PT. UNGGUL PRAKARSA PRISMA

APPENDIX

About Weld Fittings and Flanges

Even with all the advances in technology today, the wholly welded piping system has for decades remained the best choice for use in high pressure and high temperature applications.

Many piping jobs in schools, industrial plants, and factories have benefitted from the inherent advantages of a completely welded system. For instance, they become a closed container joining sections of pipe, valves, fittings and flanges, Also, a welded joint actually becomes part of the section, minimizing leak potential and extending service life. This provides greater margins of safety, especially under conditions of internal pressure. Additionally, welding fittings form a continuous metal structure with the pipe, adding forged-in strength to any piping system.
Furthemore, smoother joints simplify insulation and take up less space.

By taking a detailed look at the type of fittings and flanges specifically designed for use in welded systems, one notes immediately their gain in both recognition and preference. Here is a quick rundown on the many fittings available.

What are Fittings?

A fitting is any part used in a piping system to change direction or function and joined to that system by some mechanical means or by welding.

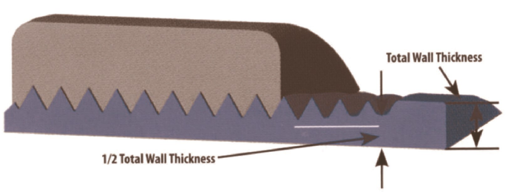
The simplest way to change the direction of a pipe would be to bend it. However, besides restricting the flow, this method often distorts the shape of the pipe and reduces the wall strength.

Another method of altering direction is with mitered joints, I.e. straight pieces of pipe cut for the required turn and welded together. This type lowers flow efficiency considerably by creating greater turbulence. A single mitered bend has about six times the resistance of a smooth elbow. Fittings are preferable for most piping systems where rate of flow, internal pressure and protection against a corrosive environment are primary design considerations.

Fittings fall into these main categories:

Screwed

These fittings are joined to a system by means of threads.
Cutting of threads may penetrate as deeply as one-half the wall thickness, thus weakening the pipe in the joint area.

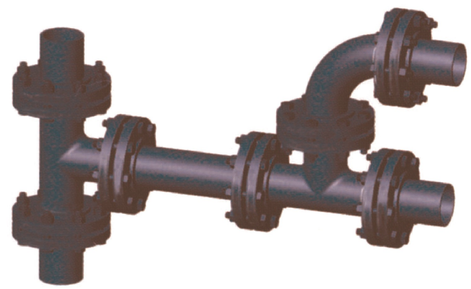


However, threaded systems usually take more time to prepare and install as they almost always require a substantial amount of field fabrication such as threading pipe ends, etc.

Unnecessary field fabrication and threaded joints present potential problem areas at higher operation pressures.

Flanges

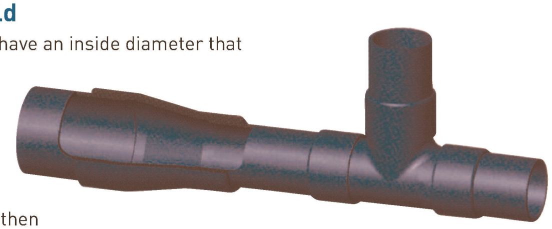
These are forged fittings with an integral flanges for bolting to mated parts. Chief disadvantages of flaged fittings atr high weight loads and increased space occupancy.



Socket Weld

These fittings have an inside diameter that accommoates a specific pipe size.

The pipe is inserted into the fitting and then welded outside circumferentially.

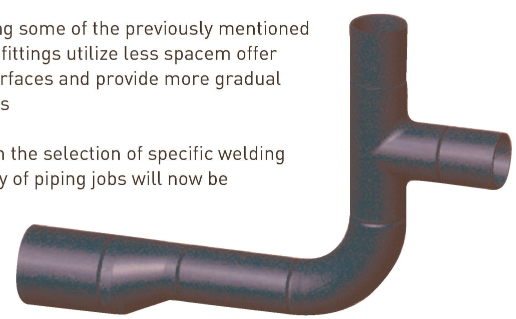


A major disadvantage is a potential "mismatch" inside the fitting where a recess is formed, allowing initiation of corrosion.

Butt Weld

In addition to having some of the previously mentioned advantages, these fittings utilize less spacem offer smoother inner surfaces and provide more gradual directional changes

Some useful tips in the selection of specific welding fittings for a variety of piping jobs will now be discussed.



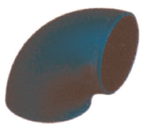
90° and 45° Elbows

Since elbows are very commonly used fittings, they will be considered first.

Generally, their size designations are either **long** radius or **short** radius. The long radius elbow is usually adequate for standard service conditions .The center-to-end dimension is always 1-1/2times the nominal size of the elbow. Short radius elbows have a center-to-end measurement equl to pipe diameter.

90° Long Radius Elbow

For a particular job, the type of elbow selected is usually a compromise based on three considerations, namely, the material flow rate, space available and initial cost.



90° Short Radius Elbow

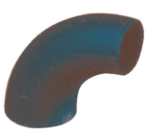
For service where the flow rate is critical and space is available, the user may select the long radius fittings. This gives him the least reduction in flow and pressure drop from internal frictional resestance and stream turbulence.

When space is limited and the flow rate is non-critical, a short radius elbow is often selected.

When fluids are moved long distances or must encounter many directional changes, short radius elbows are not recommended because of their greater friction loss, which may require installation of larger pumping equipment.

A long radius elbow costs less than a short radius fittings. Long radius elbows offer minimum resistance to flow consistent with space savings and presently account for more than 90 percent of all elbows in use.

Because of the countless variations occurring in piping systems, fitting manufacturers produce a number of fittings with special shapes and parts as standard items. Some of the major welding fittings and flanges currently available are described below.

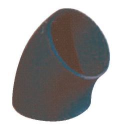


90° Reducing Elbow

The 90° **reducing** elbow is designed to change direction as well as reduce the length of flow within a piping system. Usng both a standard 90° elbow and reducer could do this or a 90° long radius-reducing elbow could do this. The latter is normally preferred because it eliminates one fitting and reduces the necessary welding by more than one-third. Also, the gradual reduction in diameter throughout the arc of the reducing elbow provides lower resistance to flow and reduces the effect of stream turbulence and potential internal eosion. These features prevent sizeable pressure drops in the line.

Because this fitting takes up less space than the straight elbow and reducer combination, the application of piping insulation is simplified.

The reducing elbow is more difficult to make and costs more than the elbow and reducer combination. However, since less welding is required and installation is faster, the actual cast differential may be very little.

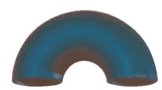


45° long Radius Elbow

The **45° long reducing** elbow has all the flow advantages of the 90°long radius elbow. It is generally used when a partial or gradual change in direction is desired. The demand for 45°long radius elbow is somewhat limited and they constitute a very small segment of the market.

180° Returns

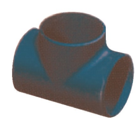
180°Long Radius Return



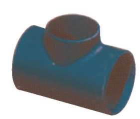
180° Short Radius Return

The recommended procedure for a 180°change in direction is to use a formed 180°return fitting rather than combine two 90°elbows or field fabricate a 180° pipe bend from a straight pipe piece. Returns are used primarily in heater coils and heat exchangers. The number of coils the space has available determines whether a **short** or **long** radius return is desirable. All long and short 180°radius returns have center-to center dimensions that are double those of matching 90°elbows.

Tees



Stright Tee



Reducing Tee

A tee is a branched, reinforced outlet fitting that permits flow at 90° to the main flow. The main flow passes through the "run" of the tee. The 90° outlet is called the "branch" of the tee. A **straingt** tee is manufactured with all three outlets, the run as well as the branchm the same size. A **reducing** tee is made with the branch outlet smaller than the run to accoomodate the design flow rate.

Lap Joint Stub End

Lap Joint Stub Ends

These fittings are used in lines that might require a quick-disconnect system. They are also used to facilitate lining up the bolt holes of flanges when there flanges are now welded or fastened to the pipe. Normally, **stub ends** are installed in pairs, the paired fittings mating with two lap joint flanges. This allows wasy opening of the line for future cleaning and inspection and if the line requires replacement, the flanges can be reused because they are not fastened to the system. They ride freely in the outside of the pipe. Lap joint stub ends are made with serrated gasket surfaces for improved sealing of the connection and prevention of leakage at the joint. This surface has replaced the raised gasket surface of a flange.

Eccentric Reducer

Reducers

All reducers, either **eccentric** or **concentric**, decrease the effective size of the pipe. With smaller cross-sectional area there is increased frictional resistance to the flowing material and an increase system pressure.

Concentric Reducer

The eccentric reducer has the reducing outlet end off center. It will line up straight with one side of the inlet but not with the other outlet. This reducer is harder to manufacture than the concentric reducer and costs more.
One advantage over the concentric reducer is that can be hung or suspended flush against a flat ceilling or wall. This lends greater support to the piping system and many times reduces the required space. When used in horizontal piping systems with the straight side up, it acts as a trap for foreign material. When installed straight side down, it prevents trapping of foreign material.

The concentric reducer is made with both inlet and outlet on a common center line. This reducer is less ostly t manufacture than the eccentric type and is adaptable to most piping installations.

Cap

Caps

The function of a **cap** is to block off the end of a line. The cap is placed over the open end and welded around the joint.

Flanges

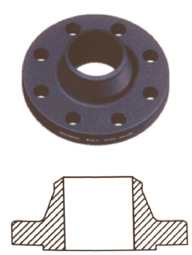
A flange is forged or cast ring of metal designed to join two sections of a piping system or originate a piping system at a pressure vessel outlet, valve, or any other integral flanged assembly. Flanges are joined to the piping system by threading or welding and are joined to each other with bolts. For example, every pressure vessel made has at least one flanged outlet. This outlet has a predetermined bolt circle and number of holes. Flanges are designed and made to match the bolt circle and bolt holes so the two can be mated together. From this flange the piping system is started. Normally, the thickness and O.D.(Outside Diameter) of the flange increase as the pressure rating of the piping system increases. The most important part of a flange is its face. Flange faces are machined to provide adequate surface contact area for a gasket. Flange classifications are:

Raised-Face : The contact area is raised 0.0625 inched for classes 150 and 300. For classed above 300, the contact area is raised 0.25 inches.
Flat-Face : When bolting class 150 or 300 flanges to cast iron flanges, flat-face should be used.
Ring Type Joint : Normal use is with flanges in classes 400 and over but can be designed for lower classes if desired.

Flanges are designed specifically for classes 150, 300, 400, 600, 900, 1500 and 2500. Common types of flanges are "high-hub" weld neck, "low-hub" slip-on, lap joint, threaded, socket and blind.

Weld Neck Flanges

The weld neck flange is normally referred to as the "high-hub" flanges. It is designed to transfer and eaually distribute stresses to the pipe, thereby reducing any concentration of high stress at the bottom of the flange after connections are made. The weld neck flange is the best-designed flange for butt-welding because of its inherent strength. A long tapered hub and gradual transition of thickness in the region of the butt-weld joint adds reinforcement from the standpoint of strength and resestance to dishing. The smooth transition from the flange thickness to the pipe wall thickness effected by the taper is extremely beneficial under conditions of repreated bending caused by line expansion or other variable forces.

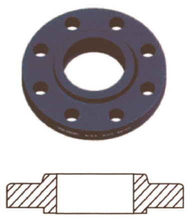


Weld Neck Flange

Weld neck flanges are used in serve services generally involving high pressure and sub-zero or high temperatures. Wld neck flnges are bored to match the I.D.(Inside Diameter) of the matching pipe. Therefore, the lighter(lower schedule) the pipe, the larger is the bore of the flanges.

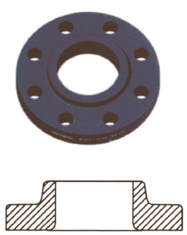
The flange is bored to match the I.D. of the pipe after joining so there is no restriction in flow that could increase stream turbulence and contribute to metal erosion.

Slip-on, Lap Joint Threaded



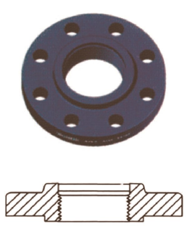
Slip-on Flange

A Slip-on flange has a low hub because the pipe slips into the flange prior to welding. It is welded both inside and out to provide sufficient strength and prevent leakage. Slip-on flanges are all bored slightly larger than the O.D. of the matching pipe. Their lower cost makes them preferable to weld neck flanges to many users. However, installed cost is not much less than for a weld neck flange because of the additional welding involved.



Lap Joint Flange

The lap joint flange is almost identical to a slip-on flange except for the radius at the intersection of the bore and flange face. This radius is necessary to accommodate connection to a lap joint stub end. Normally, a lap joint flange and a lap joint stub end assembly is used mainly in piping systems that are frequently dismantled for inspection or cleaning. These flanges are advantageous in systems where the ability to swivel flanges and align bolt holes simplifies erection of large diameter and hard-to-adjust piping.

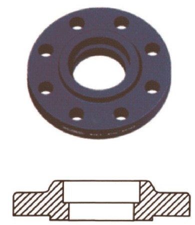


Threaded Flange

A threaded flange is similar to the slip-on flange, but the bore is threaded. Its chief merit is that it can be assembled without welding. This feature makes it preferable for services operating at low pressures and ambient temperatures. Threaded flanges can be installed in highly dangerous areas where welding might be hazardous.

Threaded flanges are unsuited for extreme temperature conditions or bending stresses of any great magnitude.

Widely fluctuating conditions could cause leakage through the threads after only a fer cycles of heating or repeated exposure to stresses. "Seal" welding around the joint is sometimes performed to overcome the possibility of leakage, but this is not always satisfactory, nor possible.

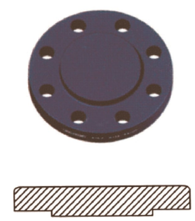


Socket Weld Flange

Socket Weld

Socket weld flanges were initially developed for use in small-size high-pressure piping and slightly more expensive than the slip-ons.

When provided with an internal weld, their static strength is equal to, but their fatigue strength is much greater than double-welded slip-on flanges.



Blind Flange

Blind

The blind flange is a solid forging used to blank off the end of a pipiing system and for gaining access to interior of the line. These flanges from the stance of internal pressure and bolt load are the most highly stressed type of all. However, since the maximum stresses in a blind flange are bending stesses at the center, they can safely be permitted to be higher than in other types of flanges. However, they are not apt for repeated severe water hammer or when temperature is a critical factor.

For these situations, a welding cap is better suited.

PRESSURE	
1 lb. per sq. in.	= 2.31 ft. water at 60°F
	= 2.04 in. hg at 60°F
1 ft. water at 60°F	= 0.433 lb. per sq. in.
	= 0.844 in. hq at 60°F
1 in. hg at 60°F	= 2.31 ft. water at 60°F
	= 2.04 in. hg at 60°F
lb. per sq. in. Absolute(pisa)	= lb. per sq. in. quage(pisg) + 14.7

TEMPERATURE	
°C	= (0°F –32) × 0.5556

WEIGHT OF LIQUID	
1 gal. (US)	= 8.34 lb. × sp. gr.
1 cu. ft.	= 62.4 lb. × sp. gr.
1 lb.	= 0.12 US gal. ÷ sp. gr.
	= 448.8 gal. per hr. (gph)

FLOW	
1 gpm	= 0.134 cu. ft. per min.
	= 500 lb. per hr. × sp. gr.
500 lb. per hr.	= 1 gpm ÷ sp. gr.
1 cu. ft. per min. (cfm)	= 448.8 gal. per hr. (gph)

WORK	
1 Btu (mean)	= 778 ft. lb.
	= 0.293 watt hr.
	= 0.0056 of heat required to change temp of 1 lb. water from 32°F to 212°F
1 hp-hr	= 2.545 Btu (mean)
	= 0.746 kwhr
1 kwhr	= 3416 Btu (mean)
	= 1.34 hp-hr

POWER	
1 Btu per hr.	= 0.293 watt
1 Btu per hr.	= 12.96 ft. lb. per min.
	= 0.00039 hp
1 ton refrigeration (US)	= 288,000 Btu per 24 Hr.
	= 12,000 Btu per hr.
	= 12,000 Btu per min.
	= 83.33 lb. ice melted per hr. from and at 32°F
	= 2,000 lb. ice melted per hr. from and at 32°F
1 hp	= 550 ft. lb. per sec.
	= 746 watt
	= 2,545 Btu per hr.
1 boiler hp.	= 33,480 Btu per hr.
	= 34.5 lb. water evap. per hr. from and at 212°F
	= 9.8 kw

MASS	
1 lb.(qvoir.)	= 16 oz. (avoir.)
	= 7,000 grain
1 ton (short)	= 2,000 lb.
1 ton (long)	= 2,240 lb.

VOLUME	
1 gal. (US)	= 128 fl.oz. (US)
	= 231 cu. in.
	= 0.833 gal. (Brit.)
1 cu. ft.	= 7.48 gal. (US)

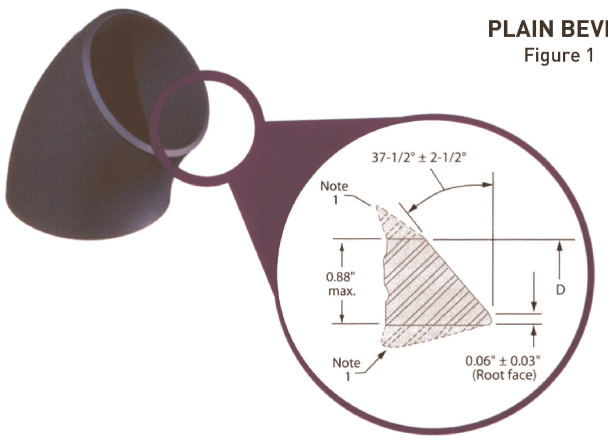
WEIGHT OF WATER
1 cu. ft. at 50°F weighs 62.41 lb.
1 gal at 50°Fweoghs 8.34 lb.
1 cu. ft. of ice weighs 57.2 lb.
Water is at its greatest density at 39.2°F
1 cu. ft. at 39.2°F weighs 62.43 lb.

CONVERSION CONTANTS		
To Change	To	Multiply By
Inches	Feet	0.0833
Inches	Millimeters	25.4
Feet	Inches	12
Feet	Yards	0.3333
Yards	Feet	3
Square inches	Squre feet	0.00694
Square feet	Squre inches	144
Square feet	Squre yards	0.11111
Square yards	Squre feet	9
Cubic inches	Cubic feet	0.00058
Cubic feet	Cubic inches	1728
Cubic feet	Cubic yards	0.303703
Cubic yards	Cubic feet	27
Cubic inches	Gallons	0.00433
Cubic feet	Gallons	7.48
Gallons	Cubic inches	231
Gallons	Cubic feet	0.1337
Gallons	Pounds of water	8.33
Pounds of Water	Gallons	0.12004
Ounces	Pounds	0.0625
Pounds	Ounces	16
Inches of Water	Pounds per square inch	0.0361
Inches of Water	Inches of mercury	0.0735
Inches of Water	Ounces per square inch	0.578
Inches of Water	Pounds per square inch	5.2
Inches of mercury	Inches of Water	13.6
Inches of mercury	Feet of water	1.1333
Inches of mercury	Pounds per square inch	0.4914
Ounces per square inch	Inches of mercury	0.127
Ounces per square inch	Inches of Water	1.733
Pounds per square inch	Inches of Water	27.72
Pounds per square inch	Feet of water	2.310
Pounds per square inch	Inches of mercury	2.04
Pounds per square inch	Atmospheres	0.0681
Feet of water	Pounds per square inch	0.434
Feet of water	Pounds per square foot	62.5
Feet of water	Inches of mercury	0.8824
Atmospheres	Pounds per square inch	14.696
Atmospheres	Inches of mercury	29.92
Atmospheres	Feet of water	34
Long tons	Pounds	2240
Short tons	Pounds	2000
Short tons	Long tons	0.89285

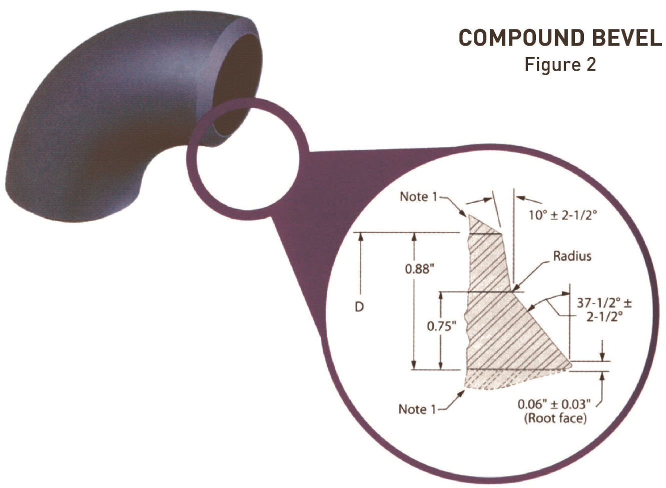
ENGLISJ-METRIC CONVERSION FACTORS		
Multiply	By	To Obtain
Millimeters	0.03937	Inches
Inches	25.4	Millimeters
Centimeters	0.3937	Inches
Inches	2.54	Centimeters
Meters	39.37	Inches
Inches	0.0254	Meters
Millimeters^2	0.00155	Inches^2
Inches^2	654.16	Millimeters^2
Millimeters^2	0.0000107639	Foot^2
Foot^2	92903.04	Millimeters^2
Kilograms	2.204624	Pounds
Pounds	0.453592	Kilograms
Kilograms/Centimeters^2	14.223	Pounds/Inches^2
Pounds/Inches^2	0.070307	Kilograms/Centimeters^2
Bars	14.504	Pounds/Inches^2
Pounds/Inches^2	0.0689	Bars
Millimeters of mercury	0.03937	Inches of mercury
Inches of mercury	25.4	Millimeters of mercury
Liters per minute	0.26417	Gallons per minute
Gallons per minute	3.785	Liters per minute
Liters	0.26414	Gallons
Gallons	3.785	Liters
Meters per second	3.281	Feet per second
Feet per second	0.3048	Meters per second
Cubic meters	35.3144	Cubic feet
Cubic feet	0.028317	Cubic meters

BEVEL DETAIL - WELDING FITTINGS

PLAIN BEVEL
Figure 1



COMPOUND BEVEL
Figure 2

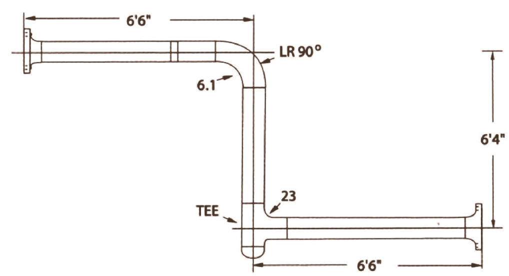


Wall Thickness(T)	End Preparation
Less than x [2]	Cut square or slightly chamfer, at manufacturer's option (not illustrated).
x to 0.88, inclusive	Plain bevel as in Figure 1 above.
More than 0.88	Compound bevel as in Figure 2 above.

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



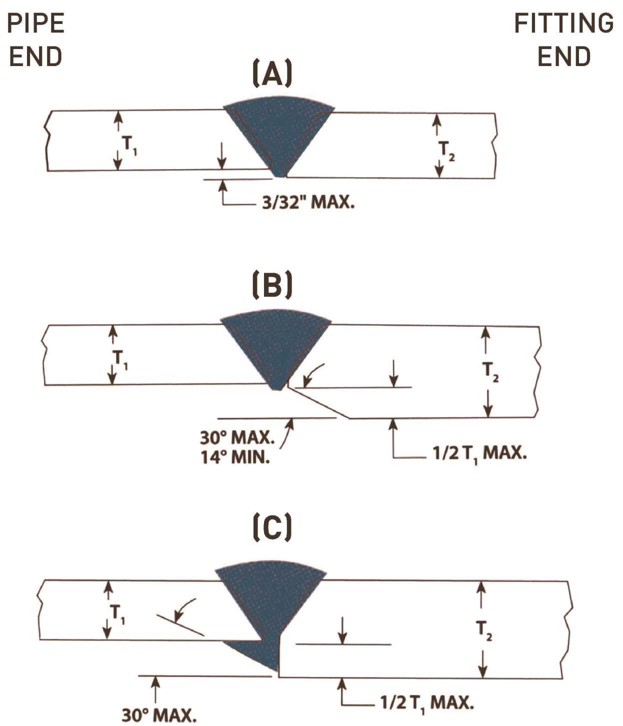
The infrmation given in the chart above illustrates the resestance of fittings ti the flow of liquids. This resistance is given in the equivalent of the straight pipe, and should be assumed as approximate information. Allowances have been made p for the curvature of elbows, so that the resistance values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

Example using 6″ pipe:

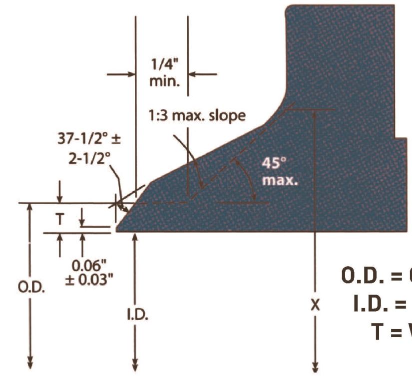
Resistance of Pipe: (6.6+6.4+6.6) = 19.6
+ Resistance of Elbow: = 6.1
Resistance of Tee: = 23.0
= 48.7

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

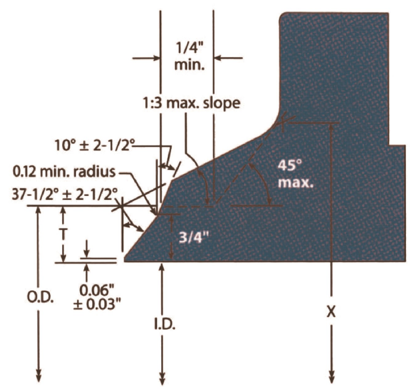


BEVEL FOR WELDNECK FLANGES



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. 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 B3^{2}1 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.

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.

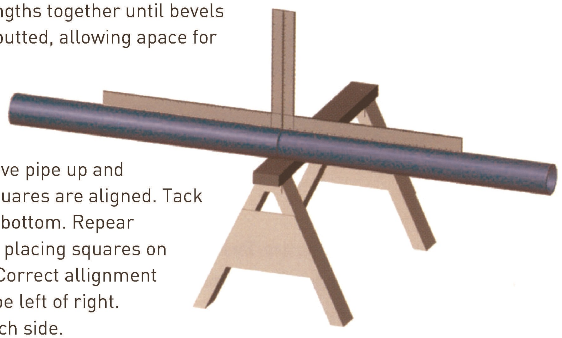
PIPE ALIGNMENT

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.

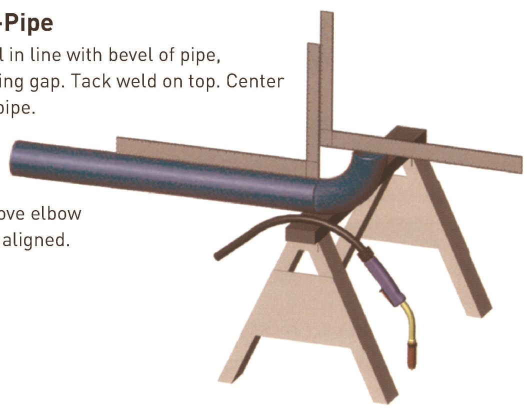
Pipe-to-Pipe

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. Repeat procedure by placing squares on side of pipe. Correct allignment by moving pipe left of right. Tack weld each side.



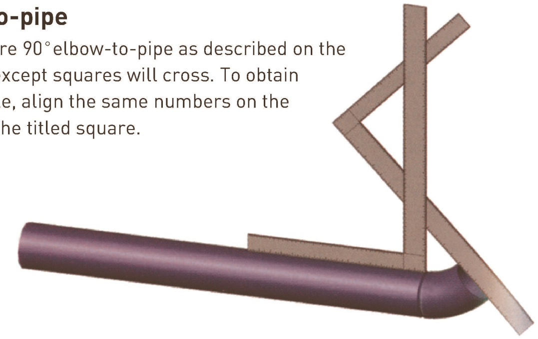
90° Elbow-to-Pipe

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.

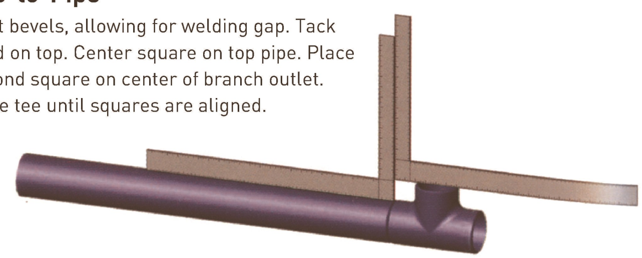


Alternate Method for 45° Elbow-to-pipe

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.

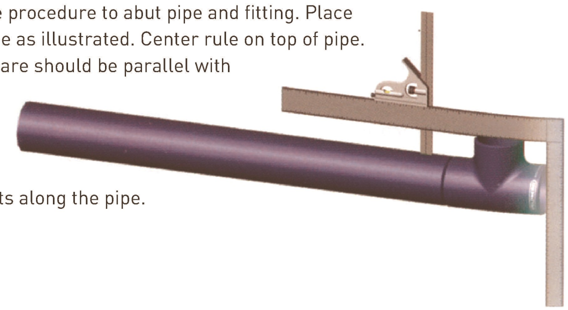
Tee-to-Pipe

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

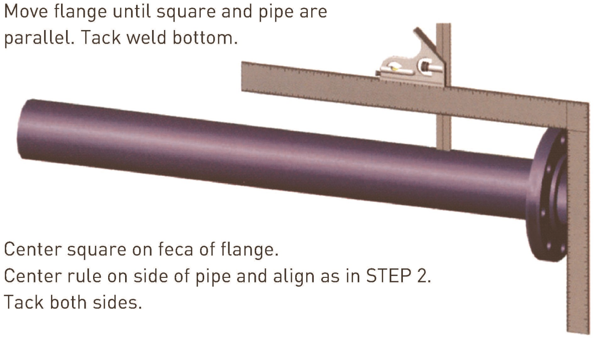
Follow same procedure to abut pipe and fitting. Place square on tee as illustrated. Center rule on top of pipe. Blade of square should be parallel with pipe. Check by measuring with rule at several points along the pipe.



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.

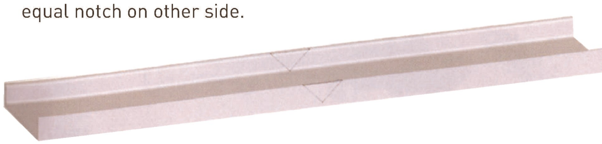


STEP 3. Center square on feca of flange. Center rule on side of pipe and align as in STEP 2. Tack both sides.

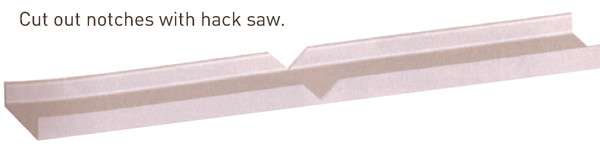
JIG FOR SMALL DIAMETER PIPING

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.



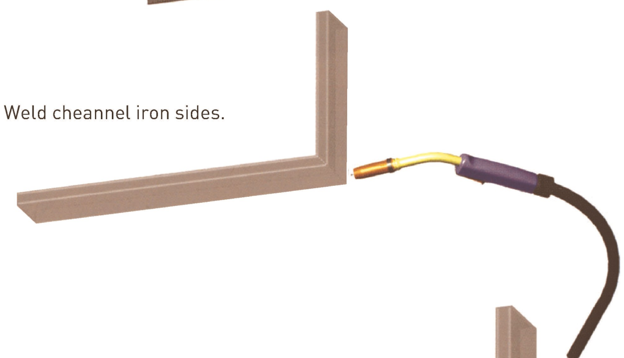
STEP 2. Cut out notches with hack saw.



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.