

Wrought and Fabricated  
Butt-Welding Fittings  
for Low Pressure,  
Corrosion Resistant  
Applications

Standard Practice  
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Substantive changes in this 2013 edition are "flagged" by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

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

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**| FOREWORD |**

ASME B16.9 is the American Standard for steel butt-welding fittings and although not so stated, it is implied that its scope deals primarily with the schedules of wall thicknesses which are common to carbon steel and the grades of alloy steel piping that are selected for pressure and temperature considerations.

The rapid expansion of the process industries in the field of chemicals, plastics, textiles, etc., has created a demand for a class of pipe referred to as stainless piping, using this word in its generic sense. This field employs the use of the austenitic stainless steels and also nickel and its related alloys. This stainless piping is used with resistance to corrosion, elimination of product contamination, or combination of the two as the principle reason for material selection. Pressure is seldom, if ever, a critical consideration.

When pressure is a consideration, reference is made to ASME B16.9.

Mechanical strength, resistance to vacuum, and economy, are the most usual criteria in the selection of pipe thickness in this field, and for this reason the wall thicknesses employed in the field of corrosion resistant pipe are lighter than those in common usage with carbon steel piping.

In 1949, the American Standards Association, now known as the American National Standards Institute or ANSI, approved B36.19, Stainless Steel Pipe, as an American Standard. The B36.19 standard was developed by the B36 Standards Committee, which included MSS as a participant. In this American Standard, a schedule of wall thickness was established and designated as Schedule 10S. Numerous companies were also using a wall thickness lighter than Schedule 10S for services where contamination rather than corrosion was the prime consideration. These lighter wall thicknesses were designated Schedule 5S and the original 1950 edition of MSS SP-43 established a series of Schedule 5S fittings. The 5S thicknesses were published in SP-43 and were developed in cooperation with representatives of the various principal chemical companies and processing industries. In 1952, the B36.19 Stainless Steel Pipe Standard was revised to recognize the Schedule 5S wall thickness pipe as an American Standard. MSS and the ASA endorsed this inclusion.

The purpose of this Standard Practice is to provide industry with a set of dimensional standards for butt-welding fittings that can be used with these light wall pipes of corrosion resisting materials. The center-to-end dimensions of all fittings are identical with those in ASME B16.9, which give to industry the advantage of uniform design room practice and a maximum utilization of existing die equipment. The only departure from this is in the lap-joint stub end, where for purposes of economy, the face-to-end of the product has been reduced for use with thin wall piping.

The advantage of longer center-to-end dimensions of size 3/4 elbows resulted in a change to the tables that would permit a gradual changeover; thus providing manufacturers ample time to deplete existing stock, re-tool, and replenish their stock.

The 1991 revision of SP-43 involved the deletion of metric equivalents.

The 2001 Reaffirmation had no technical changes. There were minor editorial changes. The precedence of the longer dimensions for 3/4 elbows was made in accordance with ASME B16.9. Referenced standards were brought up to date. The title of 180 degree returns was clarified.

In the 2008 edition, a minimal pressure rating was established to correspond with the ASTM CR designation.

The 2013 edition was revised to include a new section on welding, a revision of Table 1 to include angularity tolerances, a revision of Section 6.1 to update AISI/SAE fitting grade types, data corrections were made to Tables 4, 5, and 6, referenced standards in Annex A were updated, and numerous formatting and editorial corrections were made. In addition, the drawings for Section 10 and 11, and Tables 2, 3, and 5 have been redone in this current revision although not “flagged” given there were no substantive changes. Note that various Table corrections contained within an Errata Sheet issued in 2010 were also incorporated.

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## WROUGHT AND FABRICATED BUTT-WELDING FITTINGS FOR LOW PRESSURE, CORROSION RESISTANT APPLICATIONS

### 1. **SCOPE**

1.1 This Standard Practice provides dimensions, tolerances, and markings for butt-welding fittings for low pressure, corrosion resistant applications.

1.2 This Standard Practice covers only fittings made for use with Schedule 5S or 10S pipe, for all Nominal Pipe Sizes (NPS) listed in ASME B36.19M, except that short pattern stub ends suitable for use with Schedule 40S are also shown.

### 2. **REFERENCES**

2.1 External standards incorporated by reference in this Standard Practice are shown in Annex A for convenience of identifying edition number, date, and source of supply.

### 3. **PRESSURE RATINGS**

3.1 Fittings covered by this Standard Practice are not pressure rated; however, they must be capable of withstanding 30% of the allowable pressure rating of the pipe with which they are marked.

3.2 For fittings that are of the same pressure rating as the matching pipe, refer to ASME B16.9.

### 4. **SIZE**

4.1 The size of the fittings in Tables 1 through 6 are identified by the corresponding NPS.

### 5. **MARKING**

5.1 Each fitting shall be marked as per SP-25 to show the following:

- a) Manufacturer's name or trademark
- b) "CR" followed by the material identification symbol established for the respective grade in the appropriate ASTM specifications or AISI/SAE designations

- c) Manufacturer's heat identification number
- d) Schedule number or nominal wall thickness designation
- e) Size

5.2 Where the size of the fittings does not permit complete marking, Sections 5.1 (a) and (c) are mandatory. The other marking and identification marks may be omitted in the sequence, as specified in MSS SP-25.

5.3 The required markings shall be made by any suitable method that is not injurious to the fitting.

### 6. **MATERIALS**

6.1 Fittings made from AISI/SAE Grade Types 304, 304L, 310, 316, 316L, 317, 317L, 321, and 347 are considered standard designations under this Standard Practice. Fittings made from other corrosion resistant material, including nonferrous materials, are acceptable by agreement between the purchaser and the manufacturer provided they meet the requirements of a recognized and applicable AISI/SAE grade designation or ASTM specification.

### 7. **METAL THICKNESS**

7.1 As these fittings are to match pipe, the dimensions of the welding ends must conform to established pipe standards, with regard to outside diameters and tolerances. The nominal wall thickness of the fittings shall be the same as the pipe to which it is welded; except that fittings with heavier walls may be butt-welded to lighter wall pipe, provided the heavier wall is tapered on the inside or outside to match the dimensions of the lighter pipe.

8. **FITTINGS DIMENSIONS**

8.1 U.S. customary (inch) dimensions for the fittings covered by this Standard Practice are given in Tables 1 through 6.

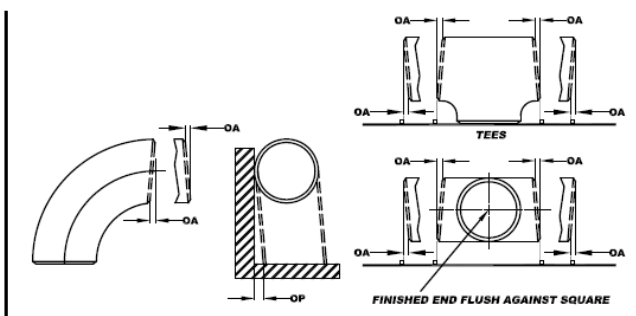
8.2 One of the principals of this Standard Practice is the maintenance of a fixed position for welding ends, with reference to the center-line of the fittings or the overall dimensions, as the case may be.

9. **TESTS**

9.1 Hydrostatic testing of fittings is not required in this Standard Practice; however, fittings shall be capable of withstanding a hydrostatic test pressure that is 1.5 times the pressure rating required in Section 3.1.

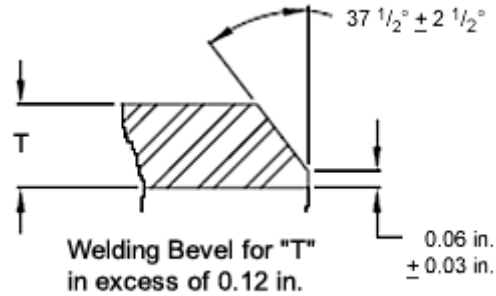
10. **TOLERANCES**

10.1 Table 1 lists tolerances for the fittings covered by this Standard Practice. The location of dimensions OA and OP are illustrated in the drawing below and actual maximum angularity tolerances indicated in Table 1.



11. **WELDING BEVEL**

11.1 Fittings conforming to this Standard Practice may be finished with ends cut square for wall thickness 0.12 in. or less. For wall thicknesses in excess of 0.12 in., they shall be beveled at  $37\frac{1}{2}^\circ$  ( $\pm 2\frac{1}{2}^\circ$ ), with root face (land) 0.06 in. ( $\pm 0.03$  in.) as indicated below.



12. **FINISH AND HEAT TREATMENT**

12.1 The fittings shall be satisfactorily heat treated by an accepted practice, and adequately cleaned to insure maximum corrosion resistance.

13. **WELDING**

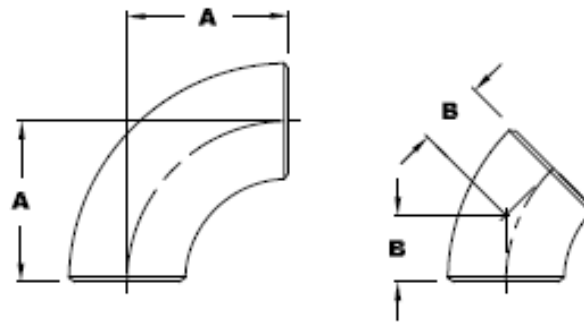
13.1 All fittings shall have welders, welding operators, and welding procedures qualified under the provisions of Section IX of the ASME Boiler and Pressure Vessel Code.

**TABLE 1**  
Tolerances

Dimensions are in inches.

NPS	All Fittings		90° Elbows 45° Elbows Tees	Reducers Lap-Joint Stub Ends	180° Returns			Caps	Lap-Joint Stub Ends		Angularity Tolerances (Max.)	
	Outside Diameter at Welding End <sup>(a)</sup>	Wall Thickness	Center-to- End Dimension A-B-C-M	Overall Length F-H	Center-to- Center Dimension O	Back-to- Face Dimension K	Alignment of Ends U	Overall Length E	Fillet <sup>(b)</sup> R a d i u s of L a p A	Outside Diameter of Lap G	Off Angle OA	Off Angle OP
1/2 – 1 <sup>1</sup> / <sub>4</sub>	± 0.03	Not less than 87½ % of nominal thickness	± 0.06	± 0.06	± 0.25	± 0.25	± 0.03	± 0.12	+ 0 - 0.03	+ 0 - 0.03	0.03	0.06
2 – 3 <sup>1</sup> / <sub>4</sub>	± 0.03		± 0.06	± 0.06	± 0.25	± 0.25	± 0.03	± 0.12	+ 0 - 0.03	+ 0 - 0.03	0.03	0.06
4	± 0.03		± 0.06	± 0.06	± 0.25	± 0.25	± 0.03	± 0.12	+ 0 - 0.03	+ 0 - 0.03	0.03	0.06
5 – 8	+ 0.06 - 0.03		± 0.06	± 0.06	± 0.25	± 0.25	± 0.03	± 0.25	+ 0 - 0.06	+ 0 - 0.03	0.06	0.12
10 – 18	+ 0.09 - 0.03		± 0.09	± 0.09	± 0.38	± 0.25	± 0.06	± 0.25	+ 0 - 0.06	+ 0 - 0.06	0.09	0.25
20 – 24	+ 0.12 - 0.03		± 0.09	± 0.09	± 0.38	± 0.25	± 0.06	± 0.25	+ 0 - 0.06	+ 0 - 0.06	0.12	0.38

GENERAL NOTE: Diameter and wall thicknesses are as specified in either ASME B36.10M or ASME B36.19M.  
 NOTES:  
 (a) Out of roundness is the vector sum of plus and minus tolerance.  
 (b) Fillet B radius is maximum (see Table 4).

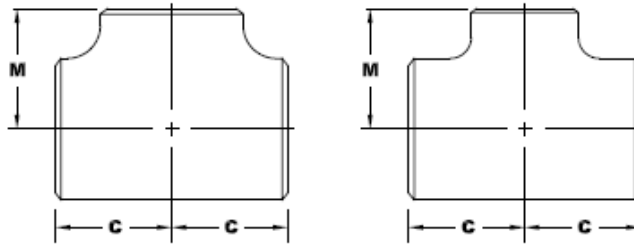


**TABLE 2**  
**Dimensions of Long Radius Elbows**

Dimensions are in inches.

NPS	Outside Diameter at Bevel	Center-to-End	
		90° Elbows A	45° Elbows B
1/2	0.84	1.50	0.62
3/4	1.05	1.50	0.75
1	1.32	1.50	0.88
1 <sup>1</sup> / <sub>4</sub>	1.66	1.88	1.00
1 <sup>1</sup> / <sub>2</sub>	1.90	2.25	1.12
2	2.38	3.00	1.38
2 <sup>1</sup> / <sub>2</sub>	2.88	3.75	1.75
3	3.50	4.50	2.00
3 <sup>1</sup> / <sub>2</sub>	4.00	5.25	2.25
4	4.50	6.00	2.50
5	5.56	7.50	3.12
6	6.62	9.00	3.75
8	8.62	12.00	5.00
10	10.75	15.00	6.25
12	12.75	18.00	7.50
14	14.00	21.00	8.75
16	16.00	24.00	10.00
18	18.00	27.00	11.25
20	20.00	30.00	12.50
22	22.00	33.00	13.50
24	24.00	36.00	15.00





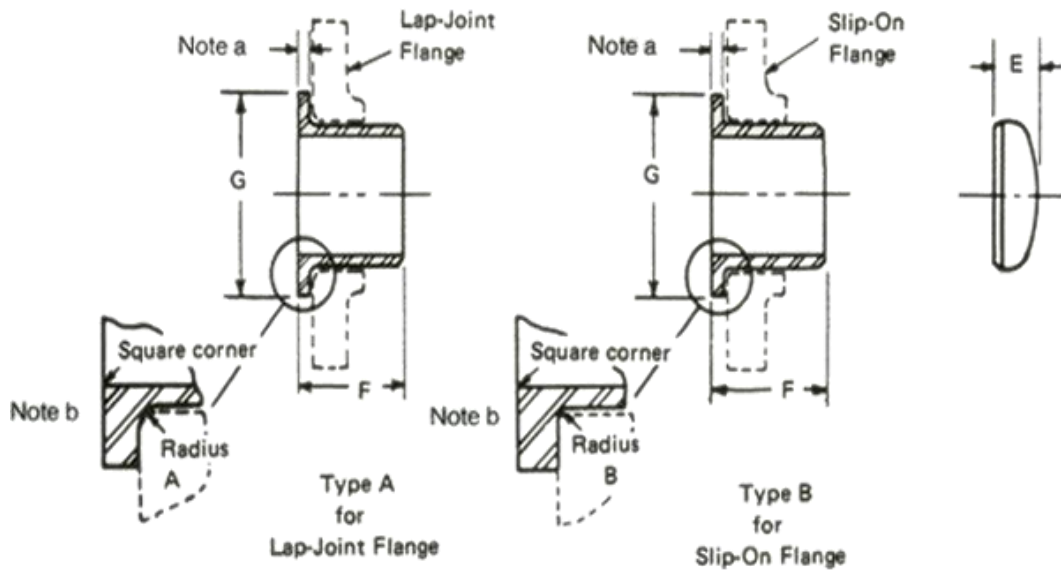
**TABLE 3**  
**Dimensions of Straight and Reducing-on-the-Outlet Tees**  
 Dimensions are in inches.

NPS	Nominal Outside Diameter at Bevel		Center-to-End	
	Run	Outlet	Run C	Outlet M
1/2 (Straight)	0.84	0.84	1.00	1.00
3/4 (Straight)	1.05	1.05	1.12	1.12
3/4 x 3/4 x 1/2	1.05	0.84	1.12	1.12
1 (Straight)	1.32	1.32	1.50	1.50
1 x 1 x 3/4	1.32	1.05	1.50	1.50
1 x 1 x 1/2	1.32	0.84	1.50	1.50
1 <sup>1</sup> / <sub>4</sub> (Straight)	1.66	1.66	1.88	1.88
1 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>4</sub> x 1	1.66	1.32	1.88	1.88
1 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>4</sub> x 3/4	1.66	1.05	1.88	1.88
1 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>4</sub> x 1/2	1.66	0.84	1.88	1.88
1 <sup>1</sup> / <sub>2</sub> (Straight)	1.90	1.90	2.25	2.25
1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub>	1.90	1.66	2.25	2.25
1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub> x 1	1.90	1.32	2.25	2.25
1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub> x 3/4	1.90	1.05	2.25	2.25
2 (Straight)	2.38	2.38	2.50	2.50
2 x 2 x 1 <sup>1</sup> / <sub>2</sub>	2.38	1.90	2.50	2.38
2 x 2 x 1 <sup>1</sup> / <sub>4</sub>	2.38	1.66	2.50	2.25
2 x 2 x 1	2.38	1.32	2.50	2.00
2 x 2 x 3/4	2.38	1.05	2.50	1.75
2 <sup>1</sup> / <sub>2</sub> (Straight)	2.88	2.88	3.00	3.00
2 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub> x 2	2.88	2.38	3.00	2.75
2 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub>	2.88	1.90	3.00	2.62
2 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub>	2.88	1.66	3.00	2.50
2 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub> x 1	2.88	1.32	3.00	2.25
3 (Straight)	3.50	3.50	3.38	3.38
3 x 3 x 2 <sup>1</sup> / <sub>2</sub>	3.50	2.88	3.38	3.25
3 x 3 x 2	3.50	2.38	3.38	3.00
3 x 3 x 1 <sup>1</sup> / <sub>2</sub>	3.50	1.90	3.38	2.88
3 <sup>1</sup> / <sub>2</sub> (Straight)	4.00	4.00	3.75	3.75
3 <sup>1</sup> / <sub>2</sub> x 3 <sup>1</sup> / <sub>2</sub> x 3	4.00	3.50	3.75	3.62
3 <sup>1</sup> / <sub>2</sub> x 3 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub>	4.00	2.88	3.75	3.50
3 <sup>1</sup> / <sub>2</sub> x 3 <sup>1</sup> / <sub>2</sub> x 2	4.00	2.38	3.75	3.25
3 <sup>1</sup> / <sub>2</sub> x 3 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub>	4.00	1.90	3.75	3.12
4 (Straight)	4.50	4.50	4.12	4.12
4 x 4 x 3 <sup>1</sup> / <sub>2</sub>	4.50	4.00	4.12	4.00
4 x 4 x 3	4.50	3.50	4.12	3.88
4 x 4 x 2 <sup>1</sup> / <sub>2</sub>	4.50	2.88	4.12	3.75
4 x 4 x 2	4.50	2.38	4.12	3.50
4 x 4 x 1 <sup>1</sup> / <sub>2</sub>	4.50	1.90	4.12	3.38
5 (Straight)	5.56	5.56	4.88	4.88
5 x 5 x 4	5.56	4.50	4.88	4.62
5 x 5 x 3 <sup>1</sup> / <sub>2</sub>	5.56	4.00	4.88	4.50
5 x 5 x 3	5.56	3.50	4.88	4.38
5 x 5 x 2 <sup>1</sup> / <sub>2</sub>	5.56	2.88	4.88	4.25
5 x 5 x 2	5.56	2.38	4.88	4.12

Continued on next page

**TABLE 3 (Continued)**  
**Dimensions of Straight and Reducing-on-the-Outlet Tees**  
 Dimensions are in inches.

NPS	Nominal Outside Diameter at Bevel		Center-to-End	
	Run	Outlet	Run C	Outlet M
6 (Straight)	6.62	6.62	5.62	5.62
6 x 6 x 5	6.62	5.56	5.62	5.38
6 x 6 x 4	6.62	4.50	5.62	5.12
6 x 6 x 3 <sup>1</sup> $\Delta_2$	6.62	4.00	5.62	5.00
6 x 6 x 3	6.62	3.50	5.62	4.88
6 x 6 x 2 <sup>1</sup> $\Delta_2$	6.62	2.88	5.62	4.75
8 (Straight)	8.62	8.62	7.00	7.00
8 x 8 x 6	8.62	6.62	7.00	6.62
8 x 8 x 5	8.62	5.56	7.00	6.38
8 x 8 x 4	8.62	4.50	7.00	6.12
8 x 8 x 3 <sup>1</sup> $\Delta_2$	8.62	4.00	7.00	6.00
10 (Straight)	10.75	10.75	8.50	8.50
10 x 10 x 8	10.75	8.62	8.50	8.00
10 x 10 x 6	10.75	6.62	8.50	7.62
10 x 10 x 5	10.75	5.56	8.50	7.50
10 x 10 x 4	10.75	4.50	8.50	7.25
12 (Straight)	12.75	12.75	10.00	10.00
12 x 12 x 10	12.75	10.75	10.00	9.50
12 x 12 x 8	12.75	8.62	10.00	9.00
12 x 12 x 6	12.75	6.62	10.00	8.62
12 x 12 x 5	12.75	5.56	10.00	8.50
14 (Straight)	14.00	14.00	11.00	11.00
14 x 14 x 12	14.00	12.75	11.00	10.62
14 x 14 x 10	14.00	10.75	11.00	10.12
14 x 14 x 8	14.00	8.62	11.00	9.75
14 x 14 x 6	14.00	6.62	11.00	9.38
16 (Straight)	16.00	16.00	12.00	12.00
16 x 16 x 14	16.00	14.00	12.00	12.00
16 x 16 x 12	16.00	12.75	12.00	11.62
16 x 16 x 10	16.00	10.75	12.00	11.12
16 x 16 x 8	16.00	8.62	12.00	10.75
16 x 16 x 6	16.00	6.62	12.00	10.38
18 (Straight)	18.00	18.00	13.50	13.50
18 x 18 x 16	18.00	16.00	13.50	13.00
18 x 18 x 14	18.00	14.00	13.50	13.00
18 x 18 x 12	18.00	12.75	13.50	12.62
18 x 18 x 10	18.00	10.75	13.50	12.12
18 x 18 x 8	18.00	8.62	13.50	11.75
20 (Straight)	20.00	20.00	15.00	15.00
20 x 20 x 18	20.00	18.00	15.00	14.50
20 x 20 x 16	20.00	16.00	15.00	14.00
20 x 20 x 14	20.00	14.00	15.00	14.00
20 x 20 x 12	20.00	12.75	15.00	13.62
20 x 20 x 10	20.00	10.75	15.00	13.12
20 x 20 x 8	20.00	8.62	15.00	12.75
24 (Straight)	24.00	24.00	17.00	17.00
24 x 24 x 20	24.00	20.00	17.00	17.00
24 x 24 x 18	24.00	18.00	17.00	16.50
24 x 24 x 16	24.00	16.00	17.00	16.00
24 x 24 x 14	24.00	14.00	17.00	16.00
24 x 24 x 12	24.00	12.75	17.00	15.62
24 x 24 x 10	24.00	10.75	17.00	15.12



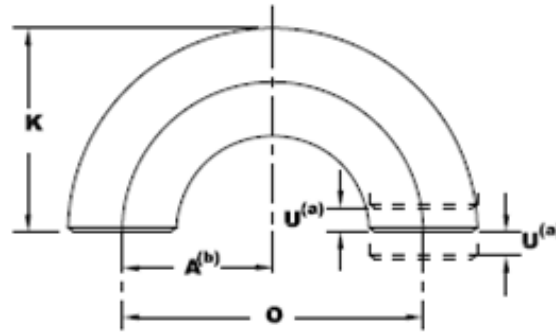
**TABLE 4**  
**Dimensions of Lap-Joint Stub Ends and Caps**

Dimensions are in inches.

NPS	Nominal O. D. at Bevel	Caps Length E	Lap-Joint Stub Ends <sup>(c)</sup>			
			Length F	Diameter of Lap G (Nominal & Max.)	Radius of Fillet	
					A	B (Max.)
1/2	0.84	1.00	2.00	1.38	0.12	0.03
3/4	1.05	1.00	2.00	1.69	0.12	0.03
1	1.32	1.50	2.00	2.00	0.12	0.03
1 <sup>1</sup> / <sub>4</sub>	1.66	1.50	2.00	2.50	0.19	0.03
1 <sup>1</sup> / <sub>2</sub>	1.90	1.50	2.00	2.88	0.25	0.03
2	2.38	1.50	2.50	3.62	0.31	0.03
2 <sup>1</sup> / <sub>2</sub>	2.88	1.50	2.50	4.12	0.31	0.03
3	3.50	2.00	2.50	5.00	0.38	0.03
3 <sup>1</sup> / <sub>2</sub>	4.00	2.50	3.00	5.50	0.38	0.03
4	4.50	2.50	3.00	6.19	0.44	0.03
5	5.56	3.00	3.00	7.31	0.44	0.06
6	6.62	3.50	3.50	8.50	0.50	0.06
8	8.62	4.00	4.00	10.62	0.50	0.06
10	10.75	5.00	5.00	12.75	0.50	0.06
12	12.75	6.00	6.00	15.00	0.50	0.06
14	14.00	6.50	6.00	16.25	0.50	0.06
16	16.00	7.00	6.00	18.50	0.50	0.06
18	18.00	8.00	6.00	21.00	0.50	0.06
20	20.00	9.00	6.00	23.00	0.50	0.06
24	24.00	10.50	6.00	27.25	0.50	0.06

NOTES:

- (a) Minimum lap thickness shall not be less than nominal wall thickness.
- (b) Connect faces of stub ends shall have a modified spiral or concentric serration.
- (c) These lengths and radii for use with Schedule 40S or thinner pipe.



**TABLE 5**  
**Dimensions of Long Radius 180 Degree Returns**

Dimensions are in inches.

NPS	Outside Diameter at Bevel	Center-to-Center O	Back-to-Face K
1/2	0.84	3.00	1.88
3/4	1.05	3.00	2.00
1	1.32	3.00	2.19
1 <sup>1</sup> / <sub>Δ</sub> <sub>4</sub>	1.66	3.75	2.75
1 <sup>1</sup> / <sub>Δ</sub> <sub>2</sub>	1.90	4.50	3.25
2	2.38	6.00	4.19
2 <sup>1</sup> / <sub>Δ</sub> <sub>2</sub>	2.88	7.50	5.19
3	3.50	9.00	6.25
3 <sup>1</sup> / <sub>Δ</sub> <sub>2</sub>	4.00	10.50	7.25
4	4.50	12.00	8.25
5	5.56	15.00	10.31
6	6.62	18.00	12.31
8	8.62	24.00	16.31
10	10.75	30.00	20.38
12	12.75	36.00	24.38
14	14.00	42.00	28.00
16	16.00	48.00	32.00
18	18.00	54.00	36.00
20	20.00	60.00	40.00
24	24.00	72.00	48.00

NOTES:

(a) Alignment of "U" ends:

NPS 8 and smaller: ± 0.03 in.

NPS 10 and larger: ± 0.06 in.

(b) "A" Dimension is equal to one-half (1/2) the "O" Dimension.

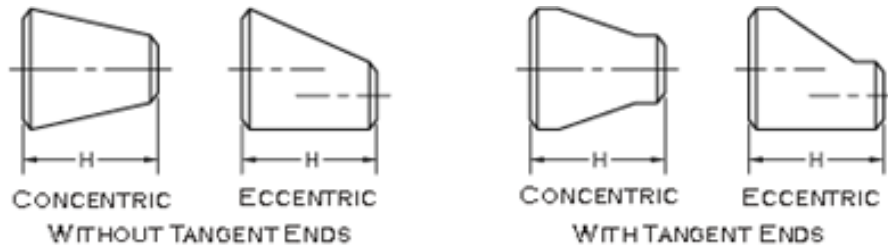


TABLE 6

Dimensions of Concentric and Eccentric Reducers

Dimensions are in inches.

Dimensions are in inches.

NPS	Outside Diameter at Bevel		Length H
	Large End	Small End	
3/4 x 1/2	1.05	0.84	1.50
1 x 3/4	1.32	1.05	2.00
1 x 1/2	1.32	0.84	2.00
1 x 3/8	1.32	0.68	2.00
1 <sup>1</sup> / <sub>4</sub> x 1	1.66	1.32	2.00
1 <sup>1</sup> / <sub>4</sub> x 3/4	1.66	1.05	2.00
1 <sup>1</sup> / <sub>4</sub> x 1/2	1.66	0.84	2.00
1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub>	1.90	1.66	2.50
1 <sup>1</sup> / <sub>2</sub> x 1	1.90	1.32	2.50
1 <sup>1</sup> / <sub>2</sub> x 3/4	1.90	1.05	2.50
1 <sup>1</sup> / <sub>2</sub> x 1/2	1.90	0.84	2.50
2 x 1 <sup>1</sup> / <sub>2</sub>	2.38	1.90	3.00
2 x 1 <sup>1</sup> / <sub>4</sub>	2.38	1.66	3.00
2 x 1	2.38	1.32	3.00
2 x 3/4	2.38	1.05	3.00
2 <sup>1</sup> / <sub>2</sub> x 2	2.88	2.38	3.50
2 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub>	2.88	1.90	3.50
2 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub>	2.88	1.66	3.50
2 <sup>1</sup> / <sub>2</sub> x 1	2.88	1.32	3.50
3 x 2 <sup>1</sup> / <sub>2</sub>	3.50	2.88	3.50
3 x 2	3.50	2.38	3.50
3 x 1 <sup>1</sup> / <sub>2</sub>	3.50	1.90	3.50
3 x 1 <sup>1</sup> / <sub>4</sub>	3.50	1.66	3.50
3 <sup>1</sup> / <sub>2</sub> x 3	4.00	3.50	4.00
3 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub>	4.00	2.88	4.00
3 <sup>1</sup> / <sub>2</sub> x 2	4.00	2.38	4.00
3 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub>	4.00	1.90	4.00
3 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub>	4.00	1.66	4.00
4 x 3 <sup>1</sup> / <sub>2</sub>	4.50	4.00	4.00
4 x 3	4.50	3.50	4.00
4 x 2 <sup>1</sup> / <sub>2</sub>	4.50	2.88	4.00
4 x 2	4.50	2.38	4.00
4 x 1 <sup>1</sup> / <sub>2</sub>	4.50	1.90	4.00
5 x 4	5.56	4.50	5.00
5 x 3 <sup>1</sup> / <sub>2</sub>	5.56	4.00	5.00
5 x 3	5.56	3.50	5.00
5 x 2 <sup>1</sup> / <sub>2</sub>	5.56	2.88	5.00
5 x 2	5.56	2.38	5.00

NPS	Outside Diameter at Bevel		Length H
	Large End	Small End	
6 x 5	6.62	5.56	5.50
6 x 4	6.62	4.50	5.50
6 x 3 <sup>1</sup> / <sub>2</sub>	6.62	4.00	5.50
6 x 3	6.62	3.50	5.50
6 x 2 <sup>1</sup> / <sub>2</sub>	6.62	2.88	5.50
8 x 6	8.62	6.62	6.00
8 x 5	8.62	5.56	6.00
8 x 4	8.62	4.50	6.00
8 x 3 <sup>1</sup> / <sub>2</sub>	8.62	4.00	6.00
10 x 8	10.75	8.62	7.00
10 x 6	10.75	6.62	7.00
10 x 5	10.75	5.56	7.00
10 x 4	10.75	4.50	7.00
12 x 10	12.75	10.75	8.00
12 x 8	12.75	8.62	8.00
12 x 6	12.75	6.62	8.00
12 x 5	12.75	5.56	8.00
14 x 12	14.00	12.75	13.00
14 x 10	14.00	10.75	13.00
14 x 8	14.00	8.62	13.00
14 x 6	14.00	6.62	13.00
16 x 14	16.00	14.00	14.00
16 x 12	16.00	12.75	14.00
16 x 10	16.00	10.75	14.00
16 x 8	16.00	8.62	14.00
18 x 16	18.00	16.00	15.00
18 x 14	18.00	14.00	15.00
18 x 12	18.00	12.75	15.00
18 x 10	18.00	10.75	15.00
20 x 18	20.00	18.00	20.00
20 x 16	20.00	16.00	20.00
20 x 14	20.00	14.00	20.00
20 x 12	20.00	12.75	20.00
24 x 20	24.00	20.00	20.00
24 x 18	24.00	18.00	20.00
24 x 16	24.00	16.00	20.00

## | 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.

<b>Standard Name</b>	<b>Description</b>
<b><u>ASME; ANSI/ASME</u></b>	
B16.9-2007	Factory-Made Wrought Steel Butt welding Fittings
B36.10M-2004 (R2010)	Welded and Seamless Wrought Steel Pipe
B36.19M-2004 (R2010)	Stainless Steel Pipe
BPVC-IX-2010	Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications; including Addenda Reprint (2011)
<b><u>MSS</u></b>	
SP-25-2008	Standard Marking System for Valves, Fittings, Flanges, and Unions

The following organizations appear in the above list or are referenced within this Standard Practice:

AISI	American Iron and Steel Institute 1101 17th Street, NW Washington, D.C. 20036-4700
ANSI	American National Standards Institute 25 West 43rd Street, Fourth Floor New York, NY 10036
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
SAE	SAE International 400 Commonwealth Drive Warrendale, PA 15096-0001

## Listing of MSS Standard Practices (as of March, 2013)

### 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-25-2008	Standard Marking System for Valves, Fittings, Flanges, and Unions
SP-42-2009	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 and Forgings 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 ( <b>ANSI-approved American National Standard</b> )
SP-58-2009	Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation (incorporates content of SP-69, 77, 89, and 90) ( <b>ANSI-approved American National Standard</b> )
SP-60-2012	Connecting Flange Joints between Tapping Sleeves and Tapping Valves
SP-61-2009	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-69-2003	Pipe Hangers and Supports – Selection and Application ( <b>ANSI-approved American National Standard</b> )
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-75-2008	Specification for High-Test, 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-81-2006a	Stainless Steel, Bonnetless, Flanged Knife Gate Valves
SP-83-2006	Class 3000 Steel Pipe Unions Socket Welding and Threaded
SP-85-2011	Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2009	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators (Incl. 2011 Errata Sheet)
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-93-2008	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-95-2006	Swage(d) Nipples and Bull Plugs
SP-96-2011	Guidelines on Terminology for Valves and Fittings
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-101-1989	(R 2001) Part-Turn Valve Actuator Attachment – 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 Resilient-Seated Cast Iron Eccentric Plug Valves
SP-108-2012	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 ( <b>ANSI-approved American National Standard</b> )
SP-115-2010	Excess Flow Valves, 1/4 NPS and Smaller, for Fuel Gas Service
SP-116-2011	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
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-123-1998	(R 2006) 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-126-2007	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
SP-128-2012	Ductile Iron Gate Valves
SP-129-2003	(R 2007) Copper-Nickel Socket-Welding Fittings and Unions
SP-130-2003	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-136-2007	Ductile Iron Swing Check Valves
SP-137-2013	Quality Standard for Positive Material Identification of Metal Valves, Flanges, Fittings, and Other Piping Components
SP-138-2009	Quality Standard Practice for Oxygen Cleaning of Valves & Fittings
SP-139-2010	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

(R YEAR) Indicates year reaffirmed □ Price List Available Upon Request □ MSS is an ANSI-accredited American National Standards developer

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