misbah global
Buttweld Fittings

# Technical Datasheet

*Only for reference purposes only.

# Material

| Ferrous Material | | | | | |
|---|---|---|---|---|---|
| Material Classification | | | | Comparison as nations | |
| Large | Middle | Small | | ASTM (U.S.A) | |
| | | | | Designation | Identification |
| Ferrous (Base Mat'l:Fe) | Carbon Steel | Ambient and Higher Temperature Service | | A234 | WPB |
| | | | | | WPC |
| | | Low Temperature Service | | A420 | WPL3 |
| | | | | | WPL6 |
| | | | | | WPL9 |
| | Alloy Steel (Cr ≥ 1%) | Low Alloy (1% ≤ Cr ≤ 9%) | | A234 | WP1 |
| | | | | | WP12 |
| | | | | | WP11 |
| | | | | | WP22 |
| | | | | | WP5 |
| | | | | | WP23 |
| | | | | | WP9 |
| | | | | | WP91 |
| | | | | | WP92 |
| | | High Alloy (Cr ≥ 12%) :Stainless Steel | Martensitic Stainless Steel | A815 | WP410 |
| | | | Ferritic Stainless Steel | | WP430 |
| | | | Austenitic Stainless Steel | A403 | WP304/L |
| | | | | | WP316/L |
| | | | | | WP317/L |
| | | | | | WP321/H |
| | | | | | WP347/H |
| | | | Super Austenitic Stainless Steel | A403 | S31254 |
| | | | | | 904L |
| | | | Ferritic / Austenitic (Duplex / Super Duplex) | A815 | S31803 |
| | | | | | S32750 |
| | | | | | S32760 |

- Applicable Code/Standard : ASTM Part A, Latest Edition,
  Non Registered materials on ASTM Latest Edition.

| Non-Ferrous Material Comparison | | |
|---|---|---|
| Material Classification | Trade Mark | UNS NO. |
| Non-Ferrous (Base Mat'l : Ni) | Inconel 600 | N06600 |
| | Inconel 690 | N06690 |
| | Inconel 800H / 800HT | N08810 / N08811 |
| | Inconel 625 | N06625 |
| | Incoloy 825 | N08825 |
| | Hastelloy B2 | N10665 |
| | Hastelloy C276 | N10276 |
| | Hastelloy C22 | N06022 |
| | Incoloy 020 | N08020 |
| | Monel 400 | N04400 |
| | Monel K500 | N05500 |
| Non-Ferrous (Base Mat'l : Cu) | Cu-Ni 70/30 | C71500 |
| | Cu-Ni 90/10 | C70600 |

- Applicable Code/Standard : ASTM Part B, Latest Edition.

# Specification

## KS : KOREAN INDUSTRIAL STANDARDS

| | |
|---|---|
| KS B 1522 | Steel Butt Welding Pipe Fittings for Oidinary use and Fuel Gas. |
| KS B 1541 | Steel Butt Welding Pipe Fittings. |
| KS B 1542 | Steel Socket Welding Pipe Fittings. |
| KS B 1543 | Steel Plate Butt Welding Pipe Fittings. |

## JIS : JAPANESE INDUSTRIAL STANDARDS

| | |
|---|---|
| JIS B 2311 | Steel Butt Welding Pipe Fittings for Ordinary use. |
| JIS B 2312 | Steel Butt Welding Pipe Fittings. |
| JIS B 2313 | Steel Plate Butt Welding Pipe Fittings. |
| JIS B 2316 | Steel Socket Welding Pipe Fittings. |

## ASTM : AMERICAN SOCIETY FOR TESTING AND MATERIALS

| | |
|---|---|
| ASTM A 105 | Carbon Steel Forgings for Piping Applications |
| ASTM A 182 | Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for high Temperature Service |
| ASTM A 234 | Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| ASTM A 350 | Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components |
| ASTM A 403 | Wrought Austenitic Stainless Steel Piping Fittings |
| ASTM A 420 | Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service |
| ASTM A 694 | Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service |
| ASTM A 815 | Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings |
| ASTM A 860 | Wrought High-Strength Low-Alloy Steel Butt-Welding Fittings |
| ASTM B 366 | Factory-Made Wrought Nickel and Nickel Alloy Fittings |

## MSS : MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY

| | |
|---|---|
| MSS SP-25 | Standard Marketing System for Valves, Fittings, Flanges and Unions. |
| MSS SP-43 | Wrought Stainless Steel Butt Welding Fittings. |
| MSS SP-44 | Standard for Steel Pipe Line Flanges. |
| MSS SP-75 | Specification for High Test Wrought Butt Welding Fittings. |
| MSS SP-79 | Socket Welding Reducer Inserts. |
| MSS SP-83 | Carbon Steel Pipe Union Socket welding and Threaded. |
| MSS SP-87 | Factory-Made Butt Welding Fittings for Class 1 Nuclear Piping Applications. |
| MSS SP-95 | Swage(d) Nipples and Bull Plugs. |
| MSS SP-97 | Integrally Reinforced Forged Branch Outlet Fittings-socket Welding, Threaded and Butt Welding Ends. |

## ASME : AMERICAN SOCIETY OF MECHANICAL ENGINEERS
## ASME : ASME BOILER AND PRESSURE VESSEL CODE AN INTERNATIONAL CODE

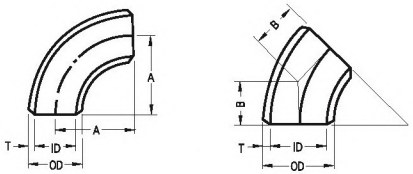
| | |
|---|---|
| ASME B 16.5 | Pipe Flanges and Flanged Fittings. |
| ASME B 16.9 | Factory Made Wrought Steel Butt Welding Fittings. |
| ASME B 16.11 | Forged Fittings, Socket welding and Threaded |
| ASME B 16.25 | Butt Welding Ends. |
| ASME B 36.10 | Welded and Seamless Wrought Steel Pipe. |
| ASME B 36.19 | Stainless Steel Pipe. |
| ASME B31.1 | Power piping. |
| ASME B31.3 | Process piping. |
| ASME SECTION Ⅱ | Materials. |
| ASME SECTION Ⅲ | Rules for Construction of Nuclear Facirity Components. |
| ASME SECTION Ⅴ | Nondestructive Examination. |
| ASME SECTION Ⅷ | Rule for Construction of Pressure Vessels. |
| ASME SECTION Ⅸ | Welding and Brazing Qualifications. |

## API : AMERICAN PETROLEUM INSTITUTE

| | |
|---|---|
| API 5L | Line Pipe. |

# 90° Elbow (Long, Short)
# 45° Elbow (Long)

## Sch5s, Sch10s, Sch40s, Sch80s




ASME B16.9, MSS SP-43

(Unit : inch)

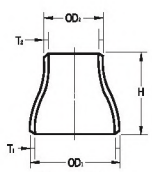
| Nominal Pipe Size | Outside Diameter O.D | Center to End | | | 5S | |
|---|---|---|---|---|---|---|
| | | Long | | Short | T | I.D |
| | | A | B | A | | |
| 1/2 | 0.840 | 1.50 | 0.62 | | 0.065 | 0.710 |
| 3/4 | 1.050 | 1.05 | 0.75 | | 0.065 | 0.920 |
| 1 | 1.315 | 1.50 | 0.88 | 1.00 | 0.065 | 1.185 |
| 1-1/4 | 1.660 | 1.88 | 1.00 | 1.25 | 0.065 | 1.530 |
| 1-1/2 | 1.900 | 2.25 | 1.12 | 1.50 | 0.065 | 1.770 |
| 2 | 2.375 | 3.00 | 1.38 | 2.00 | 0.065 | 2.245 |
| 2-1/2 | 2.875 | 3.75 | 1.75 | 2.50 | 0.083 | 2.709 |
| 3 | 3.500 | 4.25 | 2.00 | 3.00 | 0.083 | 3.334 |
| 3-1/2 | 4.000 | 5.25 | 2.25 | 3.50 | 0.083 | 3.834 |
| 4 | 4.500 | 6.00 | 2.50 | 4.00 | 0.083 | 4.334 |
| 5 | 5.563 | 7.50 | 3.12 | 5.00 | 0.109 | 5.345 |
| 6 | 6.625 | 9.00 | 3.75 | 6.00 | 0.109 | 6.407 |
| 8 | 8.625 | 12.00 | 5.00 | 8.00 | 0.109 | 8.407 |
| 10 | 10.750 | 15.00 | 6.25 | 10.00 | 0.134 | 10.482 |
| 12 | 12.750 | 18.00 | 7.50 | 12.00 | 0.156 | 12.438 |
| 14 | 14.000 | 21.00 | 8.75 | 14.00 | 0.156 | 13.688 |
| 16 | 16.000 | 24.00 | 10.00 | 16.00 | 0.165 | 15.670 |
| 18 | 18.000 | 27.00 | 11.25 | 18.00 | 0.165 | 17.670 |
| 20 | 20.000 | 30.00 | 12.50 | 20.00 | 0.188 | 19.624 |
| 22 | 22.000 | 33.00 | 13.50 | 22.00 | 0.188 | 21.624 |
| 24 | 24.000 | 36.00 | 15.00 | 24.00 | 0.218 | 23.564 |
| 30 | 30.000 | 45.00 | 18.50 | | 0.250 | 29.500 |

| Nominal Pipe Size | 10S | | 40S | | 80S | |
|---|---|---|---|---|---|---|
| | T | I.D | T | I.D | T | I.D |
| 1/2 | 0.083 | 0.674 | 0.109 | 0.622 | 0.147 | 0.546 |
| 3/4 | 0.083 | 0.884 | 0.113 | 0.824 | 0.154 | 0.742 |
| 1 | 0.109 | 1.097 | 0.133 | 1.049 | 0.179 | 0.957 |
| 1-1/4 | 0.109 | 1.442 | 0.140 | 1.380 | 0.191 | 1.278 |
| 1-1/2 | 0.109 | 1.682 | 0.145 | 1.610 | 0.200 | 1.500 |
| 2 | 0.109 | 2.157 | 0.154 | 2.067 | 0.218 | 1.939 |
| 2-1/2 | 0.120 | 2.635 | 0.203 | 2.469 | 0.276 | 2.323 |
| 3 | 0.120 | 3.260 | 0.216 | 3.068 | 0.300 | 2.900 |
| 3-1/2 | 0.120 | 3.760 | 0.226 | 3.548 | 0.318 | 3.364 |
| 4 | 0.120 | 4.260 | 0.237 | 4.026 | 0.337 | 3.826 |
| 5 | 0.134 | 5.295 | 0.258 | 5.047 | 0.375 | 4.813 |
| 6 | 0.134 | 6.357 | 0.280 | 6.065 | 0.432 | 5.761 |
| 8 | 0.148 | 8.329 | 0.322 | 7.981 | 0.500 | 7.625 |
| 10 | 0.165 | 10.420 | 0.365 | 10.020 | 0.500 | 9.750 |
| 12 | 0.180 | 12.390 | 0.375 | 12.000 | 0.500 | 11.750 |
| 14 | 0.188 | 13.624 | 0.375 | 13.250 | 0.500 | 13.000 |
| 16 | 0.188 | 15.624 | 0.375 | 15.250 | 0.500 | 15.000 |
| 18 | 0.188 | 17.624 | 0.375 | 17.250 | 0.500 | 17.000 |
| 20 | 0.218 | 19.564 | 0.375 | 19.250 | 0.500 | 19.000 |
| 22 | 0.218 | 21.564 | | | | |
| 24 | 0.250 | 23.500 | 0.375 | 23.250 | 0.500 | 23.000 |
| 30 | 0.312 | 29.376 | | | | |

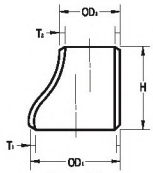
- For Bevel Details See Page 356
- For Dimensional Tolerances See Page 362
- Wall Thickness Conform to ASME B 36.19M Specifications

# Reducer

## Sch5s, Sch10s, Sch40s, Sch80s



Concentric



Eccentric

ASME B16.9, MSS SP-43

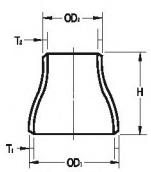
(Unit : inch)

| Nominal Pipe Size | Outside Diameter | | End to End | 5S | |
|---|---|---|---|---|---|
| | OD1 | OD2 | H | T1 | T2 |
| 3/4 X 1/2 | 1.050 | 0.840 | 1.50 | 0.065 | 0.065 |
| 1 X 3/4 | 1.315 | 1.050 | 2.00 | 0.065 | 0.065 |
| 1 X 1/2 | 1.315 | 0.840 | 2.00 | 0.065 | 0.065 |
| 1-1/4 X 1 | 1.660 | 1.315 | 2.00 | 0.065 | 0.065 |
| 1/4 X 3/4 | 1.660 | 1.050 | 2.00 | 0.065 | 0.065 |
| 1-1/4 X 1/2 | 1.660 | 0.840 | 2.00 | 0.065 | 0.065 |
| 1-1/2 X 1-1/4 | 1.900 | 1.660 | 2.50 | 0.065 | 0.065 |
| 1-1/2 X 1 | 1.900 | 1.315 | 2.50 | 0.065 | 0.065 |
| 1-1/2 X 3/4 | 1.900 | 1.050 | 2.50 | 0.065 | 0.065 |
| 1-1/2 X 1/2 | 1.900 | 0.840 | 2.50 | 0.065 | 0.065 |
| 2 X 1-1/2 | 2.375 | 1.900 | 3.00 | 0.065 | 0.065 |
| 2 X 1-1/4 | 2.375 | 1.660 | 3.00 | 0.065 | 0.065 |
| 2 X 1 | 2.375 | 1.315 | 3.00 | 0.065 | 0.065 |
| 2 X 3/4 | 2.375 | 1.050 | 3.00 | 0.065 | 0.065 |
| 2-1/2 X 2 | 2.875 | 2.375 | 3.50 | 0.083 | 0.065 |
| 2-1/2 X 1-1/2 | 2.875 | 1.900 | 3.50 | 0.083 | 0.065 |
| 2-1/2 X 1-1/4 | 2.875 | 1.660 | 3.50 | 0.083 | 0.065 |
| 3 X 2-1/2 | 3.500 | 2.875 | 3.50 | 0.083 | 0.083 |
| 3 X 2 | 3.500 | 2.375 | 3.50 | 0.083 | 0.065 |
| 3 X 1-1/2 | 3.500 | 1.900 | 3.50 | 0.083 | 0.065 |
| 3 X 1-1/4 | 3.500 | 1.660 | 3.50 | 0.083 | 0.065 |
| 3-1/2 X 3 | 4.000 | 3.500 | 4.00 | 0.083 | 0.083 |
| 3-1/2 X 2-1/2 | 4.000 | 2.875 | 4.00 | 0.083 | 0.083 |
| 3-1/2 X 2 | 4.000 | 2.375 | 4.00 | 0.083 | 0.065 |
| 4 X 3-1/2 | 4.500 | 4.000 | 4.00 | 0.083 | 0.083 |
| 4 X 3 | 4.500 | 3.500 | 4.00 | 0.083 | 0.083 |

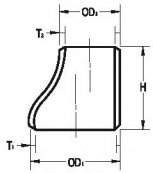
| Nominal Pipe Size | 10S | | 40S | | 80S | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T1 | T2 | T1 | T2 |
| 3/4 X 1/2 | 0.083 | 0.083 | 0.113 | 0.109 | 0.154 | 0.147 |
| 1 X 3/4 | 0.109 | 0.083 | 0.133 | 0.113 | 0.179 | 0.154 |
| 1 X 1/2 | 0.109 | 0.083 | 0.133 | 0.109 | 0.179 | 0.147 |
| 1-1/4 X 1 | 0.109 | 0.109 | 0.140 | 0.133 | 0.191 | 0.179 |
| 1/4 X 3/4 | 0.109 | 0.083 | 0.140 | 0.113 | 0.191 | 0.154 |
| 1-1/4 X 1/2 | 0.109 | 0.083 | 0.140 | 0.109 | 0.191 | 0.147 |
| 1-1/2 X 1-1/4 | 0.109 | 0.109 | 0.145 | 0.140 | 0.200 | 0.191 |
| 1-1/2 X 1 | 0.109 | 0.109 | 0.145 | 0.133 | 0.200 | 0.179 |
| 1-1/2 X 3/4 | 0.109 | 0.083 | 0.145 | 0.113 | 0.200 | 0.154 |
| 1-1/2 X 1/2 | 0.109 | 0.083 | 0.145 | 0.109 | 0.200 | 0.147 |
| 2 X 1-1/2 | 0.109 | 0.109 | 0.154 | 0.145 | 0.218 | 0.200 |
| 2 X 1-1/4 | 0.109 | 0.109 | 0.154 | 0.140 | 0.218 | 0.191 |
| 2 X 1 | 0.109 | 0.109 | 0.154 | 0.133 | 0.218 | 0.179 |
| 2 X 3/4 | 0.109 | 0.083 | 0.154 | 0.113 | 0.218 | 0.154 |
| 2-1/2 X 2 | 0.120 | 0.109 | 0.203 | 0.154 | 0.276 | 0.218 |
| 2-1/2 X 1-1/2 | 0.120 | 0.109 | 0.203 | 0.145 | 0.276 | 0.200 |
| 2-1/2 X 1-1/4 | 0.120 | 0.109 | 0.203 | 0.140 | 0.276 | 0.191 |
| 3 X 2-1/2 | 0.120 | 0.120 | 0.216 | 0.203 | 0.300 | 0.276 |
| 3 X 2 | 0.120 | 0.109 | 0.216 | 0.154 | 0.300 | 0.218 |
| 3 X 1-1/2 | 0.120 | 0.109 | 0.216 | 0.145 | 0.300 | 0.200 |
| 3 X 1-1/4 | 0.120 | 0.109 | 0.216 | 0.140 | 0.300 | 0.191 |
| 3-1/2 X 3 | 0.120 | 0.120 | 0.226 | 0.216 | 0.318 | 0.300 |
| 3-1/2 X 2-1/2 | 0.120 | 0.120 | 0.226 | 0.203 | 0.318 | 0.276 |
| 3-1/2 X 2 | 0.120 | 0.109 | 0.226 | 0.154 | 0.318 | 0.218 |
| 4 X 3-1/2 | 0.120 | 0.120 | 0.237 | 0.226 | 0.337 | 0.318 |
| 4 X 3 | 0.120 | 0.120 | 0.237 | 0.216 | 0.337 | 0.300 |

# Reducer

## Sch5s, Sch10s, Sch40s, Sch80s



Concentric



Eccentric

ASME B16.9, MSS SP-43

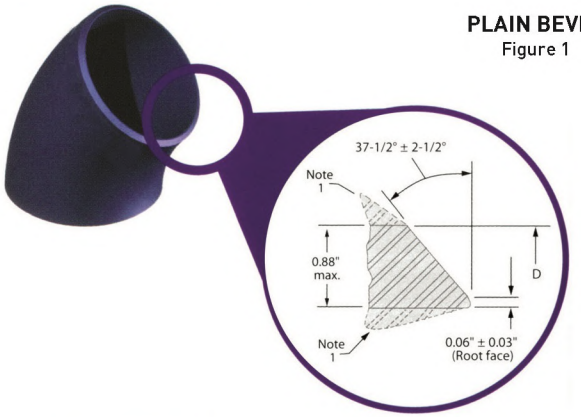
(Unit : inch)

| Nominal Pipe Size | Outside Diameter | | End to End | 5S | |
|---|---|---|---|---|---|
| | OD1 | OD2 | H | T1 | T2 |
| 4 X 2-1/2 | 4.500 | 2.875 | 4.00 | 0.083 | 0.083 |
| 4 X 2 | 4.500 | 2.375 | 4.00 | 0.083 | 0.065 |
| 5 X 4 | 5.563 | 4.500 | 5.00 | 0.109 | 0.083 |
| 5 X 3-1/2 | 5.563 | 4.000 | 5.00 | 0.109 | 0.083 |
| 5 X 3 | 5.563 | 3.500 | 5.00 | 0.109 | 0.083 |
| 5 X 2-1/2 | 5.563 | 2.875 | 5.00 | 0.109 | 0.083 |
| 6 X 5 | 6.625 | 5.563 | 5.50 | 0.109 | 0.109 |
| 6 X 4 | 6.625 | 4.500 | 5.50 | 0.109 | 0.083 |
| 6 X 3-1/2 | 6.625 | 4.000 | 5.50 | 0.109 | 0.083 |
| 6 X 3 | 6.625 | 3.500 | 5.50 | 0.109 | 0.083 |
| 8 X 6 | 8.625 | 6.625 | 6.00 | 0.109 | 0.109 |
| 8 X 5 | 8.625 | 5.563 | 6.00 | 0.109 | 0.109 |
| 8 X 4 | 8.625 | 4.500 | 6.00 | 0.109 | 0.083 |
| 10 X 8 | 10.750 | 8.625 | 7.00 | 0.134 | 0.109 |
| 10 X 6 | 10.750 | 6.625 | 7.00 | 0.134 | 0.109 |
| 10 X 5 | 10.750 | 5.563 | 7.00 | 0.134 | 0.109 |
| 12 X 10 | 12.750 | 10.750 | 8.00 | 0.156 | 0.134 |
| 12 X 8 | 12.750 | 8.625 | 8.00 | 0.156 | 0.109 |
| 12 X 6 | 12.750 | 6.625 | 8.00 | 0.156 | 0.109 |
| 14 X 12 | 14.000 | 12.750 | 13.00 | 0.156 | 0.156 |
| 14 X 10 | 14.000 | 10.750 | 13.00 | 0.156 | 0.134 |
| 14 X 8 | 14.000 | 8.625 | 13.00 | 0.156 | 0.109 |
| 16 X 14 | 16.000 | 14.000 | 14.00 | 0.165 | 0.156 |
| 16 X 12 | 16.000 | 12.750 | 14.00 | 0.165 | 0.156 |
| 16 X 10 | 16.000 | 10.750 | 14.00 | 0.165 | 0.134 |
| 18 X 16 | 18.000 | 16.000 | 15.00 | 0.165 | 0.165 |

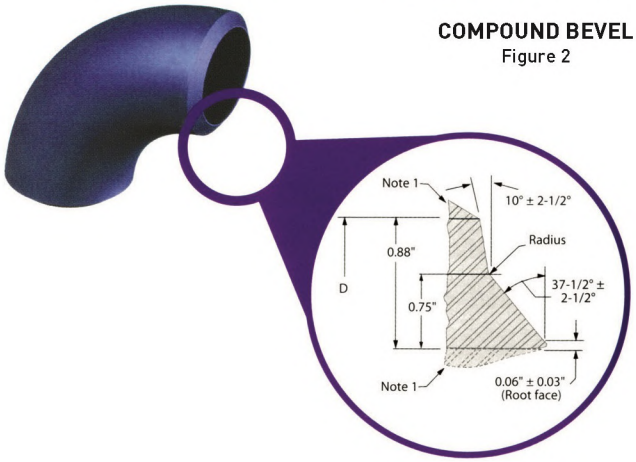
| Nominal Pipe Size | 10S | | 40S | | 80S | |
|---|---|---|---|---|---|---|
| | T1 | T2 | T1 | T2 | T1 | T2 |
| 4 X 2-1/2 | 0.120 | 0.120 | 0.237 | 0.203 | 0.337 | 0.276 |
| 4 X 2 | 0.120 | 0.109 | 0.237 | 0.154 | 0.337 | 0.218 |
| 5 X 4 | 0.134 | 0.120 | 0.258 | 0.237 | 0.375 | 0.337 |
| 5 X 3-1/2 | 0.134 | 0.120 | 0.258 | 0.226 | 0.375 | 0.318 |
| 5 X 3 | 0.134 | 0.120 | 0.258 | 0.216 | 0.375 | 0.300 |
| 5 X 2-1/2 | 0.134 | 0.120 | 0.258 | 0.203 | 0.375 | 0.276 |
| 6 X 5 | 0.134 | 0.134 | 0.280 | 0.258 | 0.432 | 0.375 |
| 6 X 4 | 0.134 | 1.120 | 0.280 | 0.237 | 0.432 | 0.337 |
| 6 X 3-1/2 | 0.134 | 1.120 | 0.280 | 0.226 | 0.432 | 0.318 |
| 6 X 3 | 0.134 | 1.120 | 0.280 | 0.216 | 0.432 | 0.300 |
| 8 X 6 | 0.148 | 0.134 | 0.322 | 0.280 | 0.500 | 0.432 |
| 8 X 5 | 0.148 | 0.134 | 0.322 | 0.258 | 0.500 | 0.375 |
| 8 X 4 | 0.148 | 0.120 | 0.322 | 0.237 | 0.500 | 0.337 |
| 10 X 8 | 0.165 | 0.148 | 0.365 | 0.322 | 0.500 | 0.500 |
| 10 X 6 | 0.165 | 0.134 | 0.365 | 0.280 | 0.500 | 0.432 |
| 10 X 5 | 0.165 | 0.134 | 0.365 | 0.258 | 0.500 | 0.375 |
| 12 X 10 | 0.180 | 0.165 | 0.375 | 0.365 | 0.500 | 0.500 |
| 12 X 8 | 0.180 | 0.148 | 0.375 | 0.322 | 0.500 | 0.500 |
| 12 X 6 | 0.180 | 0.134 | 0.375 | 0.280 | 0.500 | 0.432 |
| 14 X 12 | 0.188 | 0.180 | 0.375 | 0.375 | 0.500 | 0.500 |
| 14 X 10 | 0.188 | 0.165 | 0.375 | 0.365 | 0.500 | 0.500 |
| 14 X 8 | 0.188 | 0.148 | 0.375 | 0.322 | 0.500 | 0.500 |
| 16 X 14 | 0.188 | 0.188 | 0.375 | 0.375 | 0.500 | 0.500 |
| 16 X 12 | 0.188 | 0.180 | 0.375 | 0.375 | 0.500 | 0.500 |
| 16 X 10 | 0.188 | 0.165 | 0.375 | 0.365 | 0.500 | 0.500 |
| 18 X 16 | 0.188 | 0.188 | 0.375 | 0.375 | 0.500 | 0.500 |

## BEVEL DETAIL - WELDING FITTINGS

**PLAIN BEVEL**
Figure 1




**COMPOUND BEVEL**
Figure 2

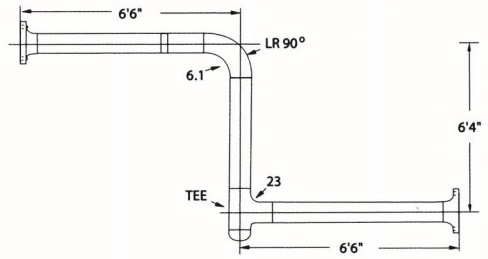



| Wall Thickness(T) | End Preparation |
|---|---|
| Less than x [2] | Cut square or slightly chamfer, at manufacturer's option (not illustrated). |
| x to 0.88, inclusive | Plain bevel as in Figure 1 above. |
| More than 0.88 | Compound bevel as in Figure 2 above. |

Note:
1. See ASME B16.9 for transition contours.
2. x = 0.19 ″ for carbon steel or ferritic alloy steel and 0.12″ for austenitic alloy steel.

## FLOW RESISTANCE EQUIVALENT LENGTH OF WELDBEND ELBOWS AND TEES

| Nominal Pipe Size | Long Radius | Short Radius | Welding Tee |
|---|---|---|---|
| 1 | 1.1 | 1.4 | 3.9 |
| 1-1/4 | 1.4 | 1.8 | 5.2 |
| 1-1/2 | 1.6 | 2.1 | 6.0 |
| 2 | 2.1 | 2.8 | 7.8 |
| 2-1/2 | 2.6 | 3.3 | 9.3 |
| 3 | 3.1 | 4.1 | 11.0 |
| 4 | 4.0 | 5.4 | 15.0 |
| 5 | 5.1 | 6.7 | 19.0 |
| 6 | 6.1 | 8.1 | 23.0 |
| 8 | 8.0 | 11.0 | 30.0 |
| 10 | 10.0 | 12.0 | 38.0 |
| 12 | 12.0 | 16.0 | 45.0 |
| 14 | 13.0 | 18.0 | 49.0 |
| 16 | 15.0 | 20.0 | 56.0 |
| 18 | 17.0 | 23.0 | 63.0 |
| 20 | 19.0 | 25.0 | 71.0 |
| 24 | 23.0 | 30.0 | 85.0 |
| 30 | 30.0 | 36.0 | 140.0 |
| 36 | 38.0 | 42.0 | 170.0 |
| 42 | 45.0 | 50.0 | 200.0 |
| 48 | 52.0 | 58.0 | 240.0 |



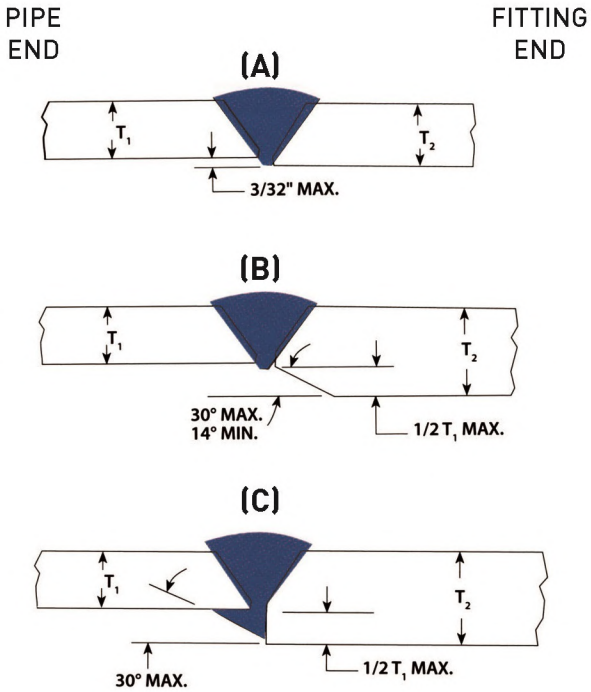

The infrmation given in the chart above illustrates the resestance of fittings ti the flow of liquids. This resistance is given in the equivalent of the straight pipe, and should be assumed as approximate information. Allowances have been made p for the curvature of elbows, so that the resistance values should be added to the total center-to end dimensions of the piping configuration.

Example using 6 ″ pipe:

| | | |
|---|---|---|
| Resistance of Pipe: | (6.6+6.4+6.6) | = 19.6 |
| + Resistance of Elbow: | | = 6.1 |
| Resistance of Tee: | | = 23.0 |
| | | = 48.7 |

Therefore, the total resistance of the entire assembly to the flow of liquid would be equal to the resistance of 48.7 Linear feet of 6 ″ straight pipe.

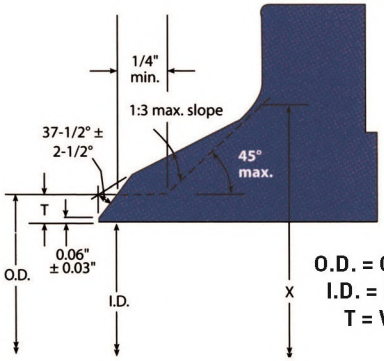
## JOINING BUTTWELDING FITTINGS TO PIPE
### of equal or less wall thickness




### NOTES

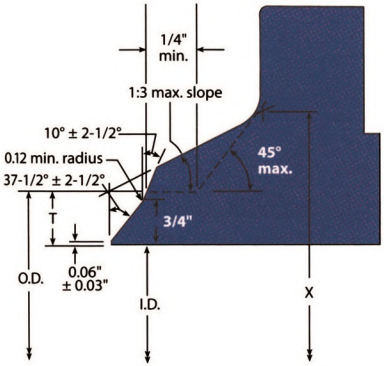
1. Buttwelding fittings can be joined to pipe of lesser wall thickness with proper end preparation and joint design.
2. Above diagrams and recommendations that follow apply to components with ends originally prepared as standard 37-1/2° or 30°degree bevels and where the wall thickness of the thicker end to be jined does not exceed 1-1/2times the thinner (pipe) end.
3. The nominal thickness T (pipe) end T (fitting) shall comply with the design requirements of the applicable section of the ASME B3²1 Code For Pressure Piping.
4. Where the total nominal offser($T_2$-$T_1$) dose not exceed 3/32" and full penetration and bonding is obtained during welding, no special treatment is required [see (A)].
5. When the internal offset exceeds 3/32", taper cut in accordance with (B) ... or tape weld in accordance with (C)
6. When joining ends with materials of unequal minimum specified yield strenghs (or unequal allowable stress), the deposited weld metal shall have mechanical properties at least equal to thoes of the higher strengh (pipe) end.
7. For treatments of ends with inequal external diameters and/or where $T_2$ is thicker than 1-1/2 times $T_1$, refer to the applicable section of the ASME Code, e., B31.4 or B31.8 or B16.9.

## BEVEL FOR WELDNECK FLANGES




**Bevel for Wall Thickness (T) from 0.19 in. to 0.88 in. Inclusive**

**O.D. = Outside Diameter of pipe**
**I.D. = Inside Diameter of pipe**
**T = Wall thickness of pipe**




**Bevel for Wall Thickness (T) Greater Than 0.88 in.**

### NOTES

1. All dimensions are in inches/
2. When the thickness of the hub at the bevel is greater than that of the pipe to which the flange is joined and the additional thickness is provided on the outside diameter, a taper weld having a slope not exceeding 1 to 3 may be employed ot, alternatively, the greater outside diameter may be tapered at the same maximum slope or less, from a point on the welding bevel equal to the outside diameter of the mating pipe. Similarly, when the greater thickness is provided on the inside of the flange, it shall be taper-bored from the welding end at the slope not exceeding 1 to 3. When flanges covered by this Standard are intended for services with light wall, hugher stengh pipe, the thickness of the hub at the bevel may be greater than that of the pipe to shich the flange is joined. Under there conditions, a single taper hub may be provided, and the outside diameter of the hub at the base (dimension X) may also be modified. The additional thickness may be provided on either inside or outside or partially on each side, but the total additional thickness shall not exceed one-half times the nominal wall thickness of intended mating pipe. See page 58.
3. The hub transition from the outside diameter to the X diameter shall fall within the maximum and minimum envelope outlined by the 1:3 max. slope and dashed line.
4. For welding end dimensions, refer to ASME B16.25.

## PIPE ALIGNMENT

Proper alignment is one of the most important tasks performed by the pipe filter.If done correctly, welding will be much easier and the piping system will be properly fabricated. if alignment is poor, however, welding will be difficult and the piping system may not function property.

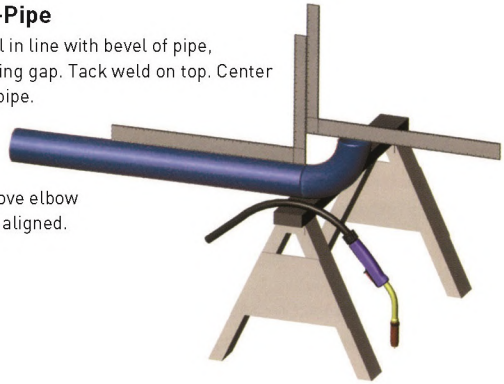
Many device are available to aid alignment and methods of alignment vary widely throughout the trade. There is no best system ... any number of methods have proven successful. The procedures suggested by this manual are popular with many craftsmen and will enable you to quickly obtain good alignment.

### Pipe-to-Pipe

Move pipe lengths together until bevels are nearby abutted, allowing apace for welding gap. Center squares on top of both pipes and move pipe up and dawn until squares are aligned. Tack weld top and bottom. Repear procedure by placing squares on side of pipe. Correct allignment by moving pipe left of right. Tack weld each side.

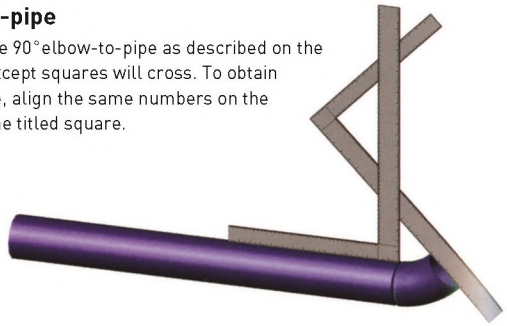
### 90° Elbow-to-Pipe

Place fitting bevel in line with bevel of pipe, allowing for welding gap. Tack weld on top. Center square on top of pipe. Center second square on elbow's alternate face. Move elbow until squares are aligned.



### 45° Elbow-to-pipe

Follow procedure 90° elbow-to-pipe as described on the previous page except squares will cross. To obtain correct 45° angle, align the same numbers on the inside scale of the titled square.

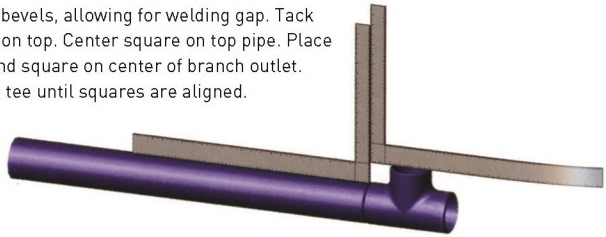


### Alternate Method for 45° Elbow-to-pipe

Use same procedure to abut pipe and fitting. Center spirit level pipe. Next, center 45° spirit level on face of elbow and move elbow until 45° bubble is centered.

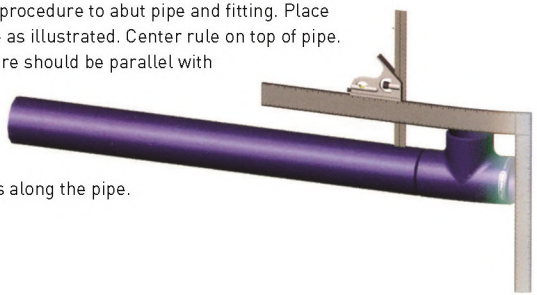
### Tee-to-Pipe

Abut bevels, allowing for welding gap. Tack weld on top. Center square on top pipe. Place second square on center of branch outlet. Move tee until squares are aligned.



### Alternate Method for Tee-to-Pipe

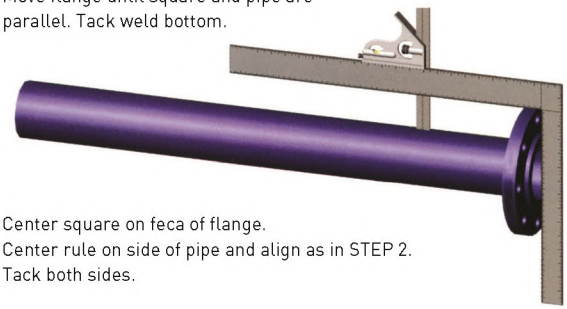
Follow same procedure to abut pipe and fitting. Place square on tee as illustrated. Center rule on top of pipe. Blade of square should be parallel with pipe. Check by measuring with rule at several points along the pipe.



### Flange-to-Pipe

**STEP 1.** Abut flange to pipe. Align top two holes of flange with spirit level. Move flange until bubble centerd. Make one tack weld on top.

**STEP 2.** Center square on feca of flange. Center rule on top of pipe. Move flange until square and pipe are parallel. Tack weld bottom.



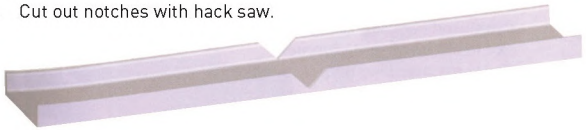
**STEP 3.** Center square on feca of flange. Center rule on side of pipe and align as in STEP 2. Tack both sides.

## JIG FOR SMALL DIAMETER PIPING

Many pipe fitters have found this simple jig to be helpful in aligning small diameter pipe and elbows. It is made from channel iron approximately 3'9"long. Use 1/8" × 1-1/2" for pipe sizes 1-1/4" thru 3";, 1/8" ×3/4" for sizes 1" or smaller.

**STEP 1.** Mark 90° notch on side of channel iron about 9" from end. Make equal notch on other side.

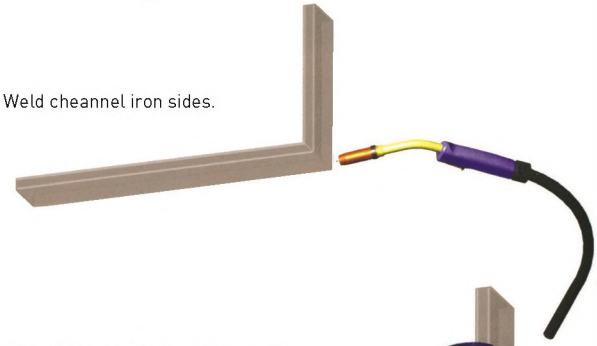
**STEP 2.** Cut out notches with hack saw.



**STEP 3.** Heat Bottome of channel iron between the notches.

**STEP 4.** Bend channel iron to 90° angle.

**STEP 5.** Weld cheannel iron sides.



**STEP 6.** Place 90° Long Radius Elbow in jig. Saw half thru both sides of channel iron as shown in illustration. Repeat with other size elbows so jig may be used for several sizes.

**STEP 7.** Place used hack saw blade in slot to obtain proper alignment and correct welding gap.