



# Butt weld pipe fittings

*Butt weld pipe fittings allow for changing the direction of flow, reducing pipe sizes and attaching auxiliary equipment.*

A butt weld fitting is a weldable pipe fitting that allows for change of direction of flow, to branch off, reduce pipe size or attach auxiliary equipment. Forged Steel butt weld fittings are manufactured in accordance with ANSI / ASME B16.9.

Butt weld fittings are available as elbows, tees, caps, reducers and out lets (olets). These fittings are the most common type of welded pipe fittings and are specified by nominal pipe size and pipe schedule. Butt weld fittings use seamless or welded pipe as the starting material and are formed (through multiple processes) to get the shape of elbows, tees and reducers etc. Just as the pipe is sold from Schedule 10 to Schedule 160, butt weld pipe fittings are

sold the same way. Welded butt weld fittings are more common in stainless steel due to cost advantage. SCH 10 fittings are also more common in stainless steel butt weld fittings.

Common material for butt weld fittings are A234 WPB (A & C also available), High Yield Carbon Steel, Stainless Steel 304 and 316 and Nickel Alloys.

Buttweld pipe fittings comprise of long radius elbow, concentric reducer, eccentric reducers and tees. They are an important part of industrial piping systems to change direction, branch off or to mechanically join equipment to the system. Buttweld fittings are sold in nominal pipe sizes with specified pipe schedule. BW fitting's dimensions and tolerances are defined as per ASME standard B16.9.

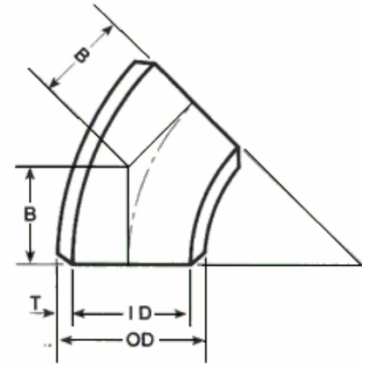
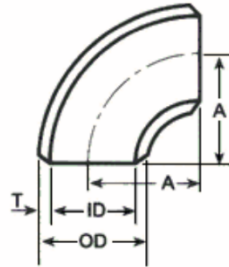
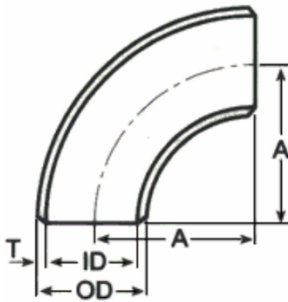


Some of the standards that apply to butt welded fittings are listed below. Many organizations such as ASME, ASTM, ISO, MSS, etc. have very well developed standards and specifications for butt welded fittings. It is always up to the designer to ensure that they are following the applicable standard and company specification, if available, during the design process.

- **Dimension:** ANSI B16.9, B16.25, B16.28, MSS SP-43, SP-48, SP-59
- **Material Spec.:** ASTM A403, A240, A312, A234 WPB
- **Material Grades:** 304, 304L, 316, 316L, CARBON STEEL

**90° ELBOW****45° ELBOW****180° ELBOW****EQUAL TEE****REDUCING TEE****CAP****CON. REDUCER****ECC. REDUCER****STUB END**

## Long and Short Radius 45°/ 90° Elbows



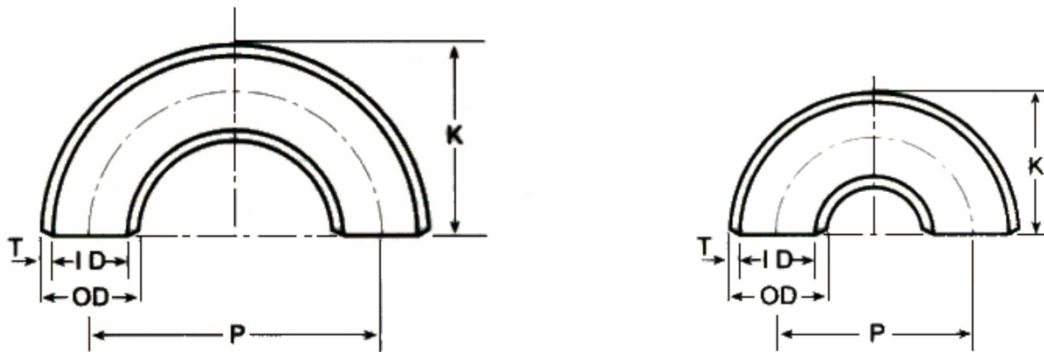
ANSI B16.9 B16.28 (in mm)  
\* Wellgrow's standard.

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>at Bevel<br>D | Center to End      |                |                     |                |
|-------------------------------|-----------------------------------|--------------------|----------------|---------------------|----------------|
|                               |                                   | Long Radius Elbows |                | Short Radius Elbows |                |
|                               |                                   | 90 degree.<br>A    | 45 degree<br>B | 90 degree<br>A      | 45 degree<br>B |
| 1/2                           | 21.3                              | 38.1               | 15.7           | -                   | -              |
| 3/4                           | 26.7                              | 38.1               | 19.1           | -                   | -              |
| 1                             | 33.4                              | 38.1               | 22.4           | 25.4                | -              |
| 1-1/4                         | 42.2                              | 47.8               | 25.4           | 31.8                | -              |
| 1-1/2                         | 48.3                              | 57.2               | 28.4           | 38.1                | -              |
| 2                             | 60.3                              | 76.2               | 35.1           | 50.8                | -              |
| 2-1/2                         | 73.0                              | 95.2               | 44.4           | 63.5                | -              |
| 3                             | 88.9                              | 114.3              | 50.8           | 76.2                | 31.6           |
| 3-1/2                         | 101.6                             | 133.4              | 57.2           | 88.9                | 36.8           |
| 4                             | 114.3                             | 152.4              | 63.5           | 101.6               | 42.1           |
| 5                             | 141.3                             | 190.5              | 79.2           | 127.0               | 52.6           |
| 6                             | 168.3                             | 228.6              | 95.2           | 152.4               | 63.4           |
| 8                             | 219.1                             | 304.8              | 127.0          | 203.2               | 84.2           |
| 10                            | 273.1                             | 381.0              | 158.8          | 254.0               | 105.2          |
| 12                            | 323.9                             | 457.2              | 190.5          | 304.8               | 126.3          |
| 14                            | 355.6                             | 533.4              | 222.2          | 355.6               | 147.3          |
| 16                            | 406.4                             | 609.6              | 254.0          | 406.4               | 168.3          |
| 18                            | 457.2                             | 685.8              | 285.8          | 457.2               | 189.4          |
| 20                            | 508.0                             | 762.0              | 317.5          | 508.0               | 210.4          |
| 22                            | 558.8                             | 838.2              | 342.9          | 558.8               | 231.5          |
| 24                            | 609.6                             | 914.4              | 381.0          | 609.6               | 252.5          |
| 26                            | 660.4                             | 990.6              | 406.4          | 660.4               | 273.5          |
| 28                            | 711.2                             | 1066.8             | 438.2          | 711.2               | 294.6          |
| 30                            | 762.0                             | 1143.0             | 469.9          | 762.0               | 315.6          |
| 32                            | 812.8                             | 1219.2             | 501.6          | 812.8               | 378.1          |
| 34                            | 863.6                             | 1295.4             | 533.4          | 863.6               | 357.7          |
| 36                            | 914.4                             | 1371.6             | 565.2          | 914.4               | 378.8          |
| 38                            | 965.2                             | 1447.8             | 599.9          | -                   | -              |
| 40                            | 1016.0                            | 1524.0             | 632.0          | 1016.0              | 420.8          |
| 42                            | 1066.8                            | 1600.2             | 660.4          | 1066.8              | 441.9          |
| 44                            | 1117.6                            | 1676.4             | 695.5          | 1117.6              | 462.9          |
| 46                            | 1168.4                            | 1752.6             | 726.9          | -                   | -              |
| 48                            | 1219.2                            | 1828.8             | 759.0          | 1219.2              | 505.0          |
| 52*                           | 1320.8                            | -                  | -              | 1320.8              | 547.1          |
| 54*                           | 1371.6                            | 2057.4             | 852.2          | 1371.6              | 568.1          |
| 56*                           | 1422.4                            | 2133.6             | 883.8          | 1422.4              | 589.2          |
| 60*                           | 1524.0                            | 2286.0             | 946.9          | 1524.0              | 631.3          |
| 66*                           | 1676.4                            | 2514.6             | 1041.6         | -                   | -              |
| 68*                           | 1727.0                            | 2591               | 1073           | 1727                | -              |
| 72*                           | 1829.0                            | 2743               | 1137           | 1829                | -              |
| 76*                           | 1930.0                            | 2896               | 1199           | 1930                | -              |
| 80                            | 2032.0                            | 3048               | 1263           | 2032                | -              |





## Long and Short Radius 180° Elbows

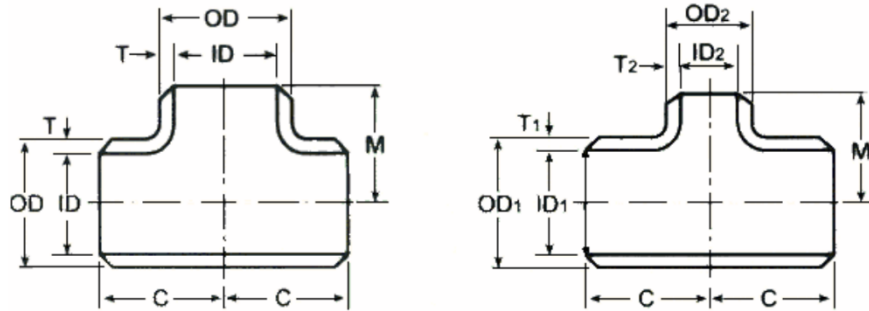


ANSI B16.9 B16.28 (in mm)

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel D | Long Radius Elbows  |                | Short Radius Elbows |                |
|-------------------------|-----------------------------|---------------------|----------------|---------------------|----------------|
|                         |                             | Center to Center. P | Back to Face K | Center to Center. P | Back to Face K |
| 1/2                     | 21.3                        | 76.2                | 47.8           | -                   | -              |
| 3/4                     | 26.7                        | 76.2                | 50.8           | -                   | -              |
| 1                       | 33.4                        | 76.2                | 55.6           | 50.8                | 41.1           |
| 1-1/4                   | 42.2                        | 95.2                | 69.8           | 63.5                | 52.3           |
| 1-1/2                   | 48.3                        | 114.3               | 82.6           | 76.2                | 62.0           |
| 2                       | 60.3                        | 152.4               | 106.4          | 101.6               | 81.0           |
| 2-1/2                   | 73.0                        | 109.5               | 131.8          | 127.0               | 100.1          |
| 3                       | 88.9                        | 228.6               | 158.8          | 152.4               | 120.7          |
| 3-1/2                   | 101.6                       | 266.7               | 184.2          | 177.8               | 139.7          |
| 4                       | 114.3                       | 304.8               | 209.6          | 203.2               | 158.8          |
| 5                       | 141.3                       | 381.0               | 261.9          | 254.0               | 196.9          |
| 6                       | 168.3                       | 457.2               | 312.7          | 304.8               | 236.5          |
| 8                       | 219.1                       | 609.6               | 414.3          | 406.4               | 312.7          |
| 10                      | 273.1                       | 762.0               | 517.7          | 508.0               | 390.7          |
| 12                      | 323.9                       | 914.4               | 619.3          | 609.6               | 466.9          |
| 14                      | 355.6                       | 1066.8              | 711.2          | 711.2               | 533.4          |
| 16                      | 406.4                       | 1219.2              | 812.8          | 812.8               | 609.6          |
| 18                      | 457.2                       | 1371.6              | 914.4          | 914.4               | 685.8          |
| 20                      | 508.0                       | 1524.0              | 1016.0         | 1016.0              | 762.0          |
| 22                      | 558.8                       | 1676.4              | 1117.6         | 1117.6              | 838.2          |
| 24                      | 609.6                       | 1828.8              | 1219.2         | 1219.2              | 914.4          |



## Equal and Reducing Tees


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

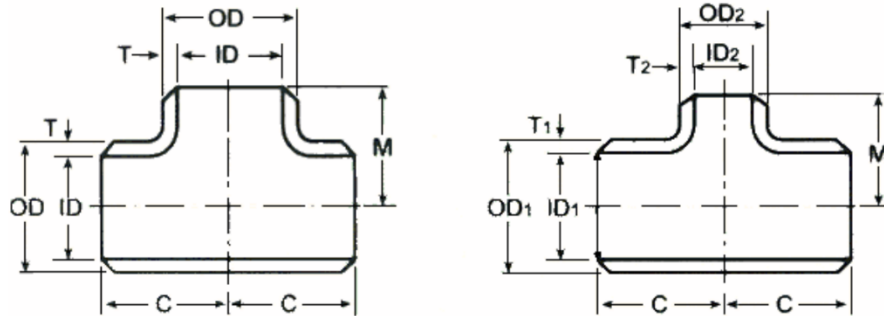
| Nominal Pipe Size (NPS) |   |       | Outside Diameter At Bevel D |        | Center to End |              |
|-------------------------|---|-------|-----------------------------|--------|---------------|--------------|
|                         |   |       | Run                         | Outlet | Run C         | Outlet (1) M |
| 1/2                     | x | 1/2   | 21.3                        | 21.3   | 25.4          | 25.4         |
| 1/2                     | x | 3/8   |                             | 17.1   |               | 25.4         |
| 1/2                     | x | 1/4   |                             | 13.7   |               | 25.4         |
| 3/4                     | x | 3/4   | 26.7                        | 26.7   | 28.4          | 28.4         |
| 3/4                     | x | 1/2   |                             | 21.3   |               | 28.4         |
| 3/4                     | x | 3/8   |                             | 17.1   |               | 28.4         |
| 1                       | x | 1     | 33.4                        | 33.4   | 38.1          | 38.1         |
| 1                       | x | 3/4   |                             | 26.7   |               | 38.1         |
| 1                       | x | 1/2   |                             | 21.3   |               | 38.1         |
| 1-1/4                   | x | 1-1/4 | 42.2                        | 42.2   | 47.8          | 47.8         |
| 1-1/4                   | x | 1     |                             | 33.4   |               | 47.8         |
| 1-1/4                   | x | 3/4   |                             | 26.7   |               | 47.8         |
| 1-1/4                   | x | 1/2   |                             | 21.3   |               | 47.8         |
| 1-1/2                   | x | 1-1/2 | 48.3                        | 48.3   | 57.2          | 57.2         |
| 1-1/2                   | x | 1-1/4 |                             | 42.2   |               | 57.2         |
| 1-1/2                   | x | 1     |                             | 33.4   |               | 57.2         |
| 1-1/2                   | x | 3/4   |                             | 26.7   |               | 57.2         |
| 1-1/2                   | x | 1/2   |                             | 21.3   |               | 57.2         |
| 2                       | x | 2     | 60.3                        | 60.3   | 63.5          | 63.5         |
| 2                       | x | 1-1/2 |                             | 48.3   |               | 60.5         |
| 2                       | x | 1-1/4 |                             | 42.2   |               | 57.2         |
| 2                       | x | 1     |                             | 33.4   |               | 50.8         |
| 2                       | x | 3/4   |                             | 26.7   |               | 44.4         |
| 2                       | x | 1/2*  |                             | 21.3   |               |              |
| 2-1/2                   | x | 2-1/2 | 73.0                        | 73.0   | 76.2          | 76.2         |
| 2-1/2                   | x | 2     |                             | 60.3   |               | 69.8         |
| 2-1/2                   | x | 1-1/2 |                             | 48.3   |               | 66.5         |
| 2-1/2                   | x | 1-1/4 |                             | 42.2   |               | 63.5         |
| 2-1/2                   | x | 1     |                             | 33.4   |               | 57.2         |
| 3                       | x | 3     | 88.9                        | 88.9   | 85.9          | 85.9         |
| 3                       | x | 2-1/2 |                             | 73.0   |               | 82.6         |
| 3                       | x | 2     |                             | 60.3   |               | 76.2         |
| 3                       | x | 1-1/2 |                             | 48.3   |               | 73.2         |
| 3                       | x | 1-1/4 |                             | 42.2   |               | 69.8         |
| 3                       | x | 1*    |                             | 33.4   |               |              |
| 3-1/2                   | x | 3-1/2 | 101.6                       | 101.6  | 95.2          | 95.2         |
| 3-1/2                   | x | 3     |                             | 88.9   |               | 91.9         |
| 3-1/2                   | x | 2-1/2 |                             | 73.0   |               | 88.9         |
| 3-1/2                   | x | 2     |                             | 60.3   |               | 82.6         |
| 3-1/2                   | x | 1-1/2 |                             | 48.3   |               | 79.2         |

| Nominal Pipe Size (NPS) |   |        | Outside Diameter At Bevel D |        | Center to End |              |
|-------------------------|---|--------|-----------------------------|--------|---------------|--------------|
|                         |   |        | Run                         | Outlet | Run C         | Outlet (1) M |
| 4                       | x | 4      | 114.3                       | 114.3  | 104.6         | 104.6        |
| 4                       | x | 3-1/2  |                             | 101.6  |               | 101.6        |
| 4                       | x | 3      |                             | 88.9   |               | 98.6         |
| 4                       | x | 2-1/2  |                             | 73.0   |               | 95.2         |
| 4                       | x | 2      |                             | 60.3   |               | 88.9         |
| 4                       | x | 1-1/2  |                             | 48.3   |               | 85.9         |
| 4                       | x | 1-1/4  |                             | 42.2   |               |              |
| 4                       | x | 1*     |                             | 33.5   |               |              |
| 5                       | x | 5      | 141.3                       | 141.3  | 124.0         | 124.0        |
| 5                       | x | 4      |                             | 114.3  |               | 117.3        |
| 5                       | x | 3-1/2  |                             | 101.6  |               | 114.3        |
| 5                       | x | 3      |                             | 88.9   |               | 111.3        |
| 5                       | x | 2-1/2  |                             | 73.0   |               | 108.0        |
| 5                       | x | 2      |                             | 60.3   |               | 104.6        |
| 5                       | x | 1-1/2* |                             | 48.3   |               |              |
| 6                       | x | 6      | 168.3                       | 168.3  | 142.7         | 142.7        |
| 6                       | x | 5      |                             | 141.3  |               | 136.7        |
| 6                       | x | 4      |                             | 114.3  |               | 130.0        |
| 6                       | x | 3-1/2  |                             | 101.6  |               | 127.0        |
| 6                       | x | 3      |                             | 88.9   |               | 124.0        |
| 6                       | x | 2-1/2  |                             | 73.0   |               | 120.6        |
| 6                       | x | 2*     |                             | 60.3   |               |              |
| 8                       | x | 8      | 219.1                       | 219.1  | 177.8         | 177.8        |
| 8                       | x | 6      |                             | 168.3  |               | 168.1        |
| 8                       | x | 5      |                             | 141.3  |               | 162.1        |
| 8                       | x | 4      |                             | 114.3  |               | 155.4        |
| 8                       | x | 3-1/2  |                             | 101.6  |               | 152.4        |
| 8                       | x | 3*     |                             | 88.9   |               |              |
| 10                      | x | 10     | 273.1                       | 273.1  | 215.9         | 215.9        |
| 10                      | x | 8      |                             | 219.1  |               | 203.2        |
| 10                      | x | 6      |                             | 168.3  |               | 193.5        |
| 10                      | x | 5      |                             | 141.3  |               | 190.5        |
| 10                      | x | 4      |                             | 114.3  |               | 184.2        |
| 12                      | x | 12     | 323.9                       | 323.9  | 254.0         | 254.0        |
| 12                      | x | 10     |                             | 273.1  |               | 241.3        |
| 12                      | x | 8      |                             | 219.1  |               | 228.6        |
| 12                      | x | 6      |                             | 168.3  |               | 218.9        |
| 12                      | x | 5      |                             | 141.3  |               | 215.9        |
|                         |   |        |                             |        |               |              |
|                         |   |        |                             |        |               |              |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.



## Equal and Reducing Tees


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

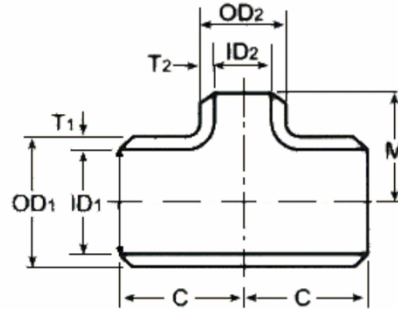
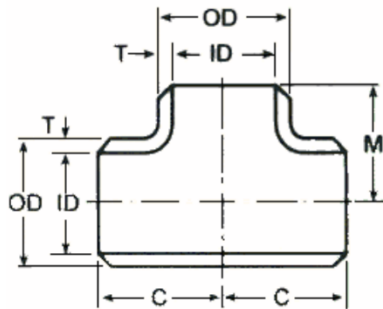
| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 14 x 14                       | 355.6                          | 355.6  | 279.4         | 279.4           |
| 14 x 12                       |                                | 323.9  |               | 269.7           |
| 14 x 10                       |                                | 273.1  |               | 257.0           |
| 14 x 8                        |                                | 219.1  |               | 247.6           |
| 14 x 6                        |                                | 168.3  |               | 238.3           |
| 16 x 16                       | 406.4                          | 406.4  | 304.8         | 304.8           |
| 16 x 14                       |                                | 355.6  |               | 304.8           |
| 16 x 12                       |                                | 323.9  |               | 295.1           |
| 16 x 10                       |                                | 273.1  |               | 282.4           |
| 16 x 8                        |                                | 219.1  |               | 373.0           |
| 16 x 6                        |                                | 168.3  |               | 263.7           |
| 18 x 18                       | 457.2                          | 457.2  | 342.9         | 342.9           |
| 18 x 16                       |                                | 406.4  |               | 330.2           |
| 18 x 14                       |                                | 355.6  |               | 330.2           |
| 18 x 12                       |                                | 323.9  |               | 320.5           |
| 18 x 10                       |                                | 273.1  |               | 307.8           |
| 18 x 8                        |                                | 219.1  |               | 298.4           |
| 20 x 20                       | 508.0                          | 508.0  | 381.0         | 381.0           |
| 20 x 18                       |                                | 457.2  |               | 369.3           |
| 20 x 16                       |                                | 406.4  |               | 355.6           |
| 20 x 14                       |                                | 355.6  |               | 355.6           |
| 20 x 12                       |                                | 323.9  |               | 345.9           |
| 20 x 10                       |                                | 273.1  |               | 333.2           |
| 20 x 8                        |                                | 219.1  |               | 323.8           |
| 22 x 22                       | 558.8                          | 558.8  | 419.1         | 419.1           |
| 22 x 20                       |                                | 508.0  |               | 406.4           |
| 22 x 18                       |                                | 457.2  |               | 393.7           |
| 22 x 16                       |                                | 406.4  |               | 381.0           |
| 22 x 14                       |                                | 355.6  |               | 381.0           |
| 22 x 12                       |                                | 323.9  |               | 371.3           |
| 22 x 10                       |                                | 273.1  |               | 358.6           |
| 24 x 24                       | 609.6                          | 609.6  | 431.8         | 431.8           |
| 24 x 22                       |                                | 558.8  |               | 431.8           |
| 24 x 20                       |                                | 508.0  |               | 431.8           |
| 24 x 18                       |                                | 457.2  |               | 419.1           |
| 24 x 16                       |                                | 406.4  |               | 406.4           |
| 24 x 14                       |                                | 355.6  |               | 406.4           |
| 24 x 12                       |                                | 323.9  |               | 396.7           |
| 24 x 10                       |                                | 273.1  |               | 384.0           |
| 26 x 26                       | 660.4                          | 660.4  | 495.3         | 495.3           |
| 26 x 24                       |                                | 609.6  |               | 482.6           |

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 26 x 22                       |                                | 558.8  |               | 469.9           |
| 26 x 20                       |                                | 508.0  |               | 457.2           |
| 26 x 18                       |                                | 457.2  |               | 444.5           |
| 26 x 16                       |                                | 406.4  |               | 431.8           |
| 26 x 14                       |                                | 355.6  |               | 431.8           |
| 26 x 12                       |                                | 323.1  |               | 422.1           |
| 28 x 28                       | 711.2                          | 711.2  | 520.7         | 520.7           |
| 28 x 26                       |                                | 660.4  |               | 520.7           |
| 28 x 24                       |                                | 609.6  |               | 508.0           |
| 28 x 22                       |                                | 558.8  |               | 495.3           |
| 28 x 20                       |                                | 508.0  |               | 482.6           |
| 28 x 18                       |                                | 457.2  |               | 469.9           |
| 28 x 16                       |                                | 406.4  |               | 457.2           |
| 28 x 14                       |                                | 355.6  |               | 457.2           |
| 28 x 12                       |                                | 323.1  |               | 447.5           |
| 30 x 30                       | 762.0                          | 762.0  | 558.8         | 558.8           |
| 30 x 28                       |                                | 711.2  |               | 546.1           |
| 30 x 26                       |                                | 660.4  |               | 546.1           |
| 30 x 24                       |                                | 609.6  |               | 533.4           |
| 30 x 22                       |                                | 558.8  |               | 520.7           |
| 30 x 20                       |                                | 508.0  |               | 508.0           |
| 30 x 18                       |                                | 457.2  |               | 495.3           |
| 30 x 16                       |                                | 406.4  |               | 482.6           |
| 30 x 14                       |                                | 355.6  |               | 482.6           |
| 30 x 12                       |                                | 323.9  |               | 472.6           |
| 30 x 10                       |                                | 273.1  |               | 460.2           |
| 32 x 32                       | 812.8                          | 812.8  | 596.9         | 596.9           |
| 32 x 30                       |                                | 762.0  |               | 584.2           |
| 32 x 28                       |                                | 711.2  |               | 571.5           |
| 32 x 26                       |                                | 660.4  |               | 571.5           |
| 32 x 24                       |                                | 609.6  |               | 558.8           |
| 32 x 22                       |                                | 558.8  |               | 546.1           |
| 32 x 20                       |                                | 508.0  |               | 533.4           |
| 32 x 18                       |                                | 457.2  |               | 520.7           |
| 32 x 16                       |                                | 406.4  |               | 508.0           |
| 32 x 14                       |                                | 355.6  |               | 508.0           |
| 34 x 34                       | 863.6                          | 863.6  | 635.0         | 635.0           |
| 34 x 32                       |                                | 812.8  |               | 622.3           |
| 34 x 30                       |                                | 762.0  |               | 609.6           |
| 34 x 28                       |                                | 711.2  |               | 596.9           |
| 34 x 26                       |                                | 660.4  |               | 596.9           |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.



## Equal and Reducing Tees


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

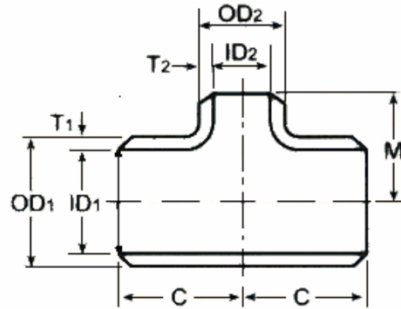
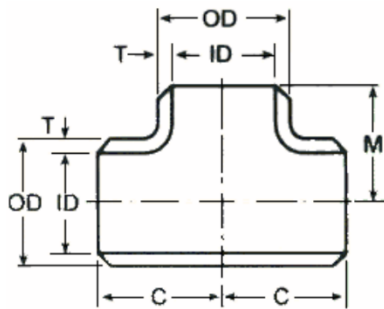
| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 34 x 24                       |                                | 609.6  |               | 584.2           |
| 34 x 22                       |                                | 558.8  |               | 571.5           |
| 34 x 20                       |                                | 508.0  |               | 558.8           |
| 34 x 18                       |                                | 457.2  |               | 546.1           |
| 34 x 16                       |                                | 406.4  |               | 533.4           |
| 36 x 36                       | 914.4                          | 914.4  | 673.1         | 673.1           |
| 36 x 34                       |                                | 863.6  |               | 660.4           |
| 36 x 32                       |                                | 812.8  |               | 647.7           |
| 36 x 30                       |                                | 762.0  |               | 635.0           |
| 36 x 28                       |                                | 711.2  |               | 622.3           |
| 36 x 26                       |                                | 660.4  |               | 622.3           |
| 36 x 24                       |                                | 609.6  |               | 609.6           |
| 36 x 22                       |                                | 558.8  |               | 596.9           |
| 36 x 20                       |                                | 508.0  |               | 584.2           |
| 36 x 18                       |                                | 457.2  |               | 571.5           |
| 36 x 16                       |                                | 406.4  |               | 558.8           |
| 38 x 38                       | 965.2                          | 965.2  | 711.2         | 711.2           |
| 38 x 36                       |                                | 914.4  |               | 711.2           |
| 38 x 34                       |                                | 863.6  |               | 698.5           |
| 38 x 32                       |                                | 812.8  |               | 685.8           |
| 38 x 30                       |                                | 762.0  |               | 673.1           |
| 38 x 28                       |                                | 711.2  |               | 647.7           |
| 38 x 26                       |                                | 660.4  |               | 647.7           |
| 38 x 24                       |                                | 609.6  |               | 635.0           |
| 38 x 22                       |                                | 558.8  |               | 622.3           |
| 38 x 20                       |                                | 508.0  |               | 609.6           |
| 38 x 18                       |                                | 457.2  |               | 596.9           |
| 40 x 40                       | 1016.0                         | 1016.0 | 749.3         | 749.3           |
| 40 x 38                       |                                | 965.2  |               | 749.3           |
| 40 x 36                       |                                | 914.4  |               | 736.6           |
| 40 x 34                       |                                | 863.6  |               | 723.9           |
| 40 x 32                       |                                | 812.8  |               | 711.2           |
| 40 x 30                       |                                | 762.0  |               | 698.5           |
| 40 x 28                       |                                | 711.2  |               | 673.1           |
| 40 x 26                       |                                | 660.4  |               | 673.1           |
| 40 x 24                       |                                | 609.6  |               | 660.4           |
| 40 x 22                       |                                | 558.8  |               | 647.7           |
| 40 x 20                       |                                | 508.0  |               | 635.0           |
| 40 x 18                       |                                | 457.2  |               | 622.3           |
| 42 x 42                       | 1066.8                         | 1066.8 | 762.0         | 711.2           |
| 42 x 40                       |                                | 1016.0 |               | 711.2           |

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 42 x 38                       |                                | 965.2  |               | 711.2           |
| 42 x 36                       |                                | 914.4  |               | 711.2           |
| 42 x 34                       |                                | 863.6  |               | 711.2           |
| 42 x 32                       |                                | 812.8  |               | 711.2           |
| 42 x 30                       |                                | 762.0  |               | 711.2           |
| 42 x 28                       | 1066.8                         | 711.2  | 762.0         | 698.5           |
| 42 x 26                       |                                | 660.4  |               | 698.5           |
| 42 x 24                       |                                | 609.6  |               | 660.4           |
| 42 x 22                       |                                | 558.8  |               | 660.4           |
| 42 x 20                       |                                | 508.0  |               | 660.4           |
| 42 x 18                       |                                | 457.2  |               | 647.7           |
| 42 x 16                       |                                | 406.4  |               | 635.0           |
| 44 x 44                       | 1117.6                         | 1117.6 | 812.8         | 762.0           |
| 44 x 42                       |                                | 1066.8 |               | 762.0           |
| 44 x 40                       |                                | 1016.0 |               | 749.3           |
| 44 x 38                       |                                | 965.2  |               | 736.6           |
| 44 x 36                       |                                | 914.4  |               | 723.9           |
| 44 x 34                       |                                | 863.6  |               | 723.9           |
| 44 x 32                       |                                | 812.8  |               | 711.2           |
| 44 x 30                       |                                | 762.0  |               | 711.2           |
| 44 x 28                       |                                | 711.2  |               | 698.5           |
| 44 x 26                       |                                | 660.4  |               | 698.5           |
| 44 x 24                       |                                | 609.6  |               | 698.5           |
| 44 x 22                       |                                | 558.8  |               | 685.8           |
| 44 x 20                       |                                | 508.0  |               | 685.8           |
| 46 x 46                       | 1168.4                         | 1168.4 | 850.9         | 800.1           |
| 46 x 44                       |                                | 1117.6 |               | 800.1           |
| 46 x 42                       |                                | 1066.8 |               | 787.4           |
| 46 x 40                       |                                | 1016.0 |               | 774.7           |
| 46 x 38                       |                                | 965.2  |               | 762.0           |
| 46 x 36                       |                                | 914.4  |               | 762.0           |
| 46 x 34                       |                                | 863.6  |               | 749.3           |
| 46 x 32                       |                                | 812.8  |               | 749.3           |
| 46 x 30                       |                                | 762.0  |               | 736.6           |
| 46 x 28                       |                                | 711.2  |               | 736.6           |
| 46 x 26                       |                                | 660.4  |               | 736.6           |
| 46 x 24                       |                                | 609.6  |               | 723.9           |
| 46 x 22                       |                                | 558.8  |               | 723.9           |
| 48 x 48                       | 1219.2                         | 1219.2 | 889.0         | 838.2           |
| 48 x 46                       |                                | 1168.4 |               | 838.2           |
| 48 x 44                       |                                | 1117.6 |               | 838.2           |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.



## Equal and Reducing Tees


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard.

| Nominal Pipe Size (NPS) |   |     | Outside Diameter At Bevel D |        | Center to End |              |
|-------------------------|---|-----|-----------------------------|--------|---------------|--------------|
|                         |   |     | Run                         | Outlet | Run C         | Outlet (1) M |
| 48                      | x | 42  |                             | 1066.8 |               | 812.8        |
| 48                      | x | 40  |                             | 1016.0 |               | 812.8        |
| 48                      | x | 38  |                             | 965.2  |               | 812.8        |
| 48                      | x | 36  |                             | 914.4  |               | 787.4        |
| 48                      | x | 34  |                             | 863.6  |               | 787.4        |
| 48                      | x | 32  | 1219.2                      | 812.8  | 889.0         | 787.4        |
| 48                      | x | 44  |                             | 1117.6 |               | 838.2        |
| 48                      | x | 42  |                             | 1066.8 |               | 812.8        |
| 48                      | x | 40  |                             | 1016.0 |               | 812.8        |
| 48                      | x | 38  |                             | 965.2  |               | 812.8        |
| 48                      | x | 36  |                             | 914.4  |               | 787.4        |
| 48                      | x | 34  |                             | 863.6  |               | 787.4        |
| 48                      | x | 32  |                             | 812.8  |               | 787.4        |
| 48                      | x | 30  |                             | 762.0  |               | 762.0        |
| 48                      | x | 28  |                             | 711.2  |               | 762.0        |
| 48                      | x | 26  |                             | 660.4  |               | 762.0        |
| 48                      | x | 24  |                             | 609.6  |               | 736.6        |
| 48                      | x | 22  |                             | 558.8  |               | 736.6        |
| 52                      | x | 52* | 1320.8                      | 1320.8 | 965.2         | 914.4        |
| 52                      | x | 48* |                             | 1219.2 |               | 863.6        |
| 52                      | x | 44* |                             | 1117.6 |               | 812.8        |
| 52                      | x | 40* |                             | 1016.0 |               | 762.0        |
| 54                      | x | 54* | 1371.6                      | 1371.6 | 1003.3        | 952.5        |
| 54                      | x | 52* |                             | 1320.8 |               | 914.4        |
| 54                      | x | 48* |                             | 1219.2 |               | 863.6        |
| 54                      | x | 44* |                             | 1117.6 |               | 863.6        |
| 54                      | x | 40* |                             | 1016.0 |               | 812.8        |
| 54                      | x | 38* |                             | 965.2  |               | 812.8        |
| 54                      | x | 36* |                             | 914.4  |               | 787.4        |
| 54                      | x | 34* |                             | 863.6  |               | 787.4        |
| 54                      | x | 32* |                             | 812.8  |               | 787.4        |
| 54                      | x | 30* |                             | 762.0  |               | 762.0        |
| 54                      | x | 28* |                             | 711.2  |               | 762.0        |
| 54                      | x | 26* |                             | 660.4  |               | 762.0        |
| 54                      | x | 24* |                             | 609.6  |               | 736.6        |
| 54                      | x | 22* |                             | 558.8  |               | 736.6        |
| 56                      | x | 56* | 1422.4                      | 1422.4 | 1041.4        | 965.2        |
| 56                      | x | 52* |                             | 1320.8 |               | 914.4        |
| 56                      | x | 48* |                             | 1219.2 |               | 863.6        |
| 56                      | x | 44* |                             | 1117.6 |               | 812.8        |
| 56                      | x | 40* |                             | 1016.0 |               | 812.8        |
| 56                      | x | 38* |                             | 965.2  |               | 812.8        |
| 56                      | x | 36* |                             | 914.4  |               | 787.4        |
| 56                      | x | 34* |                             | 863.6  |               | 787.4        |
| 56                      | x | 32* |                             | 812.8  |               | 787.4        |
| 56                      | x | 30* |                             | 762.0  |               | 762.0        |
| 56                      | x | 28* |                             | 711.2  |               | 762.0        |
| 56                      | x | 26* |                             | 660.4  |               | 762.0        |
| 56                      | x | 24* |                             | 609.6  |               | 736.6        |
| 56                      | x | 22* |                             | 558.8  |               | 736.6        |
| 60                      | x | 60* | 1524.0                      | 1524.0 | 1117.6        | 1016.0       |
| 60                      | x | 56* |                             | 1422.4 |               | 965.2        |
| 60                      | x | 52* |                             | 1320.8 |               | 914.4        |
| 60                      | x | 48* |                             | 1219.2 |               | 863.6        |

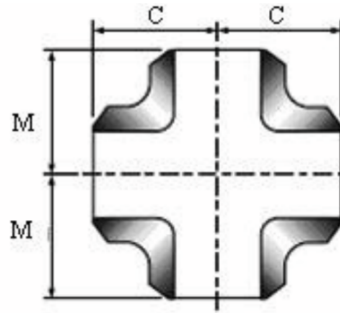
| Nominal Pipe Size (NPS) |   |     | Outside Diameter At Bevel D |        | Center to End |              |
|-------------------------|---|-----|-----------------------------|--------|---------------|--------------|
|                         |   |     | Run                         | Outlet | Run C         | Outlet (1) M |
| 60                      | x | 40* |                             | 1016.0 |               | 863.6        |
| 60                      | x | 28* |                             | 711.2  |               | 863.6        |
| 60                      | x | 20* |                             | 508.0  |               | 863.6        |
| 64                      | x | 64* | 1626.0                      | 1626.0 | 1194.0        | 1092.0       |
| 64                      | x | 60* |                             | 1524.0 |               | 1067.0       |
| 64                      | x | 56* |                             | 1422.0 |               | 1016.0       |
| 64                      | x | 52* |                             | 1321.0 |               | 965.0        |
| 64                      | x | 48* |                             | 1219.0 |               | 914          |
| 66                      | x | 66* | 1676.4                      | 1676.4 | 1219.2        | 1066.8       |
| 68                      | x | 68* | 1727.0                      | 1727.0 | 1270.0        | 1168.0       |
| 68                      | x | 64* |                             | 1626.0 |               | 1143.0       |
| 68                      | x | 60* |                             | 1524.0 |               | 1118.0       |
| 68                      | x | 56* |                             | 1422.0 |               | 1067.0       |
| 68                      | x | 52* |                             | 1321.0 |               | 1016.0       |
| 68                      | x | 48* |                             | 1219.0 |               | 965.0        |
| 72                      | x | 72* | 1829.0                      | 1829.0 | 1320.0        | 1245.0       |
| 72                      | x | 68* |                             | 1727.0 |               | 1219.0       |
| 72                      | x | 64* |                             | 1626.0 |               | 1194.0       |
| 72                      | x | 60* |                             | 1524.0 |               | 1168.0       |
| 72                      | x | 56* | 1829.0                      | 1422.0 | 1320.0        | 1118.0       |
| 72                      | x | 52* |                             | 1321.0 |               | 1067.0       |
| 72                      | x | 48* |                             | 1219.0 |               | 1016.0       |
| 76                      | x | 76* | 1930.0                      | 1930.0 | 1422.0        | 1320.0       |
| 76                      | x | 72* |                             | 1829.0 |               | 1295.0       |
| 76                      | x | 68* |                             | 1727.0 |               | 1270.0       |
| 76                      | x | 64* |                             | 1626.0 |               | 1245.0       |
| 76                      | x | 60* |                             | 1524.0 |               | 1219.0       |
| 76                      | x | 56* |                             | 1422.0 |               | 1168.0       |
| 76                      | x | 52* |                             | 1321.0 |               | 1118.0       |
| 76                      | x | 48* |                             | 1219.0 |               | 1067.0       |
| 80                      | x | 80* | 2032.0                      | 2032.0 | 1499.0        | 1397.0       |
| 80                      | x | 76* |                             | 1930.0 |               | 1372.0       |
| 80                      | x | 72* |                             | 1829.0 |               | 1346.0       |
| 80                      | x | 68* |                             | 1727.0 |               | 1321.0       |
| 80                      | x | 64* |                             | 1626.0 |               | 1295.0       |
| 80                      | x | 60* |                             | 1524.0 |               | 1270.0       |
| 80                      | x | 56* |                             | 1422.0 |               | 1219.0       |
| 80                      | x | 52* |                             | 1321.0 |               | 1168.0       |
| 80                      | x | 48* |                             | 1219.0 |               | 1118.0       |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.





## Equal and Reducing Crosses


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

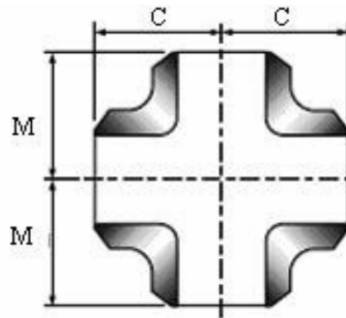
| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 1/2 x 1/2                     | 21.3                           | 21.3   | 25.4          | 25.4            |
| 1/2 x 3/8                     |                                | 17.1   |               | 25.4            |
| 1/2 x 1/4                     |                                | 13.7   |               | 25.4            |
| 3/4 x 3/4                     | 26.7                           | 26.7   | 28.4          | 28.4            |
| 3/4 x 1/2                     |                                | 21.3   |               | 28.4            |
| 3/4 x 3/8                     |                                | 17.1   |               | 28.4            |
| 1 x 1                         | 33.4                           | 33.4   | 38.1          | 38.1            |
| 1 x 3/4                       |                                | 26.7   |               | 38.1            |
| 1 x 1/2                       |                                | 21.3   |               | 38.1            |
| 1-1/4 x 1-1/4                 | 42.2                           | 42.2   | 47.8          | 47.8            |
| 1-1/4 x 1                     |                                | 33.4   |               | 47.8            |
| 1-1/4 x 3/4                   |                                | 26.7   |               | 47.8            |
| 1-1/4 x 1/2                   |                                | 21.3   |               | 47.8            |
| 1-1/2 x 1-1/2                 | 48.3                           | 48.3   | 57.2          | 57.2            |
| 1-1/2 x 1-1/4                 |                                | 42.2   |               | 57.2            |
| 1-1/2 x 1                     |                                | 33.4   |               | 57.2            |
| 1-1/2 x 3/4                   |                                | 26.7   |               | 57.2            |
| 1-1/2 x 1/2                   |                                | 21.3   |               | 57.2            |
| 2 x 2                         | 60.3                           | 60.3   | 63.5          | 63.5            |
| 2 x 1-1/2                     |                                | 48.3   |               | 60.5            |
| 2 x 1-1/4                     |                                | 42.2   |               | 57.2            |
| 2 x 1                         |                                | 33.4   |               | 50.8            |
| 2 x 3/4                       |                                | 26.7   |               | 44.4            |
| 2 x 1/2*                      |                                | 21.3   |               |                 |
| 2-1/2 x 2-1/2                 | 73.0                           | 73.0   | 76.2          | 76.2            |
| 2-1/2 x 2                     |                                | 60.3   |               | 69.8            |
| 2-1/2 x 1-1/2                 |                                | 48.3   |               | 66.5            |
| 2-1/2 x 1-1/4                 |                                | 42.2   |               | 63.5            |
| 2-1/2 x 1                     |                                | 33.4   |               | 57.2            |
| 3 x 3                         | 88.9                           | 88.9   | 85.9          | 85.9            |
| 3 x 2-1/2                     |                                | 73.0   |               | 82.6            |
| 3 x 2                         |                                | 60.3   |               | 76.2            |
| 3 x 1-1/2                     |                                | 48.3   |               | 73.2            |
| 3 x 1-1/4                     |                                | 42.2   |               | 69.8            |
| 3 x 1*                        |                                | 33.4   |               |                 |
| 3-1/2 x 3-1/2                 | 101.6                          | 101.6  | 95.2          | 95.2            |
| 3-1/2 x 3                     |                                | 88.9   |               | 91.9            |
| 3-1/2 x 2-1/2                 |                                | 73.0   |               | 88.9            |
| 3-1/2 x 2                     |                                | 60.3   |               | 82.6            |
| 3-1/2 x 1-1/2                 |                                | 48.3   |               | 79.2            |

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 4 x 4                         | 114.3                          | 114.3  | 104.6         | 104.6           |
| 4 x 3-1/2                     |                                | 101.6  |               | 101.6           |
| 4 x 3                         |                                | 88.9   |               | 98.6            |
| 4 x 2-1/2                     |                                | 73.0   |               | 95.2            |
| 4 x 2                         |                                | 60.3   |               | 88.9            |
| 4 x 1-1/2                     |                                | 48.3   |               | 85.9            |
| 4 x 1-1/4                     |                                | 42.2   |               |                 |
| 4 x 1*                        |                                | 33.5   |               |                 |
| 5 x 5                         | 141.3                          | 141.3  | 124.0         | 124.0           |
| 5 x 4                         |                                | 114.3  |               | 117.3           |
| 5 x 3-1/2                     |                                | 101.6  |               | 114.3           |
| 5 x 3                         |                                | 88.9   |               | 111.3           |
| 5 x 2-1/2                     |                                | 73.0   |               | 108.0           |
| 5 x 2                         |                                | 60.3   |               | 104.6           |
| 5 x 1-1/2*                    |                                | 48.3   |               |                 |
| 6 x 6                         | 168.3                          | 168.3  | 142.7         | 142.7           |
| 6 x 5                         |                                | 141.3  |               | 136.7           |
| 6 x 4                         |                                | 114.3  |               | 130.0           |
| 6 x 3-1/2                     |                                | 101.6  |               | 127.0           |
| 6 x 3                         |                                | 88.9   |               | 124.0           |
| 6 x 2-1/2                     |                                | 73.0   |               | 120.6           |
| 6 x 2*                        |                                | 60.3   |               |                 |
| 8 x 8                         | 219.1                          | 219.1  | 177.8         | 177.8           |
| 8 x 6                         |                                | 168.3  |               | 168.1           |
| 8 x 5                         |                                | 141.3  |               | 162.1           |
| 8 x 4                         |                                | 114.3  |               | 155.4           |
| 8 x 3-1/2                     |                                | 101.6  |               | 152.4           |
| 8 x 3*                        |                                | 88.9   |               |                 |
| 10 x 10                       | 273.1                          | 273.1  | 215.9         | 215.9           |
| 10 x 8                        |                                | 219.1  |               | 203.2           |
| 10 x 6                        |                                | 168.3  |               | 193.5           |
| 10 x 5                        |                                | 141.3  |               | 190.5           |
| 10 x 4                        |                                | 114.3  |               | 184.2           |
| 12 x 12                       | 323.9                          | 323.9  | 254.0         | 254.0           |
| 12 x 10                       |                                | 273.1  |               | 241.3           |
| 12 x 8                        |                                | 219.1  |               | 228.6           |
| 12 x 6                        |                                | 168.3  |               | 218.9           |
| 12 x 5                        |                                | 141.3  |               | 215.9           |
|                               |                                |        |               |                 |
|                               |                                |        |               |                 |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.



## Equal and Reducing Crosses


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

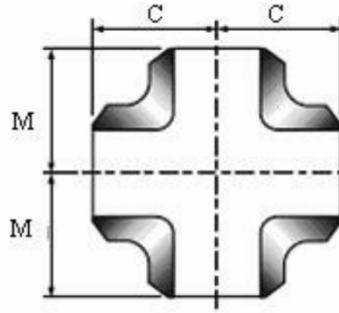
| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 14 x 14                       | 355.6                          | 355.6  | 279.4         | 279.4           |
| 14 x 12                       |                                | 323.9  |               | 269.7           |
| 14 x 10                       |                                | 273.1  |               | 257.0           |
| 14 x 8                        |                                | 219.1  |               | 247.6           |
| 14 x 6                        |                                | 168.3  |               | 238.3           |
| 16 x 16                       | 406.4                          | 406.4  | 304.8         | 304.8           |
| 16 x 14                       |                                | 355.6  |               | 304.8           |
| 16 x 12                       |                                | 323.9  |               | 295.1           |
| 16 x 10                       |                                | 273.1  |               | 282.4           |
| 16 x 8                        |                                | 219.1  |               | 373.0           |
| 16 x 6                        |                                | 168.3  |               | 263.7           |
| 18 x 18                       | 457.2                          | 457.2  | 342.9         | 342.9           |
| 18 x 16                       |                                | 406.4  |               | 330.2           |
| 18 x 14                       |                                | 355.6  |               | 330.2           |
| 18 x 12                       |                                | 323.9  |               | 320.5           |
| 18 x 10                       |                                | 273.1  |               | 307.8           |
| 18 x 8                        |                                | 219.1  |               | 298.4           |
| 20 x 20                       | 508.0                          | 508.0  | 381.0         | 381.0           |
| 20 x 18                       |                                | 457.2  |               | 369.3           |
| 20 x 16                       |                                | 406.4  |               | 355.6           |
| 20 x 14                       |                                | 355.6  |               | 355.6           |
| 20 x 12                       |                                | 323.9  |               | 345.9           |
| 20 x 10                       |                                | 273.1  |               | 333.2           |
| 20 x 8                        |                                | 219.1  |               | 323.8           |
| 22 x 22                       | 558.8                          | 558.8  | 419.1         | 419.1           |
| 22 x 20                       |                                | 508.0  |               | 406.4           |
| 22 x 18                       |                                | 457.2  |               | 393.7           |
| 22 x 16                       |                                | 406.4  |               | 381.0           |
| 22 x 14                       |                                | 355.6  |               | 381.0           |
| 22 x 12                       |                                | 323.9  |               | 371.3           |
| 22 x 10                       |                                | 273.1  |               | 358.6           |
| 24 x 24                       | 609.6                          | 609.6  | 431.8         | 431.8           |
| 24 x 22                       |                                | 558.8  |               | 431.8           |
| 24 x 20                       |                                | 508.0  |               | 431.8           |
| 24 x 18                       |                                | 457.2  |               | 419.1           |
| 24 x 16                       |                                | 406.4  |               | 406.4           |
| 24 x 14                       |                                | 355.6  |               | 406.4           |
| 24 x 12                       |                                | 323.9  |               | 396.7           |
| 24 x 10                       |                                | 273.1  |               | 384.0           |
| 26 x 26                       | 660.4                          | 660.4  | 495.3         | 495.3           |
| 26 x 24                       |                                | 609.6  |               | 482.6           |

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 26 x 22                       |                                | 558.8  |               | 469.9           |
| 26 x 20                       |                                | 508.0  |               | 457.2           |
| 26 x 18                       |                                | 457.2  |               | 444.5           |
| 26 x 16                       |                                | 406.4  |               | 431.8           |
| 26 x 14                       |                                | 355.6  |               | 431.8           |
| 26 x 12                       |                                | 323.1  |               | 422.1           |
| 28 x 28                       | 711.2                          | 711.2  | 520.7         | 520.7           |
| 28 x 26                       |                                | 660.4  |               | 520.7           |
| 28 x 24                       |                                | 609.6  |               | 508.0           |
| 28 x 22                       |                                | 558.8  |               | 495.3           |
| 28 x 20                       |                                | 508.0  |               | 482.6           |
| 28 x 18                       |                                | 457.2  |               | 469.9           |
| 28 x 16                       |                                | 406.4  |               | 457.2           |
| 28 x 14                       |                                | 355.6  |               | 457.2           |
| 28 x 12                       |                                | 323.1  |               | 447.5           |
| 30 x 30                       | 762.0                          | 762.0  | 558.8         | 558.8           |
| 30 x 28                       |                                | 711.2  |               | 546.1           |
| 30 x 26                       |                                | 660.4  |               | 546.1           |
| 30 x 24                       |                                | 609.6  |               | 533.4           |
| 30 x 22                       |                                | 558.8  |               | 520.7           |
| 30 x 20                       |                                | 508.0  |               | 508.0           |
| 30 x 18                       |                                | 457.2  |               | 495.3           |
| 30 x 16                       |                                | 406.4  |               | 482.6           |
| 30 x 14                       |                                | 355.6  |               | 482.6           |
| 30 x 12                       |                                | 323.9  |               | 472.6           |
| 30 x 10                       |                                | 273.1  |               | 460.2           |
| 32 x 32                       | 812.8                          | 812.8  | 596.9         | 596.9           |
| 32 x 30                       |                                | 762.0  |               | 584.2           |
| 32 x 28                       |                                | 711.2  |               | 571.5           |
| 32 x 26                       |                                | 660.4  |               | 571.5           |
| 32 x 24                       |                                | 609.6  |               | 558.8           |
| 32 x 22                       |                                | 558.8  |               | 546.1           |
| 32 x 20                       |                                | 508.0  |               | 533.4           |
| 32 x 18                       |                                | 457.2  |               | 520.7           |
| 32 x 16                       |                                | 406.4  |               | 508.0           |
| 32 x 14                       |                                | 355.6  |               | 508.0           |
| 34 x 34                       | 863.6                          | 863.6  | 635.0         | 635.0           |
| 34 x 32                       |                                | 812.8  |               | 622.3           |
| 34 x 30                       |                                | 762.0  |               | 609.6           |
| 34 x 28                       |                                | 711.2  |               | 596.9           |
| 34 x 26                       |                                | 660.4  |               | 596.9           |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.

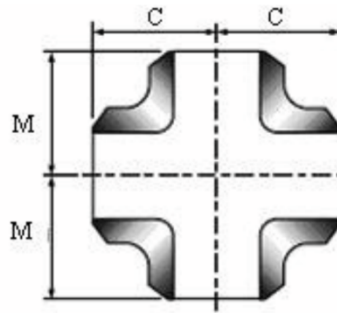


## Equal and Reducing Crosses


 MSS SP-75 ANSI B16.9 (in mm)  
 \* Wellgrow's standard

| Nominal<br>Pipe Size<br>(NPS) |   |     | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|---|-----|--------------------------------|--------|---------------|-----------------|
|                               |   |     | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 34                            | x | 24  |                                | 609.6  |               | 584.2           |
| 34                            | x | 22  |                                | 558.8  |               | 571.5           |
| 34                            | x | 20  |                                | 508.0  |               | 558.8           |
| 34                            | x | 18  |                                | 457.2  |               | 546.1           |
| 34                            | x | 16  |                                | 406.4  |               | 533.4           |
| 36                            | x | 36  | 914.4                          | 914.4  | 673.1         | 673.1           |
| 36                            | x | 34  |                                | 863.6  |               | 660.4           |
| 36                            | x | 32  |                                | 812.8  |               | 647.7           |
| 36                            | x | 30  |                                | 762.0  |               | 635.0           |
| 36                            | x | 28  |                                | 711.2  |               | 622.3           |
| 36                            | x | 26  |                                | 660.4  |               | 622.3           |
| 36                            | x | 24  |                                | 609.6  |               | 609.6           |
| 36                            | x | 22  |                                | 558.8  |               | 596.9           |
| 36                            | x | 20  |                                | 508.0  |               | 584.2           |
| 36                            | x | 18  |                                | 457.2  |               | 571.5           |
| 36                            | x | 16  |                                | 406.4  |               | 558.8           |
| 38                            | x | 38  | 965.2                          | 965.2  | 711.2         | 711.2           |
| 38                            | x | 36  |                                | 914.4  |               | 711.2           |
| 38                            | x | 34  |                                | 863.6  |               | 698.5           |
| 38                            | x | 32  |                                | 812.8  |               | 685.8           |
| 38                            | x | 30  |                                | 762.0  |               | 673.1           |
| 38                            | x | 28  |                                | 711.2  |               | 647.7           |
| 38                            | x | 26  |                                | 660.4  |               | 647.7           |
| 38                            | x | 24  |                                | 609.6  |               | 635.0           |
| 38                            | x | 22  |                                | 558.8  |               | 622.3           |
| 38                            | x | 20  |                                | 508.0  |               | 609.6           |
| 38                            | x | 18  |                                | 457.2  |               | 596.9           |
| 40                            | x | 40  | 1016.0                         | 1016.0 | 749.3         | 749.3           |
| 40                            | x | 38  |                                | 965.2  |               | 749.3           |
| 40                            | x | 36  |                                | 914.4  |               | 736.6           |
| 40                            | x | 34  |                                | 863.6  |               | 723.9           |
| 40                            | x | 32  |                                | 812.8  |               | 711.2           |
| 40                            | x | 30  |                                | 762.0  |               | 698.5           |
| 40                            | x | 28  |                                | 711.2  |               | 673.1           |
| 40                            | x | 26  |                                | 660.4  |               | 673.1           |
| 40                            | x | 24  |                                | 609.6  |               | 660.4           |
| 40                            | x | 22  |                                | 558.8  |               | 647.7           |
| 40                            | x | 20  |                                | 508.0  |               | 635.0           |
| 40                            | x | 18  |                                | 457.2  |               | 622.3           |
| 42                            | x | 42  | 1066.8                         | 1066.8 | 762.0         | 711.2           |
| 42                            | x | 40  |                                | 1016.0 |               | 711.2           |
| 42                            | x | 38  |                                | 965.2  |               | 711.2           |
| 42                            | x | 36  |                                | 914.4  |               | 711.2           |
| 42                            | x | 34  |                                | 863.6  |               | 711.2           |
| 42                            | x | 32  |                                | 812.8  |               | 711.2           |
| 42                            | x | 30  |                                | 762.0  |               | 711.2           |
| 42                            | x | 28  |                                | 711.2  |               | 698.5           |
| 42                            | x | 26  |                                | 660.4  |               | 698.5           |
| 42                            | x | 24  |                                | 609.6  |               | 698.5           |
| 42                            | x | 22  |                                | 558.8  |               | 685.8           |
| 42                            | x | 20  |                                | 508.0  |               | 685.8           |
| 46                            | x | 46  | 1168.4                         | 1168.4 | 850.9         | 800.1           |
| 46                            | x | 44  |                                | 1117.6 |               | 800.1           |
| 46                            | x | 42  |                                | 1066.8 |               | 787.4           |
| 46                            | x | 40  |                                | 1016.0 |               | 774.7           |
| 46                            | x | 38  |                                | 965.2  |               | 762.0           |
| 46                            | x | 36  |                                | 914.4  |               | 762.0           |
| 46                            | x | 34  |                                | 863.6  |               | 749.3           |
| 46                            | x | 32  |                                | 812.8  |               | 749.3           |
| 46                            | x | 30  |                                | 762.0  |               | 736.6           |
| 46                            | x | 28  |                                | 711.2  |               | 736.6           |
| 46                            | x | 26  |                                | 660.4  |               | 736.6           |
| 46                            | x | 24  |                                | 609.6  |               | 723.9           |
| 46                            | x | 20* |                                | 508.0  |               | 723.9           |
| 48                            | x | 48  | 1219.2                         | 1219.2 | 889.0         | 838.2           |
| 48                            | x | 46  |                                | 1168.4 |               | 838.2           |
| 48                            | x | 44  |                                | 1117.6 |               | 838.2           |

## Equal and Reducing Crosses



MSS SP-75 ANSI B16.9 (in mm)  
\* Wellgrow's standard.

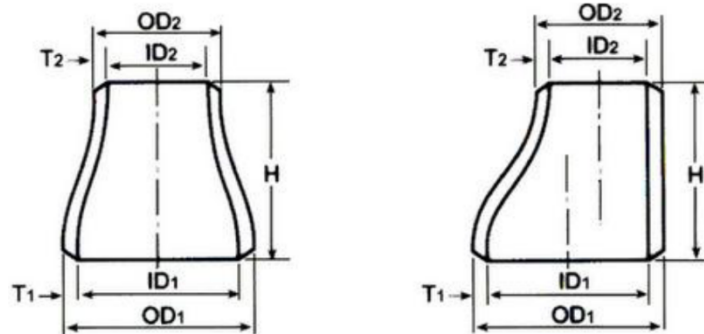
| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 48 x 42                       |                                | 1066.8 |               | 812.8           |
| 48 x 40                       |                                | 1016.0 |               | 812.8           |
| 48 x 38                       |                                | 965.2  |               | 812.8           |
| 48 x 36                       |                                | 914.4  |               | 787.4           |
| 48 x 34                       |                                | 863.6  |               | 787.4           |
| 48 x 32                       | 1219.2                         | 812.8  | 889.0         | 787.4           |
| 48 x 44                       |                                | 1117.6 |               | 838.2           |
| 48 x 42                       |                                | 1066.8 |               | 812.8           |
| 48 x 40                       |                                | 1016.0 |               | 812.8           |
| 48 x 38                       |                                | 965.2  |               | 812.8           |
| 48 x 36                       |                                | 914.4  |               | 787.4           |
| 48 x 34                       |                                | 863.6  |               | 787.4           |
| 48 x 32                       |                                | 812.8  |               | 787.4           |
| 48 x 30                       |                                | 762.0  |               | 762.0           |
| 48 x 28                       |                                | 711.2  |               | 762.0           |
| 48 x 26                       |                                | 660.4  |               | 762.0           |
| 48 x 24                       |                                | 609.6  |               | 736.6           |
| 48 x 22                       |                                | 558.8  |               | 736.6           |
| 52 x 52*                      | 1320.8                         | 1320.8 | 965.2         | 914.4           |
| 52 x 48*                      |                                | 1219.2 |               | 863.6           |
| 52 x 44*                      |                                | 1117.6 |               | 812.8           |
| 52 x 40*                      |                                | 1016.0 |               | 762.0           |
| 54 x 54*                      | 1371.6                         | 1371.6 | 1003.3        | 952.5           |
| 54 x 52*                      |                                | 1320.8 |               | 914.4           |
| 54 x 48*                      |                                | 1219.2 |               | 863.6           |
| 54 x 44*                      |                                | 1117.6 |               | 863.6           |
| 54 x 40*                      |                                | 1016.0 |               | 812.8           |
| 54 x 28*                      |                                | 711.2  |               | 787.4           |
| 54 x 20*                      |                                | 508.0  |               | 787.4           |
| 56 x 56*                      | 1422.4                         | 1422.4 | 1041.4        | 965.2           |
| 56 x 52*                      |                                | 1320.8 |               | 914.4           |
| 56 x 48*                      |                                | 1219.2 |               | 863.6           |
| 56 x 44*                      |                                | 1117.6 |               | 812.8           |
| 56 x 40*                      |                                | 1016.0 |               | 812.8           |
| 56 x 28*                      |                                | 711.2  |               | 812.8           |
| 56 x 20*                      |                                | 508.0  |               | 812.8           |
| 60 x 60*                      | 1524.0                         | 1524.0 | 1117.6        | 1016.0          |
| 60 x 56*                      |                                | 1422.4 |               | 965.2           |
| 60 x 52*                      |                                | 1320.8 |               | 914.4           |
| 60 x 48*                      |                                | 1219.2 |               | 863.6           |

| Nominal<br>Pipe Size<br>(NPS) | Outside Diameter<br>At Bevel D |        | Center to End |                 |
|-------------------------------|--------------------------------|--------|---------------|-----------------|
|                               | Run                            | Outlet | Run<br>C      | Outlet (1)<br>M |
| 60 x 40*                      |                                | 1016.0 |               | 863.6           |
| 60 x 28*                      |                                | 711.2  |               | 863.6           |
| 60 x 20*                      |                                | 508.0  |               | 863.6           |
| 64 x 64*                      | 1626.0                         | 1626.0 | 1194.0        | 1092.0          |
| 64 x 60*                      |                                | 1524.0 |               | 1067.0          |
| 64 x 56*                      |                                | 1422.0 |               | 1016.0          |
| 64 x 52*                      |                                | 1321.0 |               | 965.0           |
| 64 x 48*                      |                                | 1219.0 |               | 914             |
| 66 x 66*                      | 1676.4                         | 1676.4 | 1219.2        | 1066.8          |
| 68 x 68*                      | 1727.0                         | 1727.0 | 1270.0        | 1168.0          |
| 68 x 64*                      |                                | 1626.0 |               | 1143.0          |
| 68 x 60*                      |                                | 1524.0 |               | 1118.0          |
| 68 x 56*                      |                                | 1422.0 |               | 1067.0          |
| 68 x 52*                      |                                | 1321.0 |               | 1016.0          |
| 68 x 48*                      |                                | 1219.0 |               | 965.0           |
| 72 x 72*                      | 1829.0                         | 1829.0 | 1320.0        | 1245.0          |
| 72 x 68*                      |                                | 1727.0 |               | 1219.0          |
| 72 x 64*                      |                                | 1626.0 |               | 1194.0          |
| 72 x 60*                      |                                | 1524.0 |               | 1168.0          |
| 72 x 56*                      | 1829.0                         | 1422.0 | 1320.0        | 1118.0          |
| 72 x 52*                      |                                | 1321.0 |               | 1067.0          |
| 72 x 48*                      |                                | 1219.0 |               | 1016.0          |
| 76 x 76*                      | 1930.0                         | 1930.0 | 1422.0        | 1320.0          |
| 76 x 72*                      |                                | 1829.0 |               | 1295.0          |
| 76 x 68*                      |                                | 1727.0 |               | 1270.0          |
| 76 x 64*                      |                                | 1626.0 |               | 1245.0          |
| 76 x 60*                      |                                | 1524.0 |               | 1219.0          |
| 76 x 56*                      |                                | 1422.0 |               | 1168.0          |
| 76 x 52*                      |                                | 1321.0 |               | 1118.0          |
| 76 x 48*                      |                                | 1219.0 |               | 1067.0          |
| 80 x 80*                      | 2032.0                         | 2032.0 | 1499.0        | 1397.0          |
| 80 x 76*                      |                                | 1930.0 |               | 1372.0          |
| 80 x 72*                      |                                | 1829.0 |               | 1346.0          |
| 80 x 68*                      |                                | 1727.0 |               | 1321.0          |
| 80 x 64*                      |                                | 1626.0 |               | 1295.0          |
| 80 x 60*                      |                                | 1524.0 |               | 1270.0          |
| 80 x 56*                      |                                | 1422.0 |               | 1219.0          |
| 80 x 52*                      |                                | 1321.0 |               | 1168.0          |
| 80 x 48*                      |                                | 1219.0 |               | 1118.0          |

(1) Outlet dimension "M" for run sizes 14 and larger is recommended but not mandatory.



## Concentric and Eccentric Reducers



MSS SP-75 ANSI B16.9 (in mm)  
\* Wellgrow's standard.

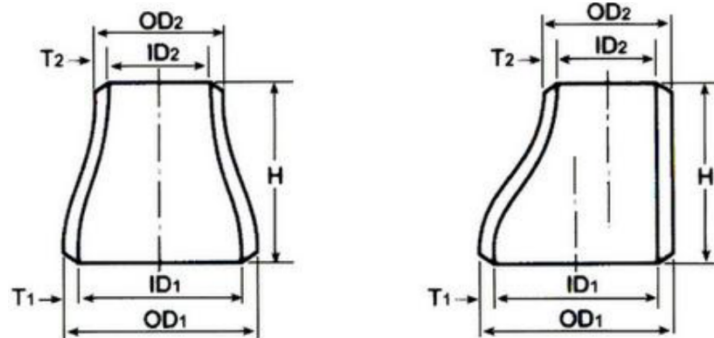
| Nominal Pipe Size (NPS) |   |       | Outside Diameter at Bevel |           | End-to-end |
|-------------------------|---|-------|---------------------------|-----------|------------|
|                         |   |       | Large End                 | Small End |            |
| 3/4                     | x | 1/2   | 26.7                      | 21.3      | 38.1       |
| 3/4                     | x | 3/8   |                           | 17.3      |            |
| 1                       | x | 3/4   | 33.4                      | 26.7      | 50.8       |
| 1                       | x | 1/2   |                           | 21.3      |            |
| 1-1/4                   | x | 1     | 42.2                      | 33.4      | 50.8       |
| 1-1/4                   | x | 3/4   |                           | 26.7      |            |
| 1-1/4                   | x | 1/2   |                           | 21.3      |            |
| 1-1/2                   | x | 1-1/4 | 48.3                      | 42.2      | 63.5       |
| 1-1/2                   | x | 1     |                           | 33.4      |            |
| 1-1/2                   | x | 3/4   |                           | 26.7      |            |
| 1-1/2                   | x | 1/2   |                           | 21.3      |            |
| 2                       | x | 1-1/2 | 60.3                      | 48.3      | 76.2       |
| 2                       | x | 1-1/4 |                           | 42.2      |            |
| 2                       | x | 1     |                           | 33.4      |            |
| 2                       | x | 3/4   |                           | 26.7      |            |
| 2-1/2                   | x | 2     | 73.0                      | 60.3      | 88.9       |
| 2-1/2                   | x | 1-1/2 |                           | 48.3      |            |
| 2-1/2                   | x | 1-1/4 |                           | 42.2      |            |
| 2-1/2                   | x | 1     |                           | 33.4      |            |
| 3                       | x | 2-1/2 | 88.9                      | 73.0      | 88.9       |
| 3                       | x | 2     |                           | 60.3      |            |
| 3                       | x | 1-1/2 |                           | 48.3      |            |
| 3                       | x | 1-1/4 |                           | 42.2      |            |
| 3-1/2                   | x | 3     | 101.6                     | 88.9      | 101.6      |
| 3-1/2                   | x | 2-1/2 |                           | 73.0      |            |
| 3-1/2                   | x | 2     |                           | 60.3      |            |
| 3-1/2                   | x | 1-1/2 |                           | 48.3      |            |
| 3-1/2                   | x | 1-1/4 |                           | 42.2      |            |
| 4                       | x | 3-1/2 | 114.3                     | 101.6     | 101.6      |
| 4                       | x | 3     |                           | 88.9      |            |
| 4                       | x | 2-1/2 |                           | 73.0      |            |
| 4                       | x | 2     |                           | 60.3      |            |
| 4                       | x | 1-1/2 |                           | 48.3      |            |
| 5                       | x | 4     | 141.3                     | 114.3     | 127.0      |
| 5                       | x | 3-1/2 |                           | 101.6     |            |
| 5                       | x | 3     |                           | 88.9      |            |
| 5                       | x | 2-1/2 |                           | 73.0      |            |
| 5                       | x | 2     |                           | 60.3      |            |
| 6                       | x | 5     | 168.3                     | 141.3     | 139.7      |
| 6                       | x | 4     |                           | 114.3     |            |
| 6                       | x | 3-1/2 |                           | 101.6     |            |
| 6                       | x | 3     |                           | 88.9      |            |
| 6                       | x | 2-1/2 |                           | 73.0      |            |

| Nominal Pipe Size (NPS) |   |       | Outside Diameter at Bevel |           | End-to-end |
|-------------------------|---|-------|---------------------------|-----------|------------|
|                         |   |       | Large End                 | Small End |            |
| 8                       | x | 6     | 219.1                     | 168.3     | 152.4      |
| 8                       | x | 5     |                           | 141.3     |            |
| 8                       | x | 4     |                           | 114.3     |            |
| 8                       | x | 3-1/2 |                           | 101.6     |            |
| 8                       | x | 3     |                           | 88.9      |            |
| 8                       | x | 2-1/2 |                           | 73.0      |            |
| 10                      | x | 8     | 273.1                     | 29.1      | 177.8      |
| 10                      | x | 6     |                           | 168.3     |            |
| 10                      | x | 5     |                           | 141.3     |            |
| 10                      | x | 4     |                           | 114.3     |            |
| 12                      | x | 10    | 323.9                     | 273.1     | 203.2      |
| 12                      | x | 8     |                           | 219.1     |            |
| 12                      | x | 6     |                           | 168.3     |            |
| 12                      | x | 5     |                           | 141.3     |            |
| 14                      | x | 12    | 355.6                     | 323.9     | 330.2      |
| 14                      | x | 10    |                           | 273.1     |            |
| 14                      | x | 8     |                           | 219.1     |            |
| 14                      | x | 6     |                           | 168.3     |            |
| 16                      | x | 14    | 406.4                     | 355.6     | 355.6      |
| 16                      | x | 12    |                           | 323.9     |            |
| 16                      | x | 10    |                           | 273.1     |            |
| 16                      | x | 8     |                           | 219.1     |            |
| 18                      | x | 16    | 457.2                     | 406.4     | 381.0      |
| 18                      | x | 14    |                           | 355.6     |            |
| 18                      | x | 12    |                           | 323.9     |            |
| 18                      | x | 10    |                           | 273.1     |            |
| 18                      | x | 8     |                           | 219.1     |            |
| 20                      | x | 18    | 508.0                     | 457.2     | 508.0      |
| 20                      | x | 16    |                           | 406.4     |            |
| 20                      | x | 14    |                           | 355.6     |            |
| 20                      | x | 12    |                           | 323.9     |            |
| 20                      | x | 10    |                           | 273.0     |            |
| 22                      | x | 20    | 558.8                     | 508.0     | 508.0      |
| 22                      | x | 18    |                           | 457.2     |            |
| 22                      | x | 16    |                           | 406.4     |            |
| 22                      | x | 14    |                           | 355.6     |            |
| 22                      | x | 12    |                           | 323.8     |            |
| 24                      | x | 22    | 609.6                     | 558.8     | 508.0      |
| 24                      | x | 20    |                           | 508.0     |            |
| 24                      | x | 18    |                           | 457.2     |            |
| 24                      | x | 16    |                           | 406.4     |            |
| 24                      | x | 16    |                           | 355.6     |            |
| 24                      | x | 16    |                           | 323.8     |            |





## Concentric and Eccentric Reducers



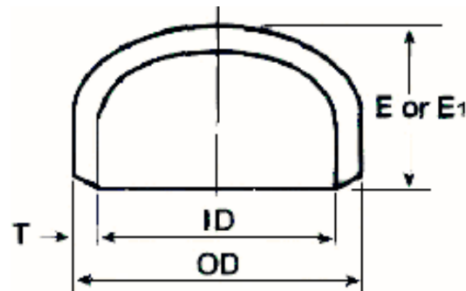
MSS SP-75 ANSI B16.9 (in mm)  
\* Wellgrow's standard.

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel |           | End-to-end |
|-------------------------|---------------------------|-----------|------------|
|                         | Large End                 | Small End |            |
| 26 x 24                 | 660.4                     | 609.6     | 609.6      |
| 26 x 22                 |                           | 558.8     |            |
| 26 x 20                 |                           | 508.0     |            |
| 26 x 18                 |                           | 457.2     |            |
| 26 x 16                 |                           | 406.4     |            |
| 26 x 14                 |                           | 355.6     |            |
| 28 x 26                 | 711.2                     | 660.4     | 609.6      |
| 28 x 24                 |                           | 609.6     |            |
| 28 x 22                 |                           | 559.0     |            |
| 28 x 20                 |                           | 508.0     |            |
| 28 x 18                 |                           | 457.2     |            |
| 28 x 16                 |                           | 406.4     |            |
| 28 x 14                 |                           | 355.6     |            |
| 30 x 28                 | 762.0                     | 711.2     | 609.6      |
| 30 x 26                 |                           | 660.4     |            |
| 30 x 24                 |                           | 609.6     |            |
| 30 x 22                 |                           | 559.0     |            |
| 30 x 20                 |                           | 508.0     |            |
| 30 x 18                 |                           | 457.0     |            |
| 30 x 16                 |                           | 406.4     |            |
| 30 x 14                 |                           | 355.6     |            |
| 32 x 30                 | 813.0                     | 762.0     | 609.6      |
| 32 x 28                 |                           | 711.0     |            |
| 32 x 26                 |                           | 660.0     |            |
| 32 x 24                 |                           | 610.0     |            |
| 32 x 22                 |                           | 559.0     |            |
| 32 x 20                 |                           | 508.0     |            |
| 34 x 32                 | 863.6                     | 812.8     | 609.6      |
| 34 x 30                 |                           | 762.0     |            |
| 34 x 28                 |                           | 711.0     |            |
| 34 x 26                 |                           | 711.2     |            |
| 34 x 24                 |                           | 660.4     |            |
| 34 x 22                 |                           | 559.0     |            |
| 36 x 34                 | 914.0                     | 864.0     | 609.6      |
| 36 x 32                 |                           | 813.0     |            |
| 36 x 30                 |                           | 762.0     |            |
| 36 x 28                 |                           | 711.0     |            |
| 36 x 26                 |                           | 660.0     |            |
| 36 x 24                 |                           | 610.0     |            |
| 36 x 22                 |                           | 559.0     |            |
| 38 x 36                 | 965.0                     | 914.0     | 609.6      |
| 38 x 34                 |                           | 864.0     |            |
| 38 x 32                 |                           | 813.0     |            |
| 38 x 30                 |                           | 762.0     |            |
| 38 x 28                 |                           | 711.0     |            |
| 38 x 26                 |                           | 660.0     |            |
| 38 x 24                 |                           | 610.0     |            |

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel |           | End-to-end |
|-------------------------|---------------------------|-----------|------------|
|                         | Large End                 | Small End |            |
| 40 x 38                 | 1016.0                    | 965.0     | 609.6      |
| 40 x 36                 |                           | 914.0     |            |
| 40 x 34                 |                           | 864.0     |            |
| 40 x 32                 |                           | 813.0     |            |
| 40 x 30                 |                           | 762.0     |            |
| 40 x 28                 |                           | 711.0     |            |
| 42 x 40                 | 1067.0                    | 1016.0    | 609.6      |
| 42 x 38                 |                           | 965.0     |            |
| 42 x 36                 |                           | 914.4     |            |
| 42 x 34                 |                           | 863.6     |            |
| 42 x 32                 |                           | 812.8     |            |
| 42 x 30                 |                           | 762.0     |            |
| 42 x 28                 |                           | 711.0     |            |
| 44 x 42                 | 1117.6                    | 1066.8    | 609.6      |
| 44 x 40                 |                           | 1016.0    |            |
| 44 x 38                 |                           | 965.2     |            |
| 44 x 36                 |                           | 914.4     |            |
| 44 x 34                 |                           | 864.0     |            |
| 44 x 32                 |                           | 813.0     |            |
| 46 x 44                 | 1168.4                    | 1117.6    | 711.2      |
| 46 x 42                 |                           | 1066.8    |            |
| 46 x 40                 |                           | 1016.0    |            |
| 46 x 38                 |                           | 965.2     |            |
| 46 x 36                 |                           | 914.0     |            |
| 46 x 34                 |                           | 864.0     |            |
| 48 x 46                 | 1219.2                    | 1168.4    | 711.2      |
| 48 x 44                 |                           | 1117.6    |            |
| 48 x 42                 |                           | 1066.8    |            |
| 48 x 40                 |                           | 1016.0    |            |
| 48 x 38                 |                           | 965.0     |            |
| 48 x 36                 |                           | 914.0     |            |
| 52 x 48                 | 1321.0                    | 1219.0    | 711.2      |
| 52 x 46                 |                           | 1168.0    |            |
| 52 x 44                 |                           | 1118.0    |            |
| 52 x 42                 |                           | 1067.0    |            |
| 52 x 40                 |                           | 1016.0    |            |
| 56 x 52                 | 1422.0                    | 1321.0    | 711.2      |
| 56 x 48                 |                           | 1219.0    |            |
| 56 x 44                 |                           | 1118.0    |            |
| 52 x 40                 |                           | 1016.0    |            |
| 60 x 56                 | 1524.0                    | 1422.0    | 711.2      |
| 60 x 52                 |                           | 1321.0    |            |
| 60 x 48                 |                           | 1219.0    |            |
| 60 x 44                 |                           | 1118.0    |            |
|                         |                           |           |            |
|                         |                           |           |            |
|                         |                           |           |            |



## Pipe Caps



MSS SP-75 ANSI B16.9 (in mm)

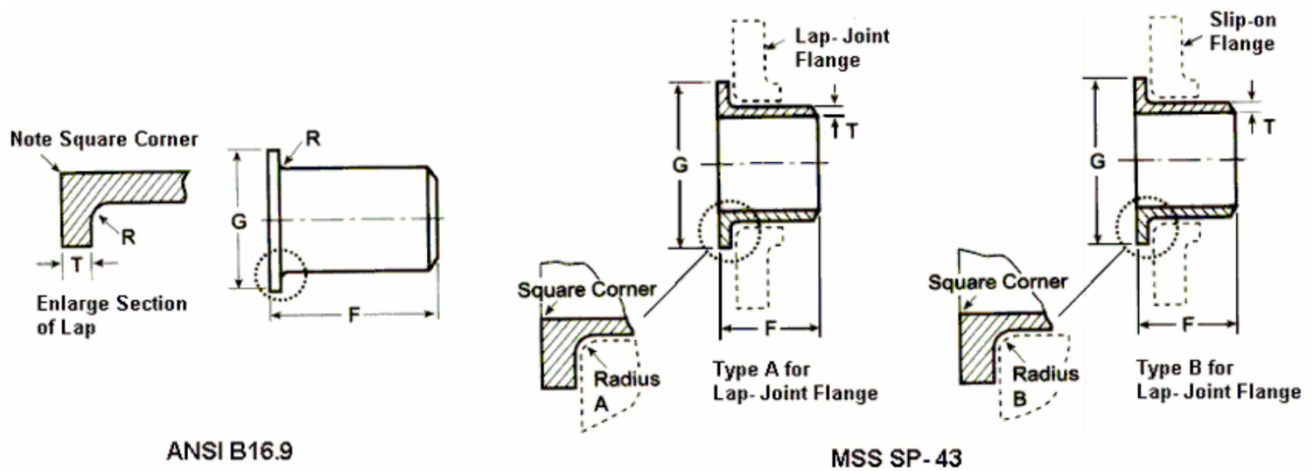
| Nominal Pipe Size (NPS) | Outside Diameter at Bevel D | Length (2) E | Limiting Wall Thickness for Length E | Length (3) E1 |
|-------------------------|-----------------------------|--------------|--------------------------------------|---------------|
| 1/2                     | 21.3                        | 25.4         | 4.6                                  | 25.4          |
| 3/4                     | 26.7                        | 25.4         | 3.8                                  | 25.4          |
| 1                       | 33.4                        | 38.1         | 4.6                                  | 38.1          |
| 1-1/4                   | 42.2                        | 38.1         | 4.8                                  | 38.1          |
| 1-1/2                   | 48.3                        | 38.1         | 5.1                                  | 38.1          |
| 2                       | 60.3                        | 38.1         | 5.6                                  | 44.4          |
| 2-1/2                   | 73.0                        | 38.1         | 7.1                                  | 50.8          |
| 3                       | 88.9                        | 50.8         | 7.6                                  | 63.5          |
| 3-1/2                   | 101.6                       | 63.5         | 8.1                                  | 76.2          |
| 4                       | 114.3                       | 63.5         | 8.6                                  | 76.2          |
| 5                       | 141.3                       | 76.2         | 9.7                                  | 88.9          |
| 6                       | 168.3                       | 88.9         | 10.9                                 | 101.6         |
| 8                       | 219.1                       | 101.6        | 12.7                                 | 127.0         |
| 10                      | 273.1                       | 127.0        | 12.7                                 | 152.4         |
| 12                      | 323.9                       | 152.4        | 12.7                                 | 177.8         |
| 14                      | 355.6                       | 165.1        | 12.7                                 | 190.5         |
| 16                      | 406.4                       | 177.8        | 12.7                                 | 203.2         |
| 18                      | 457.2                       | 203.2        | 12.7                                 | 228.6         |
| 20                      | 508.0                       | 228.6        | 12.7                                 | 254.0         |
| 22                      | 558.8                       | 254.0        | 12.7                                 | 254.0         |
| 24                      | 609.6                       | 266.7        | 12.7                                 | 304.8         |
| 26                      | 660.4                       | 266.7        |                                      |               |
| 28                      | 711.2                       | 266.7        |                                      |               |
| 30                      | 762.0                       | 266.7        |                                      |               |
| 32                      | 812.8                       | 266.7        |                                      |               |
| 34                      | 863.6                       | 266.7        |                                      |               |
| 36                      | 914.4                       | 266.7        |                                      |               |
| 38                      | 965.2                       | 304.8        |                                      |               |
| 40                      | 1016.0                      | 304.8        |                                      |               |
| 42                      | 1066.8                      | 304.8        |                                      |               |
| 44                      | 1117.6                      | 342.9        |                                      |               |
| 46                      | 1168.4                      | 342.9        |                                      |               |
| 48                      | 1219.2                      | 342.9        |                                      |               |

Wall thickness for caps up to and including 36" conform to ANSI B36.10 specifications. Caps 38" and larger conform to XS specifications for wall thickness of 36". These are Wellgrow's standards as no internationally recognized standards have been set for such large size wall thickness.

- (1) The shape of these caps shall be ellipsoidal and shall conform to the shape requirements as given in the ASME boiler and pressure vessel code.
- (2) Length E applies for thickness not exceeding that given in column "limiting wall thickness for length E".
- (3) Length E1 applies for thickness greater than that given in column "limiting wall thickness" for NPS 24 and smaller. For NPS 26 and larger, length E1 shall be by agreement between manufacturer and purchaser.



## Stub Ends



MSS SP-43 ANSI B16.9 (in mm)

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel | Outside Diameter of Barrel |        | Length F |       | Radius of Fillet R |            | Diameter of Lap G |
|-------------------------|---------------------------|----------------------------|--------|----------|-------|--------------------|------------|-------------------|
|                         |                           | Min.                       | Max.   | ANSI     | MSS   | ANSI & MSS Type A  | MSS Type B |                   |
| 1/2                     | 21.3                      | 20.55                      | 22.76  | 76.2     | 50.8  | 3.0                | 0.8        | 35.0              |
| 3/4                     | 26.7                      | 25.88                      | 28.09  | 76.2     | 50.8  | 3.0                | 0.8        | 42.9              |
| 1                       | 33.4                      | 32.61                      | 34.95  | 101.6    | 50.8  | 3.0                | 0.8        | 50.8              |
| 1-1/4                   | 42.2                      | 41.38                      | 43.59  | 101.6    | 50.8  | 4.8                | 0.8        | 63.5              |
| 1-1/2                   | 48.3                      | 47.47                      | 49.94  | 101.6    | 50.8  | 6.4                | 0.8        | 73.2              |
| 2                       | 60.3                      | 59.54                      | 62.38  | 152.4    | 63.5  | 7.9                | 0.8        | 91.9              |
| 2-1/2                   | 73.0                      | 72.24                      | 75.34  | 152.4    | 63.5  | 7.9                | 0.8        | 104.6             |
| 3                       | 88.9                      | 88.11                      | 91.34  | 152.4    | 63.5  | 9.7                | 0.8        | 127.0             |
| 3-1/2                   | 101.6                     | 100.81                     | 104.04 | 152.4    | 76.2  | 9.7                | 0.8        | 139.7             |
| 4                       | 114.3                     | 113.51                     | 116.66 | 152.4    | 76.2  | 11.2               | 0.8        | 157.2             |
| 5                       | 141.3                     | 140.51                     | 144.35 | 203.2    | 76.2  | 11.2               | 1.5        | 185.7             |
| 6                       | 168.3                     | 167.49                     | 171.27 | 203.2    | 88.9  | 12.7               | 1.5        | 215.9             |
| 8                       | 219.1                     | 218.29                     | 222.07 | 203.2    | 101.6 | 12.7               | 1.5        | 269.7             |
| 10                      | 273.1                     | 272.26                     | 277.19 | 254.0    | 127.0 | 12.7               | 1.5        | 323.9             |
| 12                      | 323.9                     | 323.06                     | 327.99 | 254.0    | 152.4 | 12.7               | 1.5        | 381.0             |
| 14                      | 355.6                     | 354.81                     | 359.92 | 304.8    | 152.4 | 12.7               | 1.5        | 412.8             |
| 16                      | 406.4                     | 405.61                     | 410.97 | 304.8    | 152.4 | 12.7               | 1.5        | 469.9             |
| 18                      | 457.2                     | 456.41                     | 462.03 | 304.8    | 152.4 | 12.7               | 1.5        | 533.4             |
| 20                      | 508.0                     | 507.21                     | 514.10 | 304.8    | 152.4 | 12.7               | 1.5        | 584.2             |
| 22                      | 558.8                     | 558.01                     | 564.90 | 304.8    | 152.4 | 12.7               | 1.5        | 641.4             |
| 24                      | 609.6                     | 608.81                     | 615.70 | 304.8    | 152.4 | 12.7               | 1.5        | 692.2             |



## Wall Thickness Schedule

 JIS G3448 JIS G3455 ANSI B36.10M  
 JIS G3454 JIS G3459 ANSI B36.19M (in mm)

| Nominal Pipe Size |       | Outside Diameter |        | Nominal Wall Thickness |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |
|-------------------|-------|------------------|--------|------------------------|---------|---------|-----|--------|----------|--------|--------|-------|--------|--------|--------|--------|---------|---------|---------|---------|------|
| A                 | B     | JIS              | ANSI   | Sch 5S                 | Sch 10S | Sch 20S | GS  | Sch 10 | LG (7.9) | Sch 20 | Sch 30 | STD   | Sch 40 | Sch 60 | XS     | Sch 80 | Sch 100 | Sch 120 | Sch 140 | Sch 160 | XXS  |
| 8                 | 1/4   | 13.8             | 13.7   | 1.2                    | 1.65    | 2.0     | 2.3 | -      | -        | -      | -      | (2.2) | 2.2    | 2.4    | (3.0)  | 3.0    | -       | -       | -       | -       | -    |
| 10                | 3/8   | 17.3             | 17.1   | 1.2                    | 1.65    | 2.0     | 2.3 | -      | -        | -      | -      | (2.3) | 2.3    | 2.8    | (3.2)  | 3.2    | -       | -       | -       | -       | -    |
| 15                | 1/2   | 21.7             | 21.3   | 1.65                   | 2.1     | 2.5     | 2.8 | -      | -        | -      | -      | (2.8) | 2.8    | 3.2    | (3.7)  | 3.7    | -       | -       | -       | 4.7     | 7.5  |
| 20                | 3/4   | 27.2             | 26.7   | 1.65                   | 2.1     | 2.5     | 2.8 | -      | -        | -      | -      | (2.9) | 2.9    | 3.4    | (3.9)  | 3.9    | -       | -       | -       | 5.5     | 7.8  |
| 25                | 1     | 34.0             | 33.4   | 1.65                   | 2.8     | 3.0     | 3.2 | -      | -        | -      | -      | (3.4) | 3.4    | 3.9    | (4.5)  | 4.5    | -       | -       | -       | 6.4     | 9.1  |
| 32                | 1-1/4 | 42.7             | 42.2   | 1.65                   | 2.8     | 3.0     | 3.5 | -      | -        | -      | -      | (3.6) | 3.6    | 4.5    | (4.9)  | 4.9    | -       | -       | -       | 6.4     | 9.7  |
| 40                | 1-1/2 | 48.6             | 48.3   | 1.65                   | 2.8     | 3.0     | 3.5 | -      | -        | -      | -      | (3.7) | 3.7    | 4.5    | (5.1)  | 5.1    | -       | -       | -       | 7.1     | 10.2 |
| 50                | 2     | 60.5             | 60.3   | 1.65                   | 2.8     | 3.5     | 3.8 | -      | -        | -      | -      | (3.9) | 3.9    | 4.9    | (5.5)  | 5.5    | -       | -       | -       | 8.7     | 11.1 |
| 65                | 2-1/2 | 76.3             | 73.0   | 2.1                    | 3.0     | 3.5     | 4.2 | -      | -        | -      | -      | (5.2) | 5.2    | 6.0    | (7.0)  | 7.0    | -       | -       | -       | 9.5     | 14.0 |
| 80                | 3     | 89.1             | 88.9   | 2.1                    | 3.0     | 4.0     | 4.2 | -      | -        | -      | -      | (5.5) | 5.5    | 6.6    | (7.6)  | 7.6    | -       | -       | -       | 11.1    | 15.2 |
| 90                | 3-1/2 | 101.6            | 101.6  | 2.1                    | 3.0     | 4.0     | 4.2 | -      | -        | -      | -      | (5.7) | 5.7    | 7.0    | (8.1)  | 8.1    | -       | -       | -       | 12.7    | -    |
| 100               | 4     | 114.3            | 114.3  | 2.1                    | 3.0     | 4.0     | 4.5 | -      | -        | -      | -      | (6.0) | 6.0    | 7.1    | (8.6)  | 8.6    | -       | 11.1    | -       | 13.5    | 17.1 |
| 125               | 5     | 139.8            | 141.3  | 2.8                    | 3.4     | 5.0     | 4.5 | -      | -        | -      | -      | (6.6) | 6.6    | 8.1    | (9.5)  | 9.5    | -       | 12.7    | -       | 15.9    | 19.0 |
| 150               | 6     | 165.2            | 168.3  | 2.8                    | 3.4     | 5.0     | 5.0 | -      | 5.0**    | -      | -      | (7.1) | 7.1    | 9.3    | (11.0) | 11.0   | -       | 14.3    | -       | 18.2    | 21.9 |
| 175               | 7     | 190.7            | -      | -                      | -       | -       | 5.3 | -      | -        | -      | -      | -     | -      | -      | -      | -      | -       | -       | -       | -       | -    |
| 200               | 8     | 216.3            | 219.1  | 2.8                    | 3.8     | 6.5     | 5.8 | -      | 5.8**    | 6.4    | 7.0    | (8.2) | 8.2    | 10.3   | (12.7) | 12.7   | 15.1    | 18.2    | 20.6    | 23.0    | 22.2 |
| 225               | 9     | 241.8            | -      | -                      | -       | -       | 6.2 | -      | -        | -      | -      | -     | -      | -      | -      | -      | -       | -       | -       | -       | -    |
| 250               | 10    | 267.4            | 273.1  | 3.4                    | 4.2     | 6.5     | 6.6 | -      | 6.6**    | 6.4    | 7.8    | (9.3) | 9.3    | 12.7   | 12.7   | 15.1   | 18.3    | 21.4    | 25.4    | 28.6    | 25.4 |
| 300               | 12    | 318.5            | 323.9  | 4.0                    | 4.6     | 6.5     | 6.9 | -      | 6.9**    | 6.4    | 8.4    | 9.5   | 10.3   | 14.3   | 12.7   | 17.4   | 21.4    | 25.4    | 28.6    | 33.3    | 25.4 |
| 350               | 14    | 355.6            | 355.6  | 4.0                    | 4.8     | 7.9     | 7.9 | 6.4    | 7.9      | 7.9    | 9.5    | 9.5   | 11.1   | 15.1   | 12.7   | 19.0   | 23.8    | 27.8    | 31.8    | 35.7    | -    |
| 400               | 16    | 406.4            | 406.4  | 4.2                    | 4.8     | 7.9     | 7.9 | 6.4    | 7.9      | 7.9    | 9.5    | 9.5   | 12.7   | 16.7   | 12.7   | 21.4   | 26.2    | 30.9    | 36.5    | 40.5    | -    |
| 450               | 18    | 457.2            | 457.2  | 4.2                    | 4.8     | 7.9     | 7.9 | 6.4    | 7.9      | 7.9    | 11.1   | 9.5   | 14.3   | 19.0   | 12.7   | 23.8   | 29.4    | 34.9    | 39.7    | 45.2    | -    |
| 500               | 20    | 508.0            | 508.0  | 4.8                    | 5.5     | 7.9     | 7.9 | 6.4    | 7.9      | 9.5    | 12.7   | 9.5   | 15.1   | 20.6   | 12.7   | 26.2   | 32.5    | 38.1    | 44.4    | 50.0    | -    |
| 550               | 22    | 558.8            | 558.8  | 4.8                    | 5.5     | -       | -   | 6.4    | 7.9      | 9.5    | 12.7   | 9.5   | -      | 22.2   | 12.7   | 28.6   | 34.9    | 41.3    | 47.6    | 54.0    | -    |
| 600               | 24    | 609.6            | 609.6  | 5.5                    | 6.4     | -       | -   | 6.4    | 7.9      | 9.5    | 14.3   | 9.5   | 17.5   | 24.6   | 12.7   | 31.0   | 38.9    | 46.0    | 52.4    | 59.5    | -    |
| 650               | 26    | 660.4            | 660.4  | -                      | -       | -       | -   | 7.9    | 7.9      | 12.7   | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 700               | 28    | 711.2            | 711.2  | -                      | -       | -       | -   | 7.9    | 7.9      | 12.7   | 15.9   | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 750               | 30    | 762.0            | 762.0  | 6.4                    | 7.9     | -       | -   | 7.9    | 7.9      | 12.7   | 15.9   | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 800               | 32    | 812.8            | 812.8  | -                      | -       | -       | -   | 7.9    | 7.9      | 12.7   | 15.9   | 9.5   | 17.5   | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 850               | 34    | 863.6            | 863.6  | -                      | -       | -       | -   | 7.9    | 7.9      | 12.7   | 15.9   | 9.5   | 17.5   | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 900               | 36    | 914.4            | 914.4  | -                      | -       | -       | -   | 7.9    | 7.9      | 12.7   | 15.9   | 9.5   | 19.1   | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 950               | 38    | 965.2            | 965.2  | -                      | -       | -       | -   | -      | 7.9      | 12.7   | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1000              | 40    | 1016.0           | 1016.0 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1050              | 42    | 1066.8           | 1066.8 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1100              | 44    | 1117.6           | 1117.6 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1150              | 46    | 1168.4           | 1168.4 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1200              | 48    | 1219.2           | 1219.2 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1250              | 50    | 1270.0           | 1270.0 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1300              | 52    | 1320.8           | 1320.8 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1350              | 54    | 1371.6           | 1371.6 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1400              | 56    | 1422.4           | 1422.4 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1450              | 58    | 1473.2           | 1473.2 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1500              | 60    | 1524.0           | 1524.0 | -                      | -       | -       | -   | -      | 7.9      | -      | -      | 9.5   | -      | -      | 12.7   | -      | -       | -       | -       | -       | -    |
| 1600              | 64    | 1626.0           |        |                        |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |
| 1700              | 68    | 1727.0           |        |                        |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |
| 1800              | 72    | 1829.0           |        |                        |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |
| 1900              | 76    | 1932.0           |        |                        |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |
| 2000              | 80    | 2032.0           |        |                        |         |         |     |        |          |        |        |       |        |        |        |        |         |         |         |         |      |

(1) \* Wellgrow's standard.

(2) \*\*Applied only small end side of the tee and reducers.

(3) The numerical values in parenthesis are the same thickness as Sch. 40 or Sch. 80.

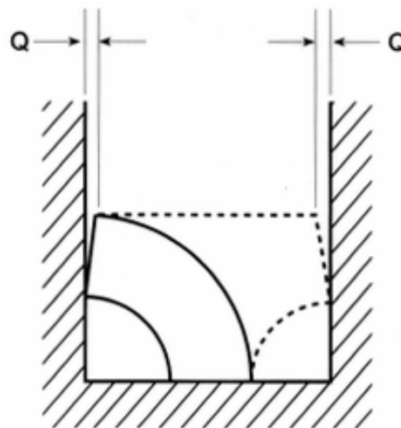


## ANSI Dimensional Tolerances

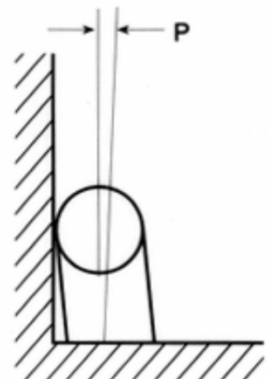
ANSI B16.9, B16.28 (in mm)  
\* Wellgrow's standard

| Nominal<br>Pipe Size | All Fittings                          |                                    |                                                   | 90° and 45°<br>Elbows      | Tees                       | Reducers          | Caps              | 180° Returns                           |                                |                      |     |
|----------------------|---------------------------------------|------------------------------------|---------------------------------------------------|----------------------------|----------------------------|-------------------|-------------------|----------------------------------------|--------------------------------|----------------------|-----|
|                      | Outside<br>Diameter at<br>Bevel<br>OD | Inside<br>Diameter at<br>End<br>ID | Wall<br>Thickness                                 | Center-to-end<br>Dimension | Center-to-end<br>Dimension | Overall<br>Length | Overall<br>Length | Center-to-<br>center<br>Dimension<br>P | Back-to-face<br>Dimension<br>K | Alignment of<br>Ends |     |
|                      |                                       |                                    | T                                                 | A, B                       | C, M                       | H                 | E                 |                                        |                                | U                    |     |
| 1/2~2-1/2            | +1.5<br>-0.7                          | 0.7                                | Not less than<br>87.5% of<br>nominal<br>thickness | 1.5                        | 1.5                        | 1.5               | 3.0               | 6.3                                    | 6.3                            | 0.7                  |     |
| 3~4                  | 1.5                                   | 1.5                                |                                                   |                            |                            |                   | 6.3               |                                        |                                |                      | 0.7 |
| 5~8                  | +2.2<br>-1.5                          |                                    |                                                   |                            |                            |                   |                   |                                        |                                |                      |     |
| 10~18                | +4.0<br>-3.0                          | 3.0                                |                                                   | 2.2                        | 2.2                        | 2.2               |                   | 6.3                                    | 9.6                            | 0.7                  |     |
| 20~24                | +6.3<br>-4.8                          | 4.8                                |                                                   | 3.0                        | 3.0                        | 4.8               | 9.6               |                                        |                                |                      |     |
| 26~30                |                                       |                                    |                                                   | 4.8                        | 4.8                        |                   |                   |                                        |                                |                      |     |
| 32~48                |                                       |                                    |                                                   | 9.5<br>-6.4                | 6.4                        | 9.5               | 9.5               |                                        |                                |                      | 9.5 |
| *50~60               | +12.7<br>-9.5                         | 9.5                                |                                                   | 12.7                       | -                          | -                 | -                 |                                        |                                |                      |     |
| *62~70               | +15.9<br>-11.9                        | 11.9                               |                                                   | 15.9                       |                            |                   |                   |                                        |                                |                      |     |

| Nominal<br>Pipe Size | Angularity Tolerance |           |
|----------------------|----------------------|-----------|
|                      | Off Angle            | Off Plane |
|                      | Q                    | P         |
| 1/2~4                | 0.7                  | 1.5       |
| 5~8                  | 1.5                  | 3.0       |
| 10~12                | 2.2                  | 4.8       |
| 14~16                |                      | 6.3       |
| 18~24                | 3.0                  | 9.6       |
| 26~30                | 4.8                  |           |
| 32~42                |                      | 12.7      |
| 44~48                |                      | 19.0      |
| *50~60               | 6.4                  |           |
| *62~70               | 9.5                  |           |
| *72~80               | 11.9                 |           |



Off Angle



Off Plane





## MSS Dimensional Tolerances

MSS SP-43 (in mm)

| Nominal Pipe Size | All Fittings                              |                                                   | 90° Elbows<br>45° Elbows<br>Tees         | Reducers<br>Lap Joint<br>Stub Ends | Caps                   | 180° Returns                       |                                |                           | Lap Joint<br>Stub Ends           |                                 |
|-------------------|-------------------------------------------|---------------------------------------------------|------------------------------------------|------------------------------------|------------------------|------------------------------------|--------------------------------|---------------------------|----------------------------------|---------------------------------|
|                   | Outside (1)<br>Diameter at<br>Welding End | Wall<br>Thickness                                 | Center-to-end<br>Dimension<br>A, B, C, M | Overall<br>Length<br>F, H          | Overall<br>Length<br>E | Center-to-center<br>Dimension<br>O | Back-to-face<br>Dimension<br>K | Alignment<br>of Ends<br>U | Fillet (2)<br>Radius of Lap<br>A | Outside<br>Diameter of Lap<br>G |
| 1/2~1-1/2         | 0.8                                       | Not less than<br>87.5% of<br>nominal<br>thickness | 1.6                                      | 1.6                                | 3.0                    | 6.4                                | 6.4                            | 0.8                       | +0<br>-0.8                       | +0<br>-0.8                      |
| 2~3-1/2           | 0.8                                       |                                                   | 1.6                                      | 1.6                                | 3.0                    | 6.4                                | 6.4                            | 0.8                       | +0<br>-0.8                       | +0<br>-0.8                      |
| 4                 | 0.8                                       |                                                   | 1.6                                      | 1.6                                | 3.0                    | 6.4                                | 6.4                            | 0.8                       | +0<br>-1.6                       | +0<br>-0.8                      |
| 5~8               | +1.6<br>-0.8                              |                                                   | 1.6                                      | 1.6                                | 6.4                    | 6.4                                | 6.4                            | 0.8                       | +0<br>-1.6                       | +0<br>-0.8                      |
| 10~18             | +2.3<br>-0.8                              |                                                   | 2.3                                      | 2.3                                | 6.4                    | 9.7                                | 6.4                            | 1.6                       | +0<br>-1.6                       | +0<br>-1.6                      |
| 20~24             | +3.0<br>-0.8                              |                                                   | 2.3                                      | 2.3                                | 6.4                    | 9.7                                | 6.4                            | 1.6                       | +0<br>-1.6                       | +0<br>-1.6                      |

- (1) Out of roundness is the vector sum of the plus and minus tolerance.  
 (2) Fillet B radius is the maximum.

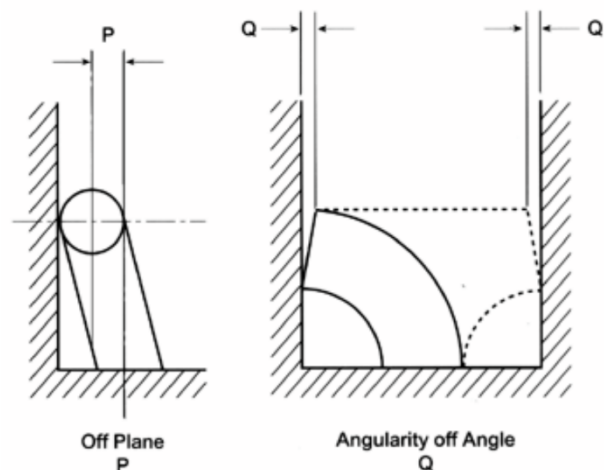
## MSS Dimensional Tolerances

MSS SP-75 (in mm)

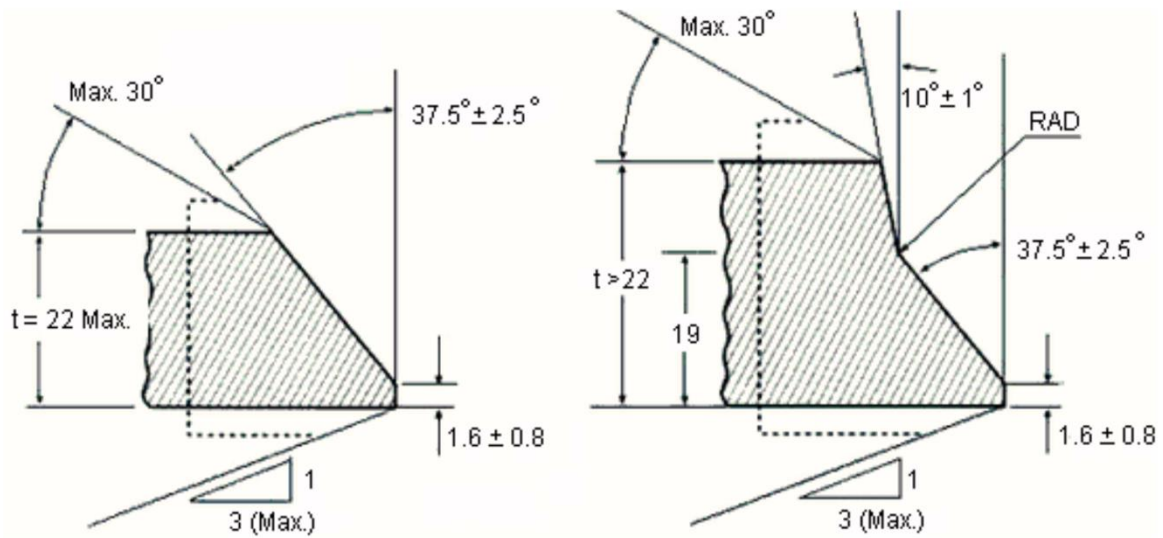
| Nominal<br>Pipe Size | Inside (1)<br>Diameter<br>at End | Minimum (3)<br>Wall<br>Thickness | Out-of-roundness (2) |       |                                  | 90°, 60°, 45°, 30° Elbows<br>& Tees<br>Center-to-end Dimension<br>A, B, C, M |     | Reducers<br>Overall<br>Length | Caps<br>Overall<br>Length | Angularity<br>Off Angle | Elbows<br>Off<br>Plane | Eccentric and<br>Concentric<br>Reducers Off<br>Plane<br>P (6) |
|----------------------|----------------------------------|----------------------------------|----------------------|-------|----------------------------------|------------------------------------------------------------------------------|-----|-------------------------------|---------------------------|-------------------------|------------------------|---------------------------------------------------------------|
|                      |                                  |                                  | At Ends of fittings  |       | Throughout (4)<br>Body of Elbows |                                                                              |     |                               |                           |                         |                        |                                                               |
|                      |                                  |                                  | Elbows (5)           | Other |                                  | 1-1/2R & Tee                                                                 | 3R  |                               |                           |                         |                        |                                                               |
| 16~24                | 2.3                              | Nominal                          | 4.8                  | 3.0   | 2.5%                             | 2.3                                                                          | 3.0 | 2.3                           | 6.4                       | 1.5                     | 6.4                    | 2.5%                                                          |
| 26~36                | 2.3                              | -0.25                            | (5)                  | 3.0   | 2.5%                             | 3.0                                                                          | 6.4 | 4.8                           | 9.6                       | 2.3                     | 12.7                   | 2.5%                                                          |
| 38~48                | 3.0                              |                                  | (5)                  | 3.0   | 2.5%                             | 4.8                                                                          | 9.6 | 9.6                           | 9.6                       | 3.0                     | 19.1                   | 2.5%                                                          |

- (1) The inside diameter at end shall be determined by circumferential measurement, and the tolerance refers to variations from nominal I.D. calculation by  $(OD \text{ nom} - 2t \text{ nom})$ .  
 (2) Out-of-roundness tolerances shall be the difference between the maximum and minimum diameters measured on any radial cross-section.  
 (3) Minus 0.01 in. except that isolated non-continuous reductions are permitted in accordance with subsection 13.2.1. Excess thickness whether on inside or outside is to be treated in accordance with sketch given in figure 3.  
 (4) When elbows are intended for field segmenting, out-of-roundness tolerance may be furnished to 1% by agreement between the manufacturer and the purchaser. It is recognized that extra thickness, if any, may be on the I.D.  
 (5) Out-of-roundness tolerances at ends shall be 1% of diameter for NPS 26 and larger.  
 (6) Percent of O.D.

Outside diameter may be tapered at angle up to 30° beyond weld level.



## Weld End Preparation



(a) Plain bevel

(b) Compound bevel

| Nominal Pipe Wall Thickness (t) | End Preparation                                          |
|---------------------------------|----------------------------------------------------------|
| Less than $x^*$                 | Cut square or slightly chamfer, at manufacturer's option |
| $x^*$ to 22 included            | Plain bevel as in sketch "a" above                       |
| More than 22                    | Compound bevel as in sketch "b" above                    |

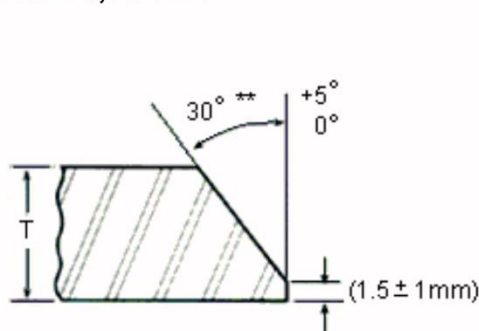
$x^* = 5$  for carbon steel, ferritic alloy steel or wrought iron;  
 $4$  for austenitic alloy steel

(in mm)

**Notes:**

- (1) End preparations are in accordance with ANSI B16.25 Paragraph 4.2.
- (2) End preparations conforming to customer specifications will be specially manufactured upon consultation.

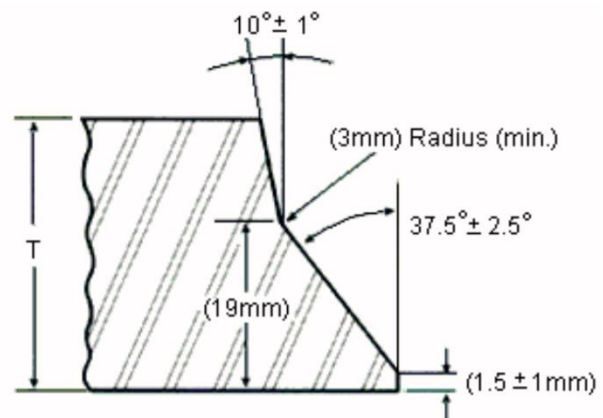
## MSS SP-75, API 5L



\* Or 1 inch (25mm) at option of the manufacturer.

\*\* Fittings size 24 and smaller may be furnished with  $37\frac{1}{2}$  bevel at option of manufacturer.

**Recommended bevel for wall thickness (T)  
at end of fitting, 19mm\* or less.**



**Recommended bevel for wall thickness (T)  
at end of fitting, greater than 19mm.**





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