



 **MIE TECHNO**  
CO.,LTD.

***STAINLESS STEEL  
BUTT-WELDING  
FITTINGS***



# MATERIAL FOR WROUGHT AUSTENITIC STAINLESS STEEL PIPING FITTING

American Standards applied in this catalogue are the latest edition as of January 2003, respectively.

## ASTM A 403/A 403M-02

### Chemical Requirements

Grade <sup>A</sup>			Composition, %								
Grade WP	Grade CR	UNS Designation	C max.	Mn max.	P max.	S max.	Si max.	Ni	Cr	Mo	Ti
WP304	CR304	S30400	0.08	2.00	0.045	0.030	1.00	8.0-11.0	18.0-20.0	...	...
WP304L	CR304L	S30403	0.030 <sup>B</sup>	2.00	0.045	0.030	1.00	8.0-12.0	18.0-20.0	...	...
WP304H	CR304H	S30409	0.04-0.10	2.00	0.045	0.030	1.00	8.0-11.0	18.0-20.0	...	...
WP310S	CR310S	S31008	0.08	2.00	0.045	0.030	1.00	19.0-22.0	24.0-26.0	...	...
WP316	CR316	S31600	0.08	2.00	0.045	0.030	1.00	10.0-14.0	16.0-18.0	2.00-3.00	
WP316L	CR316L	S31603	0.030 <sup>B</sup>	2.00	0.045	0.030	1.00	10.0-14.0 <sup>C</sup>	16.0-18.0	2.00-3.00	
WP316H	CR316H	S31609	0.04-0.10	2.00	0.045	0.030	1.00	10.0-14.0	16.0-18.0	2.00-3.00	
WP321	CR321	S32100	0.08	2.00	0.045	0.030	1.00	9.0-12.0	17.0-19.0	...	D
WP321H	CR321H	S32109	0.04-0.10	2.00	0.045	0.030	1.00	9.0-12.0	17.0-19.0	...	E

#### NOTES:

A: In addition to the WP Grade designation, WP fittings shall be marked with the following Fitting Class

#### Fitting Classes for WP Grades

Class	Construction	Nondestructive Examination
S	Seamless	None
W	Welded	Radiography or Ultrasonic
WX	Welded	Radiography
WU	Welded	Ultrasonic

B: For small diameter or thin walls, or both, where many drawing passes are required, a carbon maximum of 0.040% is necessary in grades TP304L and TP316L. Small outside diameter tubes are defined as those less than 0.500in in outside diameter and light wall tubes as those less than 0.049in in average wall thickness.

C: On pierced tubing, the nickel may be 11.0–16.0%.

D:  $5 \times (C+N_2) - 0.70$  (The titanium content shall be not less than five times the carbon content plus nitrogen content and not more than 0.70%)

E:  $4 \times (C+N_2) - 0.70$  (The titanium content shall be not less than four times the carbon content plus nitrogen content and not more than 0.70%)

### Tensile Requirements

All WP and CR Grades	Yield Strength min. ksi (Mpa)	Tensile Strength min. ksi (Mpa)	Elongation Requirements		
304, 304H, 310, 316, 316H, 321, 321H	30 (205)	75 (515)	Standard round specimen, or small proportional specimen, or strip-type specimen, minimum % in 4D	Longitudinal	Transverse
304L, 316L	25 (170)	70 (485)		28	20

#### Heat Treatment

All fittings shall be furnished in the heat-treated condition.

For H grades, separate solution heat treatments are required for solution annealing; in-process heat treatments are not permitted as a substitute for the separate solution annealing treatments.

The heat-treat procedure, except for 321 and 321H, shall consist of solution annealing the fittings at a minimum temperature of 1900°F (1040°C) until the chromium carbides go into solution, and then cooling at a sufficient rate to prevent reprecipitation.

A solution annealing temperature above 1950°F (1065°C) may impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in 321 and 321H.

All welding shall be done prior to heat treatment.

# DIMENSIONS OF WELDED & SEAMLESS STAINLESS STEEL PIPE

**ANSI/ASME B36.19M**

## CUSTOMARY UNITS

Dimensions in inches

Inch Nominal Pipe Size	Outside Diameter in.	Nominal Wall Thickness			
		Schedule 5S	Schedule 10S	Schedule 40S	Schedule 80S
1/8	0.405	...	0.049	0.068	0.095
1/4	0.540	...	0.065	0.088	0.119
3/8	0.675	...	0.065	0.091	0.126
1/2	0.840	0.065	0.083	0.109	0.147
3/4	1.050	0.065	0.083	0.113	0.154
1	1.315	0.065	0.109	0.133	0.179
1 1/4	1.660	0.065	0.109	0.140	0.191
1 1/2	1.900	0.065	0.109	0.145	0.200
2	2.375	0.065	0.109	0.154	0.218
2 1/2	2.875	0.083	0.120	0.203	0.276
3	3.500	0.083	0.120	0.216	0.300
3 1/2	4.000	0.083	0.120	0.226	0.318
4	4.500	0.083	0.120	0.237	0.337
5	5.563	0.109	0.134	0.258	0.375
6	6.625	0.109	0.134	0.280	0.432
8	8.625	0.109	0.148	0.322	0.500
10	10.750	0.134	0.165	0.365	0.500 (1)
12	12.750	0.156	0.180	0.375 (1)	0.500 (1)
14	14.000	0.156	0.188 (1)	0.375 (1)	...
16	16.000	0.165	0.188 (1)	0.375 (1)	...
18	18.000	0.165	0.188 (1)	0.375 (1)	...
20	20.000	0.188	0.218 (1)	0.375 (1)	...
22	22.000	0.188	0.218 (1)	0.375 (1)	...
24	24.000	0.218	0.250	0.375 (1)	...
30	30.000	0.250	0.312	0.375 (1)	...

**NOTES:**

(1) These dimensions do not conform to ANSI/ASME B36.19M.

(2) For tolerances, permissible variations for dimensions are indicated in each specification listed below.

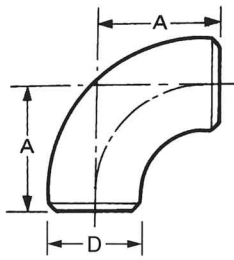
Specifications for pipe with ASTM designations and titles of standards specifications

ASTM Designation	Title
A312	Specifications for Seamless and Welded Austenitic Stainless Steel Pipe
A358	Specifications for Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
A376	Specifications for Seamless Austenitic Steel Pipe for High-Temperature Central-Station Service
A409	Specifications for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service

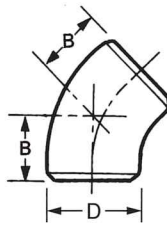
# DIMENSIONS OF LONG RADIUS ELBOW

ASME B16.9 • MSS SP-43

Dimensions in inches



90 deg. ELBOWS



45 deg. ELBOWS

Nominal Pipe Size (NPS)	Outside Diameter at Bevel D	Center-to-End	
		90 deg. Elbows A	45 deg. Elbows B
1/2	0.84	1.50	0.62
3/4 (1)	1.05	1.50 (1.12)	0.75 (0.44)
1	1.32	1.50	0.88
1 1/4	1.66	1.88	1.00
1 1/2	1.90	2.25	1.12
2	2.38	3.00	1.38
2 1/2	2.88	3.75	1.75
3	3.50	4.50	2.00
3 1/2	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
26	26.00	39.00	16.00
28	28.00	42.00	17.25
30	30.00	45.00	18.50
32	32.00	48.00	19.75
34	34.00	51.00	21.00
36	36.00	54.00	22.25
38	38.00	57.00	23.62
40	40.00	60.00	24.88
42	42.00	63.00	26.00
44	44.00	66.00	27.38
46	46.00	69.00	28.62
48	48.00	72.00	29.88

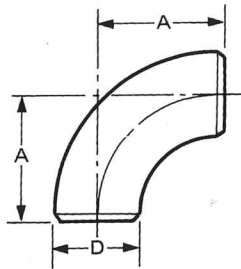
**NOTES:**

- (1) In accordance with MSS SP-43, A and B dimensions of (1.12in.) and (0.44in.) respectively may be furnished for NPS 3/4 at the manufacturer's option.
- (2) Dimensions for MSS SP-43 cover NPS 1/2 through NPS 24.

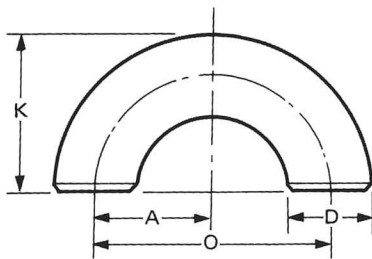
# DIMENSIONS OF SHORT RADIUS ELBOW AND RETURN

## ASME B16.9 • ASME B16.28

Dimensions in inches



**SHORT RADIUS  
ELBOW**



**SHORT RADIUS  
180 deg. RETURNS**

Nominal Pipe Size	Outside Diameter at Bevel D	Center-to-End A (1)	Center-to-Center O	Back-to-Face K
1	1.32	1.00	2.00	1.62
1 <sup>1</sup> / <sub>4</sub>	1.66	1.25	2.50	2.06
1 <sup>1</sup> / <sub>2</sub>	1.90	1.50	3.00	2.44
2	2.38	2.00	4.00	3.19
2 <sup>1</sup> / <sub>2</sub>	2.88	2.50	5.00	3.94
3	3.50	3.00	6.00	4.75
3 <sup>1</sup> / <sub>2</sub> (2)	4.00	3.40 (3.50)	7.00	5.50
4	4.50	4.00	8.00	6.25
5	5.56	5.00	10.00	7.75
6	6.62	6.00	12.00	9.31
8	8.62	8.00	16.00	12.31
10	10.75	10.00	20.00	15.38
12	12.75	12.00	24.00	18.38
14	14.00	14.00	28.00	21.00
16	16.00	16.00	32.00	24.00
18	18.00	18.00	36.00	27.00
20	20.00	20.00	40.00	30.00
22	22.00	22.00	44.00	33.00
24	24.00	24.00	48.00	36.00

**NOTES:**

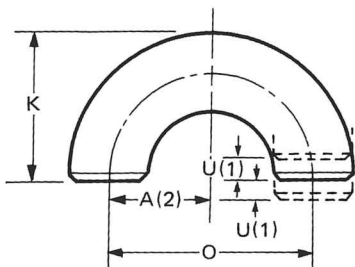
(1) Dimension A is equal to one-half of dimension O.

(2) In accordance with ASME B16.28, dimension A of (3.50in.) may be furnished for NPS 3<sup>1</sup>/<sub>2</sub>.

# DIMENSIONS OF LONG RADIUS RETURN

## ASME B16.9 • MSS SP-43

Dimensions in inches



**NOTES:**

(1) Tolerance for alignment of ends U for NPS 8 and smaller is  $\pm 0.03$ in. and for NPS 10 and larger  $\pm 0.06$ in.

(2) Dimension A is equal to one-half of dimension O.

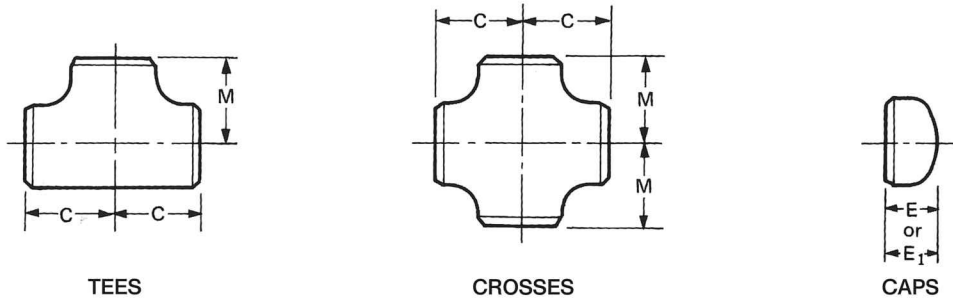
(3) In accordance with MSS SP-43, O and K dimensions of (2.25in.) and (1.69in.) respectively, may be furnished for NPS 3<sup>1</sup>/<sub>4</sub> at the manufacturer's option.

(4) Dimensions for NPS 22 are not specified in MSS SP-43.

Nominal Pipe Size	Outside Diameter at Bevel	Center-to-Center O	Back-to-Face (3) K
1/2	0.84	3.00	1.88
3/4 (3)	1.05	3.00 (2.25)	2.00 (1.69)
1	1.32	3.00	2.19
1 <sup>1</sup> / <sub>4</sub>	1.66	3.75	2.75
1 <sup>1</sup> / <sub>2</sub>	1.90	4.50	3.25
2	2.38	6.00	4.19
2 <sup>1</sup> / <sub>2</sub>	2.88	7.50	5.19
3	3.50	9.00	6.25
3 <sup>1</sup> / <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
22 (4)	22.00	66.00	44.00
24	24.00	72.00	48.00

# DIMENSIONS OF STRAIGHT TEES, CROSSES AND CAP

ASME B16.9•MSS SP-43



Dimensions in inches

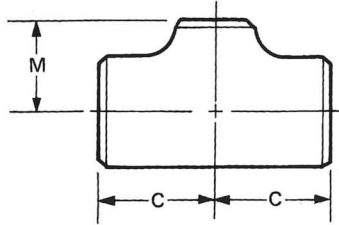
Nominal Pipe Size (NPS)	Outside Diameter at Bevel D	Center-to-End		Length (3) E	Limiting Wall Thickness for Length E	Length (4) E <sub>1</sub>
		Run C	Outlet (1), (2) M			
1/2	0.84	1.00	1.00	1.00	0.18	1.00
3/4	1.05	1.12	1.12	1.00	0.15	1.00
1	1.32	1.50	1.50	1.50	0.18	1.50
1 1/4	1.66	1.88	1.88	1.50	0.19	1.50
1 1/2	1.90	2.25	2.25	1.50	0.20	1.50
2	2.38	2.50	2.50	1.50	0.22	1.75
2 1/2	2.88	3.00	3.00	1.50	0.28	2.00
3	3.50	3.38	3.38	2.00	0.30	2.50
3 1/2	4.00	3.75	3.75	2.50	0.32	3.00
4	4.50	4.12	4.12	2.50	0.34	3.00
5	5.56	4.88	4.88	3.00	0.38	3.50
6	6.62	5.62	5.62	3.50	0.43	4.00
8	8.62	7.00	7.00	4.00	0.50	5.00
10	10.75	8.50	8.50	5.00	0.50	6.00
12	12.75	10.00	10.00	6.00	0.50	7.00
14	14.00	11.00	11.00	6.50	0.50	7.50
16	16.00	12.00	12.00	7.00	0.50	8.00
18	18.00	13.50	13.50	8.00	0.50	9.00
20	20.00	15.00	15.00	9.00	0.50	10.00
22	22.00	16.50	16.50	10.00	0.50	10.00
24	24.00	17.00	17.00	10.50	0.50	12.00
26	26.00	19.50	19.50	10.50	...	...
28	28.00	20.50	20.50	10.50	...	...
30	30.00	22.00	22.00	10.50	...	...
32	32.00	23.50	23.50	10.50	...	...
34	34.00	25.00	25.00	10.50	...	...
36	36.00	26.50	26.50	10.50	...	...
38	38.00	28.00	28.00	12.00	...	...
40	40.00	29.50	29.50	12.00	...	...
42	42.00	30.00	28.00	12.00	...	...
44	44.00	32.00	30.00	13.50	...	...
46	46.00	33.50	31.50	13.50	...	...
48	48.00	35.00	33.00	13.50	...	...

**NOTES:**

- (1) Outlet dimension M for NPS 26 and larger is recommended but not required.
- (2) Dimensions applicable to crosses NPS 24 and smaller.
- (3) Length E applies for thickness not exceeding that given in column "Limiting Wall Thickness for Length E."
- (4) Length E<sub>1</sub> applies for thickness greater than that given in column "Limiting Wall Thickness" for NPS 24 and smaller. For NPS 26 and larger, length E<sub>1</sub> shall be by agreement between the manufacturer and purchaser. Length E<sub>1</sub> is not specified in MSS SP-43.
- (5) Dimensions applicable to cap in MSS SP-43 are NPS 24 and smaller with the exception of NPS 22.
- (6) The shape of these caps shall be ellipsoidal and shall conform to the sharp requirements as given in the ASME Boiler and Pressure Vessel Code.

# DIMENSIONS OF REDUCING OUTLET TEES

ASME B16.9 • MSS SP-43

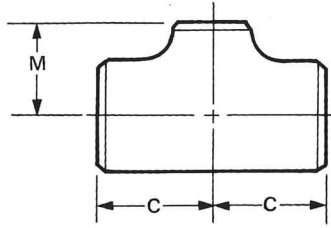


Dimensions in inches

Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		Center-to-End		Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		Center-to-End	
	Run	Outlet	Run C	Outlet (1) M		Run	Outlet	Run C	Outlet (1) M
1/2x1/2x3/8	0.84	0.68	1.00	1.00	6x6x5	6.62	5.56	5.62	5.38
1/2x1/2x1/4	0.84	0.54	1.00	1.00	6x6x4	6.62	4.50	5.62	5.12
3/4x3/4x1/2	1.05	0.84	1.12	1.12	6x6x3 1/2	6.62	4.00	5.62	5.00
3/4x3/4x3/8	1.05	0.68	1.12	1.12	6x6x3	6.62	3.50	5.62	4.88
1x1x3/4	1.32	1.05	1.50	1.50	6x6x2 1/2	6.62	2.88	5.62	4.75
1x1x1/2	1.32	0.84	1.50	1.50	8x8x6	8.62	6.62	7.00	6.62
1 1/4x1 1/4x1	1.66	1.32	1.88	1.88	8x8x5	8.62	5.56	7.00	6.38
1 1/4x1 1/4x3/4	1.66	1.05	1.88	1.88	8x8x4	8.62	4.50	7.00	6.12
1 1/4x1 1/4x1/2	1.66	0.84	1.88	1.88	8x8x3 1/2	8.62	4.00	7.00	6.00
1 1/2x1 1/2x1 1/4	1.90	1.66	2.25	2.25	10x10x8	10.75	8.62	8.50	8.00
1 1/2x1 1/2x1	1.90	1.32	2.25	2.25	10x10x6	10.75	6.62	8.50	7.62
1 1/2x1 1/2x3/4	1.90	1.05	2.25	2.25	10x10x5	10.75	5.56	8.50	7.50
1 1/2x1 1/2x1/2	1.90	0.84	2.25	2.25	10x10x4	10.75	4.50	8.50	7.25
2x2x1 1/2	2.38	1.90	2.50	2.38	12x12x10	12.75	10.75	10.00	9.50
2x2x1 1/4	2.38	1.66	2.50	2.25	12x12x8	12.75	8.62	10.00	9.00
2x2x1	2.38	1.32	2.50	2.00	12x12x6	12.75	6.62	10.00	8.62
2x2x3/4	2.38	1.05	2.50	1.75	12x12x5	12.75	5.56	10.00	8.50
2 1/2x2 1/2x2	2.88	2.38	3.00	2.75	14x14x12	14.00	12.75	11.00	10.62
2 1/2x2 1/2x1 1/2	2.88	1.90	3.00	2.62	14x14x10	14.00	10.75	11.00	10.12
2 1/2x2 1/2x1 1/4	2.88	1.66	3.00	2.50	14x14x8	14.00	8.62	11.00	9.75
2 1/2x2 1/2x1	2.88	1.32	3.00	2.25	14x14x6	14.00	6.62	11.00	9.38
3x3x2 1/2	3.50	2.88	3.38	3.25	16x16x14	16.00	14.00	12.00	12.00
3x3x2	3.50	2.38	3.38	3.00	16x16x12	16.00	12.75	12.00	11.62
3x3x1 1/2	3.50	1.90	3.38	2.88	16x16x10	16.00	10.75	12.00	11.12
3x3x1 1/4	3.50	1.66	3.38	2.75	16x16x8	16.00	8.62	12.00	10.75
3 1/2x3 1/2x3	4.00	3.50	3.75	3.62	16x16x6	16.00	6.62	12.00	10.38
3 1/2x3 1/2x2 1/2	4.00	2.88	3.75	3.50	18x18x16	18.00	16.00	13.50	13.00
3 1/2x3 1/2x2	4.00	2.38	3.75	3.25	18x18x14	18.00	14.00	13.50	13.00
3 1/2x3 1/2x1 1/2	4.00	1.90	3.75	3.12	18x18x12	18.00	12.75	13.50	12.62
4x4x3 1/2	4.50	4.00	4.12	4.00	18x18x10	18.00	10.75	13.50	12.12
4x4x3	4.50	3.50	4.12	3.88	18x18x8	18.00	8.62	13.50	11.75
4x4x2 1/2	4.50	2.88	4.12	3.75	20x20x18	20.00	18.00	15.00	14.50
4x4x2	4.50	2.38	4.12	3.50	20x20x16	20.00	16.00	15.00	14.00
4x4x1 1/2	4.50	1.90	4.12	3.38	20x20x14	20.00	14.00	15.00	14.00
5x5x4	5.56	4.50	4.88	4.62	20x20x12	20.00	12.75	15.00	13.62
5x5x3 1/2	5.56	4.00	4.88	4.50	20x20x10	20.00	10.75	15.00	13.12
5x5x3	5.56	3.50	4.88	4.38	20x20x8	20.00	8.62	15.00	12.75
5x5x2 1/2	5.56	2.88	4.88	4.25	22x22x20	22.00	20.00	16.50	16.00
5x5x2	5.56	2.38	4.88	4.12	22x22x18	22.00	18.00	16.50	15.50

# DIMENSIONS OF REDUCING OUTLET TEES

ASME B16.9-MSS SP-43



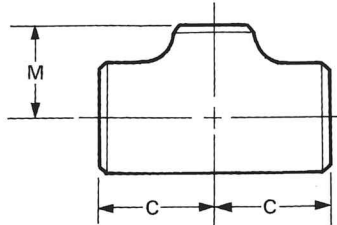
Dimensions in inches

Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		Center-to-End		Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		Center-to-End	
	Run	Outlet	Run C	Outlet (1) M		Run	Outlet	Run C	Outlet (1) M
22×22×16	22.00	16.00	16.50	15.00	34×34×24	34.00	24.00	25.00	23.00
22×22×14	22.00	14.00	16.50	15.00	34×34×22	34.00	22.00	25.00	22.50
22×22×12	22.00	12.75	16.50	14.62	34×34×20	34.00	20.00	25.00	22.00
22×22×10	22.00	10.75	16.50	14.12	34×34×18	34.00	18.00	25.00	21.50
24×24×22	24.00	22.00	17.00	17.00	34×34×16	34.00	16.00	25.00	21.00
24×24×20	24.00	20.00	17.00	17.00	36×36×34	36.00	34.00	26.50	26.00
24×24×18	24.00	18.00	17.00	16.50	36×36×32	36.00	32.00	26.50	25.50
24×24×16	24.00	16.00	17.00	16.00	36×36×30	36.00	30.00	26.50	25.00
24×24×14	24.00	14.00	17.00	16.00	36×36×28	36.00	28.00	26.50	24.50
24×24×12	24.00	12.75	17.00	15.62	36×36×26	36.00	26.00	26.50	24.50
24×24×10	24.00	10.75	17.00	15.12	36×36×24	36.00	24.00	26.50	24.00
26×26×24	26.00	24.00	19.50	19.00	36×36×22	36.00	22.00	26.50	23.50
26×26×22	26.00	22.00	19.50	18.50	36×36×20	36.00	20.00	26.50	23.00
26×26×20	26.00	20.00	19.50	18.00	36×36×18	36.00	18.00	26.50	22.50
26×26×18	26.00	18.00	19.50	17.50	36×36×16	36.00	16.00	26.50	22.00
26×26×16	26.00	16.00	19.50	17.00	38×38×36	38.00	36.00	28.00	28.00
26×26×14	26.00	14.00	19.50	17.00	38×38×34	38.00	34.00	28.00	27.50
26×26×12	26.00	12.75	19.50	16.62	38×38×32	38.00	32.00	28.00	27.00
28×28×26	28.00	26.00	20.50	20.50	38×38×30	38.00	30.00	28.00	26.50
28×28×24	28.00	24.00	20.50	20.00	38×38×28	38.00	28.00	28.00	25.50
28×28×22	28.00	22.00	20.50	19.50	38×38×26	38.00	26.00	28.00	25.50
28×28×20	28.00	20.00	20.50	19.00	38×38×24	38.00	24.00	28.00	25.00
28×28×18	28.00	18.00	20.50	18.50	38×38×22	38.00	22.00	28.00	24.50
28×28×16	28.00	16.00	20.50	18.00	38×38×20	38.00	20.00	28.00	24.00
28×28×14	28.00	14.00	20.50	18.00	38×38×18	38.00	18.00	28.00	23.50
28×28×12	28.00	12.75	20.50	17.62	40×40×38	40.00	38.00	29.50	29.50
30×30×28	30.00	28.00	22.00	21.50	40×40×36	40.00	36.00	29.50	29.00
30×30×26	30.00	26.00	22.00	21.50	40×40×34	40.00	34.00	29.50	28.50
30×30×24	30.00	24.00	22.00	21.00	40×40×32	40.00	32.00	29.50	28.00
30×30×22	30.00	22.00	22.00	20.50	40×40×30	40.00	30.00	29.50	27.50
30×30×20	30.00	20.00	22.00	20.00	40×40×28	40.00	28.00	29.50	26.50
30×30×18	30.00	18.00	22.00	19.50	40×40×26	40.00	26.00	29.50	26.50
30×30×16	30.00	16.00	22.00	19.00	40×40×24	40.00	24.00	29.50	26.00
30×30×14	30.00	14.00	22.00	19.00	40×40×22	40.00	22.00	29.50	25.50
30×30×12	30.00	12.75	22.00	18.62	40×40×20	40.00	20.00	29.50	25.00
30×30×10	30.00	10.75	22.00	18.12	40×40×18	40.00	18.00	29.50	24.50
32×32×30	32.00	30.00	23.50	23.00	42×42×40	42.00	40.00	30.00	28.00
32×32×28	32.00	28.00	23.50	22.50	42×42×38	42.00	38.00	30.00	28.00
32×32×26	32.00	26.00	23.50	22.50	42×42×36	42.00	36.00	30.00	28.00
32×32×24	32.00	24.00	23.50	22.00	42×42×34	42.00	34.00	30.00	28.00
32×32×22	32.00	22.00	23.50	21.50	42×42×32	42.00	32.00	30.00	28.00
32×32×20	32.00	20.00	23.50	21.00	42×42×30	42.00	30.00	30.00	28.00
32×32×18	32.00	18.00	23.50	20.50	42×42×28	42.00	28.00	30.00	27.50
32×32×16	32.00	16.00	23.50	20.00	42×42×26	42.00	26.00	30.00	27.50
32×32×14	32.00	14.00	23.50	20.00	42×42×24	42.00	24.00	30.00	26.00
34×34×32	34.00	32.00	25.00	24.50	42×42×22	42.00	22.00	30.00	26.00
34×34×30	34.00	30.00	25.00	24.00	42×42×20	42.00	20.00	30.00	26.00
34×34×28	34.00	28.00	25.00	23.50	42×42×18	42.00	18.00	30.00	25.50
34×34×26	34.00	26.00	25.00	23.50	42×42×16	42.00	16.00	30.00	25.00



# DIMENSIONS OF REDUCING OUTLET TEES

**ASME B16.9 • MSS SP-43**



Dimensions in inches

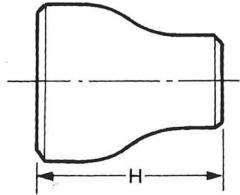
Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		Center-to-End	
	Run	Outlet	Run C	Outlet (1) M
44×44×42	44.00	42.00	32.00	30.00
44×44×40	44.00	40.00	32.00	29.50
44×44×38	44.00	38.00	32.00	29.00
44×44×36	44.00	36.00	32.00	28.50
44×44×34	44.00	34.00	32.00	28.50
44×44×32	44.00	32.00	32.00	28.00
44×44×30	44.00	30.00	32.00	28.00
44×44×28	44.00	28.00	32.00	27.50
44×44×26	44.00	26.00	32.00	27.50
44×44×24	44.00	24.00	32.00	27.50
44×44×22	44.00	22.00	32.00	27.00
44×44×20	44.00	20.00	32.00	27.00
46×46×44	46.00	44.00	33.50	31.50
46×46×42	46.00	42.00	33.50	31.00
46×46×40	46.00	40.00	33.50	30.50
46×46×38	46.00	38.00	33.50	30.00
46×46×36	46.00	36.00	33.50	30.00
46×46×34	46.00	34.00	33.50	29.50
46×46×32	46.00	32.00	33.50	29.50
46×46×30	46.00	30.00	33.50	29.00
46×46×28	46.00	28.00	33.50	29.00
46×46×26	46.00	26.00	33.50	29.00
46×46×24	46.00	24.00	33.50	28.50
46×46×22	46.00	22.00	33.50	28.50
48×48×46	48.00	46.00	35.00	33.00
48×48×44	48.00	44.00	35.00	33.00
48×48×42	48.00	42.00	35.00	32.00
48×48×40	48.00	40.00	35.00	32.00
48×48×38	48.00	38.00	35.00	32.00
48×48×36	48.00	36.00	35.00	31.00
48×48×34	48.00	34.00	35.00	31.00
48×48×32	48.00	32.00	35.00	31.00
48×48×30	48.00	30.00	35.00	30.00
48×48×28	48.00	28.00	35.00	30.00
48×48×26	48.00	26.00	35.00	30.00
48×48×24	48.00	24.00	35.00	29.00
48×48×22	48.00	22.00	35.00	29.00

**NOTES:**

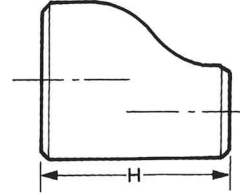
- (1) Outlet dimension M for run size 14 and large is recommended but not required..
- (2) Regarding Outside Diameter at Bevel D, run size 24" and smaller are stated in MSS SP-43.
- (3) Dimensions for NPS 22 are not specified in MSS SP-43.

# DIMENSIONS OF REDUCERS

ASME B16.9·MSS SP-43



CONCENTRIC REDUCERS



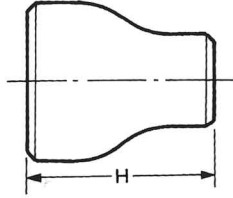
ECCENTRIC REDUCERS

Dimensions in inches

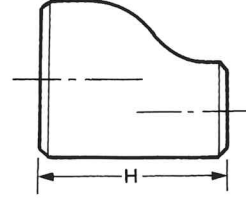
Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		End-to-End H	Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		End-to-End H
	Large End	Small End			Large End	Small End	
3/4×1/2	1.05	0.84	1.50	6×5	6.62	5.56	5.50
3/4×3/8	1.05	0.68	1.50	6×4	6.62	4.50	5.50
1×3/4	1.32	1.05	2.00	6×3 1/2	6.62	4.00	5.50
1×1/2	1.32	0.84	2.00	6×3	6.62	3.50	5.50
1×3/8	1.32	0.68	2.00	6×2 1/2	6.62	2.88	5.50
1 1/4×1	1.66	1.32	2.00	8×6	8.62	6.62	6.00
1 1/4×3/4	1.66	1.05	2.00	8×5	8.62	5.56	6.00
1 1/4×1/2	1.66	0.84	2.00	8×4	8.62	4.50	6.00
1 1/2×1 1/4	1.90	1.66	2.50	8×3 1/2	8.62	4.00	6.00
1 1/2×1	1.90	1.32	2.50	10×8	10.75	8.62	7.00
1 1/2×3/4	1.90	1.05	2.50	10×6	10.75	6.62	7.00
1 1/2×1/2	1.90	0.84	2.50	10×5	10.75	5.56	7.00
2×1 1/2	2.38	1.90	3.00	10×4	10.75	4.50	7.00
2×1 1/4	2.38	1.66	3.00	12×10	12.75	10.75	8.00
2×1	2.38	1.32	3.00	12×8	12.75	8.62	8.00
2×3/4	2.38	1.05	3.00	12×6	12.75	6.62	8.00
2 1/2×2	2.88	2.38	3.50	12×5	12.75	5.56	8.00
2 1/2×1 1/2	2.88	1.90	3.50	14×12	14.00	12.75	13.00
2 1/2×1 1/4	2.88	1.66	3.50	14×10	14.00	10.75	13.00
2 1/2×1	2.88	1.32	3.50	14×8	14.00	8.62	13.00
3×2 1/2	3.50	2.88	3.50	14×6	14.00	6.62	13.00
3×2	3.50	2.38	3.50	16×14	16.00	14.00	14.00
3×1 1/2	3.50	1.90	3.50	16×12	16.00	12.75	14.00
3×1 1/4	3.50	1.66	3.50	16×10	16.00	10.75	14.00
3 1/2×3	4.00	3.50	4.00	16×8	16.00	8.62	14.00
3 1/2×2 1/2	4.00	2.88	4.00	18×16	18.00	16.00	15.00
3 1/2×2	4.00	2.38	4.00	18×14	18.00	14.00	15.00
3 1/2×1 1/2	4.00	1.90	4.00	18×12	18.00	12.75	15.00
3 1/2×1 1/4	4.00	1.66	4.00	18×10	18.00	10.75	15.00
4×3 1/2	4.50	4.00	4.00	20×18	20.00	18.00	20.00
4×3	4.50	3.50	4.00	20×16	20.00	16.00	20.00
4×2 1/2	4.50	2.88	4.00	20×14	20.00	14.00	20.00
4×2	4.50	2.38	4.00	20×12	20.00	12.75	20.00
4×1 1/2	4.50	1.90	4.00	22×20	22.00	20.00	20.00
5×4	5.56	4.50	5.00	22×18	22.00	18.00	20.00
5×3 1/2	5.56	4.00	5.00	22×16	22.00	16.00	20.00
5×3	5.56	3.50	5.00	22×14	22.00	14.00	20.00
5×2 1/2	5.56	2.88	5.00				
5×2	5.56	2.38	5.00				

# DIMENSIONS OF REDUCERS

## ASME B16.9 • MSS SP-43



CONCENTRIC REDUCERS



ECCENTRIC REDUCERS

Dimensions in inches

Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		End-to-End H	Nominal Pipe Size (NPS)	Outside Diameter at Bevel D		End-to-End H
	Large End	Small End			Large End	Small End	
24×22	24.00	22.00	20.00	38×36	38.00	36.00	24.00
24×20	24.00	20.00	20.00	38×34	38.00	34.00	24.00
24×18	24.00	18.00	20.00	38×32	38.00	32.00	24.00
24×16	24.00	16.00	20.00	38×30	38.00	30.00	24.00
26×24	26.00	24.00	24.00	38×28	38.00	28.00	24.00
26×22	26.00	22.00	24.00	38×26	38.00	26.00	24.00
26×20	26.00	20.00	24.00	40×38	40.00	38.00	24.00
26×18	26.00	18.00	24.00	40×36	40.00	36.00	24.00
28×26	28.00	26.00	24.00	40×34	40.00	34.00	24.00
28×24	28.00	24.00	24.00	40×32	40.00	32.00	24.00
28×20	28.00	20.00	24.00	40×30	40.00	30.00	24.00
28×18	28.00	18.00	24.00	42×40	42.00	40.00	24.00
30×28	30.00	28.00	24.00	42×38	42.00	38.00	24.00
30×26	30.00	26.00	24.00	42×36	42.00	36.00	24.00
30×24	30.00	24.00	24.00	42×34	42.00	34.00	24.00
30×20	30.00	20.00	24.00	42×32	42.00	32.00	24.00
32×30	32.00	30.00	24.00	42×30	42.00	30.00	24.00
32×28	32.00	28.00	24.00	44×42	44.00	42.00	24.00
32×26	32.00	26.00	24.00	44×40	44.00	40.00	24.00
32×24	32.00	24.00	24.00	44×38	44.00	38.00	24.00
34×32	34.00	32.00	24.00	44×36	44.00	36.00	24.00
34×30	34.00	30.00	24.00	46×44	46.00	44.00	28.00
34×26	34.00	26.00	24.00	46×42	46.00	42.00	28.00
34×24	34.00	24.00	24.00	46×40	46.00	40.00	28.00
36×34	36.00	34.00	24.00	46×38	46.00	38.00	28.00
36×32	36.00	32.00	24.00	48×46	48.00	46.00	28.00
36×30	36.00	30.00	24.00	48×44	48.00	44.00	28.00
36×26	36.00	26.00	24.00	48×42	48.00	42.00	28.00
36×24	36.00	24.00	24.00	48×40	48.00	40.00	28.00

**NOTES:**

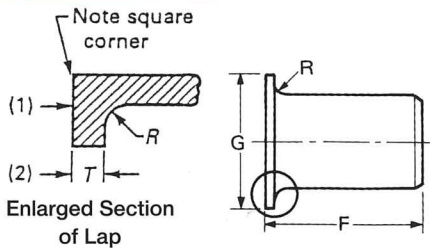
- (1) While the figure illustrates a "bell shaped" reducer, the use of conical reducer is not prohibited.
- (2) Dimensions applicable to the large end in MSS SP-43 are NPS 24 and smaller.
- (3) Dimensions for NPS 22 are not specified in MSS SP-43.
- (4) Dimensions for NPS 1<sup>3</sup>/<sub>8</sub> are not specified in ASME B16.9.

# DIMENSIONS OF LAP-JOINT STUB ENDS

## ASME B16.9

Dimensions in inches

### ASME STANDARD



**NOTES:**

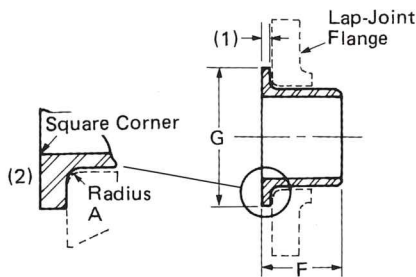
- (1) Gasket face finish shall be in accordance with ASME B16.5 for raised face flanges.
- (2) The lap thickness T shall not be less than nominal pipe wall thickness.
- (3) When short pattern stub ends are used with large flanges in Classes 300 and 600, and with most sizes in Classes 900 and higher, and when long pattern stub ends are used with larger flanges in Classes 1500 and 2500, it may be necessary to increase the length of the stub ends in order to avoid covering the weld with the flange. Such increases in length shall be a matter of agreement between the manufacturer and the purchaser.
- (4) When special facings such as tongue and groove, male and female, etc., are employed, additional lap thickness must be provided and such additional thickness shall be in addition to (not included in) the basic length F.
- (5) These dimensions conform to the radius established for lap joint flanges in ASME B16.5, Pipe Flanges and Flanged Fittings.
- (6) This dimension conforms to standard machine facings shown in ASME B16.5. The back face of the lap shall be machined to conform to the surface on which it seats. Where ring joint facings are to be applied, use dimension K as given in ASME B16.5.

Nominal Pipe Size (NPS)	Outside Diameter of Barrel		Long Pattern Length	Short Pattern Length	Radius of Fillet	Diameter of Lap
	Max.	Min.	F (3), (4)	F (3), (4)	R (5)	G (6)
1/2	0.896	0.809	3.00	2.00	0.12	1.38
3/4	1.106	1.019	3.00	2.00	0.12	1.38
1	1.376	1.284	4.00	2.00	0.12	2.00
1 1/4	1.716	1.629	4.00	2.00	0.19	2.50
1 1/2	1.965	1.896	4.00	2.00	0.25	2.88
2	2.456	2.344	6.00	2.50	0.31	3.62
2 1/2	2.966	2.844	6.00	2.50	0.31	4.12
3	3.596	3.469	6.00	2.50	0.38	5.00
3 1/2	4.096	3.969	6.00	3.00	0.38	5.50
4	4.593	4.469	6.00	3.00	0.44	5.19
5	5.683	5.532	8.00	3.00	0.44	7.31
6	6.743	6.594	8.00	3.50	0.50	8.50
8	8.743	8.594	8.00	4.00	0.50	10.62
10	10.913	10.719	10.00	5.00	0.50	12.75
12	12.913	12.719	10.00	6.00	0.50	15.00
14	14.170	13.969	12.00	6.00	0.50	16.25
16	16.180	15.969	12.00	6.00	0.50	18.50
18	18.190	17.969	12.00	6.00	0.50	21.00
20	20.240	19.969	12.00	6.00	0.50	23.00
22	22.240	21.969	12.00	6.00	0.50	25.25
24	24.240	23.969	12.00	6.00	0.50	27.25

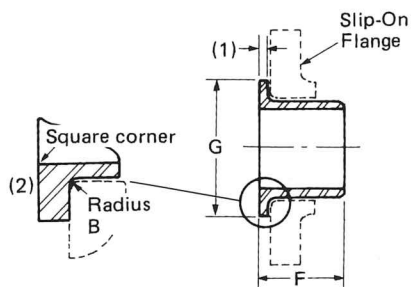
## MSS SP-43

Dimensions in inches

### MSS STANDARD



**TYPE A FOR LAP-JOINT FLANGES**



**TYPE B FOR SLIP-ON FLANGES**

**NOTES:**

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

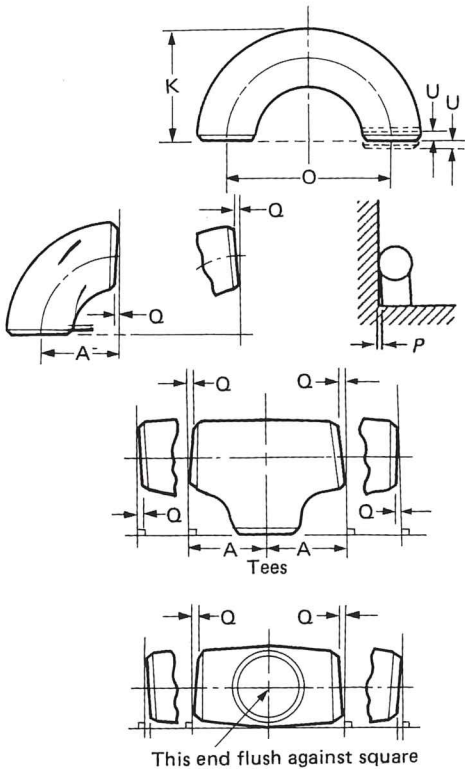
Nominal Pipe Size (NPS)	Nominal O.D. at Bevel	Lap-Joint Stub Ends (3)			
		Length F	Dia. of Lap Nominal & Maximum G	Radius of Fillet	
				Nominal & Max. A	Max. B
1/2	0.84	2.00	1.38	0.12	0.03
3/4	1.05	2.00	1.69	0.12	0.03
1	1.32	2.00	2.00	0.12	0.03
1 1/4	1.66	2.00	2.50	0.19	0.03
1 1/2	1.90	2.00	2.88	0.25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

# DIMENSIONAL TOLERANCES

## ASME B16.9 • ASME B16.28 • MSS SP-43

Dimensions in inches

Nominal Pipe Size (NPS)	All Fittings		Inside Diameter at End (1), (2)	Wall thickness t	90° Elbows 45° Elbows Tees	Reducers Lap Joint Stub Ends	Cap	180° Returns		
	Outside Diameter at Bevel (1)				Center-to-End Dimension	Overall Length	Overall Length	Center-to-Center Dimension	Back-to-Face Dimension	Alignment of Ends
	ASME	MSS			A, B, C, M	F, H	E	O	K	U
1/2 to 2 1/2	+0.06 -0.03	±0.03	±0.03	Not less than 87.5% of nominal thick- ness	±0.06	±0.06	±0.12	±0.25	±0.25	±0.03
3 to 3 1/2	±0.06	±0.03	±0.06		±0.06	±0.06	±0.12	±0.25	±0.25	±0.03
4	±0.06	±0.03	±0.06		±0.06	±0.06	±0.12	±0.25	±0.25	±0.03
5 to 8	+0.09 -0.06	+0.06 -0.03	±0.06		±0.06	±0.06	±0.25	±0.25	±0.25	±0.03
10 to 18	+0.16 -0.12	+0.09 -0.03	±0.12		±0.09	±0.09	±0.25	±0.38	±0.25	±0.06
20 to 24	+0.25 -0.19	+0.12 -0.03	±0.19		±0.09	±0.09	±0.25	±0.38	±0.25	±0.06
26 to 30	+0.25 -0.19	...	±0.19		±0.12	±0.19	±0.38	...	...	...
32 to 48	+0.25 -0.19	...	±0.19	±0.19	±0.19	±0.38	...	...	...	



Nominal Pipe Size (NPS)	Angularity Tolerances	
	Off Angle	Off Plane
	Q	P
1/2 to 4	±0.03	±0.06
5 to 8	±0.06	±0.12
10 to 12	±0.09	±0.19
14 to 16	±0.09	±0.25
18 to 24	±0.12	±0.38
26 to 30	±0.19	±0.38
32 to 42	±0.19	±0.50
44 to 48	±0.19	±0.75

Nominal Pipe Size (NPS)	Lap Joint Stub Ends				
	Outside Diameter of Lap		Fillet Radius of Lap		Lap Thickness T
	ASME	MSS	ASME	MSS	
	G	R	A	T	
1/2 to 2 1/2	+0	+0 -0.03	+0	+0 -0.03	+0.06 -0
3 to 3 1/2	+0 -0.03	+0 -0.03	+0 -0.03	+0 -0.03	+0.06 -0
4	+0 -0.03	+0 -0.03	+0 -0.06	+0 -0.06	+0.06 -0
5 to 8	+0 -0.03	+0 -0.03	+0 -0.06	+0 -0.06	+0.06 -0
10 to 18	+0 -0.06	+0 -0.06	+0 -0.06	+0 -0.06	+0.12 -0
20 to 24	+0 -0.06	+0 -0.06	+0 -0.06	+0 -0.06	+0.12 -0

**NOTES:**

- (1) Out-of-round is the sum of absolute values of plus and minus tolerance.
- (2) Unless otherwise specified, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wall thickness.
- (3) The standard ASME B16.28 covers nominal pipe sizes 1/2 through 24.
- (4) The standard MSS SP-43 covers nominal pipe sizes 1/2 through 24.

## WELDING BEVEL

