel Pipe for High-Temperature Service |
| A234/A234M-13e1 | Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| A182/A182M-13a | Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service |
| A403/A403M-13a | Wrought Austenitic Stainless Steel Piping Fittings |
| A312/A312M-13b | Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipe |
| B366-10a | Factory-Made Wrought Nickel and Nickel Alloy Fittings |
| B564-11e1 | Nickel Alloy Forgings |
| **MSS;ANSI/MSS** | |
| SP-25-2013 | Standard Marking System for Valves, Fittings, Flanges, and Unions |

The following organizations appear in the above list:

ASME American Society of Mechanical Engineers (ASME International)
Two Park Avenue
New York, NY 10016-5990

ASTM ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

MSS Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, NE
Vienna, VA 22180-4602

# Listing of MSS Standard Practices (as of December, 2014)

| TITLE | |
|---|---|
| SP-6-2012 | Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings |
| SP-9-2013 | Spot Facing for Bronze, Iron, and Steel Flanges |
| SP-25-2013 | Standard Marking System for Valves, Fittings, Flanges, and Unions **(ANSI-approved American National Standard)** |
| SP-42-2013 | Corrosion-Resistant Gate, Globe, Angle, and Check Valves with Flanged and Butt Weld Ends (Classes 150, 300 & 600) |
| SP-43-2013 | Wrought and Fabricated Butt-Welding Fittings for Low Pressure, Corrosion Resistant Applications |
| SP-44-2010 | Steel Pipeline Flanges (incl. 2011 Errata Sheet) |
| SP-45-2003 | (R 2008) Bypass and Drain Connections |
| SP-51-2012 | Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings |
| SP-53-2012 | Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Magnetic Particle Examination Method |
| SP-54-2013 | Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components – Radiographic Examination Method |
| SP-55-2011 | Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components – Visual Method for Evaluation of Surface Irregularities **(ANSI-approved American National Standard)** |
| SP-58-2009 | Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation (incorporates content of "Withdrawn" SP-69, 77, 89, and 90) **(ANSI-approved American National Standard)** |
| SP-60-2012 | Connecting Flange Joints between Tapping Sleeves and Tapping Valves |
| SP-61-2013 | Pressure Testing of Valves |
| SP-65-2012 | High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets |
| SP-67-2011 | Butterfly Valves |
| SP-68-2011 | High Pressure Butterfly Valves with Offset Design |
| SP-70-2011 | Gray Iron Gate Valves, Flanged and Threaded Ends |
| SP-71-2011 | Gray Iron Swing Check Valves, Flanged and Threaded Ends (incl. 2013 Errata Sheet) |
| SP-72-2010a | Ball Valves with Flanged or Butt-Welding Ends for General Service |
| SP-75-2014 | High-Strength, Wrought, Butt-Welding Fittings |
| SP-78-2011 | Gray Iron Plug Valves, Flanged and Threaded Ends |
| SP-79-2011 | Socket Welding Reducer Inserts |
| SP-80-2013 | Bronze Gate, Globe, Angle, and Check Valves |
| SP-81-2013 | Stainless-Steel or Stainless-Steel-Lined, Bonnetless, Knife Gate Valves with Flanged Ends |
| SP-83-2014 | Class 3000 and 6000 Pipe Unions, Socket Welding and Threaded (Carbon Steel, Alloy Steel, Stainless Steels, and Nickel Alloys) |
| SP-85-2011 | Gray Iron Globe and Angle Valves, Flanged and Threaded Ends |
| SP-86-2014 | Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators |
| SP-87-1991 | (R 1996 – Reinstated 2011) Factory-Made Butt-Welding Fittings for Class I Nuclear Piping Applications |
| SP-88-2010 | Diaphragm Valves |
| SP-91-2009 | Guidelines for Manual Operation of Valves |
| SP-92-2012 | MSS Valve User Guide |
| SP-93-2014 | Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Liquid Penetrant Examination Method |
| SP-94-2008 | Quality Standard for Ferritic and Martensitic Steel Castings for Valves, Flanges, Fittings, and Other Piping Components – Ultrasonic Examination Method |
| SP-95-2014 | Swage(d) Nipples and Bull Plugs |
| SP-96-2011 | Guidelines on Terminology for Valves and Fittings **(ANSI-approved American National Standard)** |
| SP-97-2012 | Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends |
| SP-98-2012 | Protective Coatings for the Interior of Valves, Hydrants, and Fittings |
| SP-99-2010 | Instrument Valves |
| SP-100-2009 | Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Valves |
| SP-101-2014 | Part-Turn Valve Actuator Attachment – FA Flange and Driving Component Dimensions and Performance Characteristics |
| SP-102-1989 | (R 2001) Multi-Turn Valve Actuator Attachment – Flange and Driving Component Dimensions and Performance Characteristics |
| SP-104-2012 | Wrought Copper Solder-Joint Pressure Fittings |
| SP-105-2010 | Instrument Valves for Code Applications |
| SP-106-2012 | Cast Copper Alloy Flanges and Flanged Fittings: Class 125, 150, and 300 |
| SP-108-2012 | Resilient-Seated Cast Iron Eccentric Plug Valves |
| SP-109-2012 | Weld-Fabricated Copper Solder-Joint Pressure Fittings (incl. 2012 Errata Sheet) |
| SP-110-2010 | Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends (incl. 2010 Errata Sheet) |
| SP-111-2012 | Gray-Iron and Ductile-Iron Tapping Sleeves |
| SP-112-2010 | Quality Standard for Evaluation of Cast Surface Finishes – Visual and Tactile Method. This SP must be used with a 10-surface, three dimensional Cast Surface Comparator, which is a necessary part of the standard. Additional Comparators available separately. |
| SP-113-2012 | Connecting Joints between Tapping Machines and Tapping Valves |
| SP-114-2007 | Corrosion Resistant Pipe Fittings Threaded and Socket Welding Class 150 and 1000 **(ANSI-approved American National Standard)** |
| SP-115-2010 | Excess Flow Valves, 1¼ NPS and Smaller, for Fuel Gas Service |
| SP-116-2014 | Service-Line Valves and Fittings for Drinking Water Systems |
| SP-117-2011 | Bellows Seals for Globe and Gate Valves |
| SP-119-2010 | Factory-Made Wrought Belled End Pipe Fittings for Socket-Welding (incl. 2014 Errata Sheet) |
| SP-120-2011 | Flexible Graphite Packing System for Rising Stem Valves – Design Requirements |
| SP-121-2006 | Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves |
| SP-122-2012 | Plastic Industrial Ball Valves |
| SP-123-2013 | Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube |
| SP-124-2012 | Fabricated Tapping Sleeves |
| SP-125-2010 | Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves |
| SP-126-2013 | In-Line, Spring-Assisted, Center-Guided Check Valves (Carbon, Alloy Steel, Stainless Steel, & Nickel Alloys) |
| SP-127-2014a | Bracing for Piping Systems: Seismic-Wind-Dynamic Design, Selection, and Application |
| SP-128-2012 | Ductile Iron Gate Valves |
| SP-129-2014 | Copper-Nickel Socket-Welding, Fittings, and Unions |
| SP-130-2013 | Bellows Seals for Instrument Valves |
| SP-131-2010 | Metallic Manually Operated Gas Distribution Valves |
| SP-132-2010 | Compression Packing Systems for Instrument Valves |
| SP-133-2010 | Excess Flow Valves for Low Pressure Fuel Gas Appliances |
| SP-134-2012 | Valves for Cryogenic Service, including Requirements for Body/Bonnet Extensions |
| SP-135-2010 | High Pressure Knife Gate Valves |
| SP-136-2014 | Ductile Iron Swing Check Valves |
| SP-137-2013 | Quality Standard for Positive Material Identification of Metal Valves, Flanges, Fittings, and Other Piping Components |
| SP-138-2014 | Quality Standard Practice for Oxygen Cleaning of Valves and Fittings **(ANSI-approved American National Standard)** |
| SP-139-2014 | Copper Alloy Gate, Globe, Angle, and Check Valves for Low Pressure/Low Temperature Plumbing Applications |
| SP-140-2012 | Quality Standard Practice for Preparation of Valves and Fittings for Silicone-Free Service |
| SP-141-2012 | Multi-Turn and Check Valve Modifications |
| SP-142-2012 | Excess Flow Valves for Fuel Gas Service, NPS 1½ through 12 |
| SP-143-2012 | Live-Loaded Valve Stem Packing Systems |
| SP-144-2013 | Pressure Seal Bonnet Valves |
| SP-145-2013 | Metal Ball Valves for Low Pressure/Low Temperature Plumbing Applications |
| SP-146-2014 | High Pressure, Lug- and Wafer-Type, Iron and Ductile Iron Knife Gate Valves |
| SP-147-2014 | Quality Standard for Steel Castings Used in Standard Class Steel Valves – Sampling Method for Evaluating Casting Quality |
| SP-148-2014 | Low Pressure Flanged or Lugged Carbon Steel and Iron or Ductile Iron, Cast or Fabricated, Bonnetless, Knife Gate Valves without Liners |

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