Basic Design and Pipe Drafting

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Lecture Times : Tuesdays EST 14-16 on class days

Tutorial Times: Sunday EST 14-15

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Pipe Fittings – The Stub-In

Stub-in Reinforcements

For situations where a 45° angular connection may be required, other o-lets are available for installation. Specifically, they are the latr-o-let and elb-o-let. Figure 3.38 shows drawing symbols for a latr-o-let and an elb-o-let.

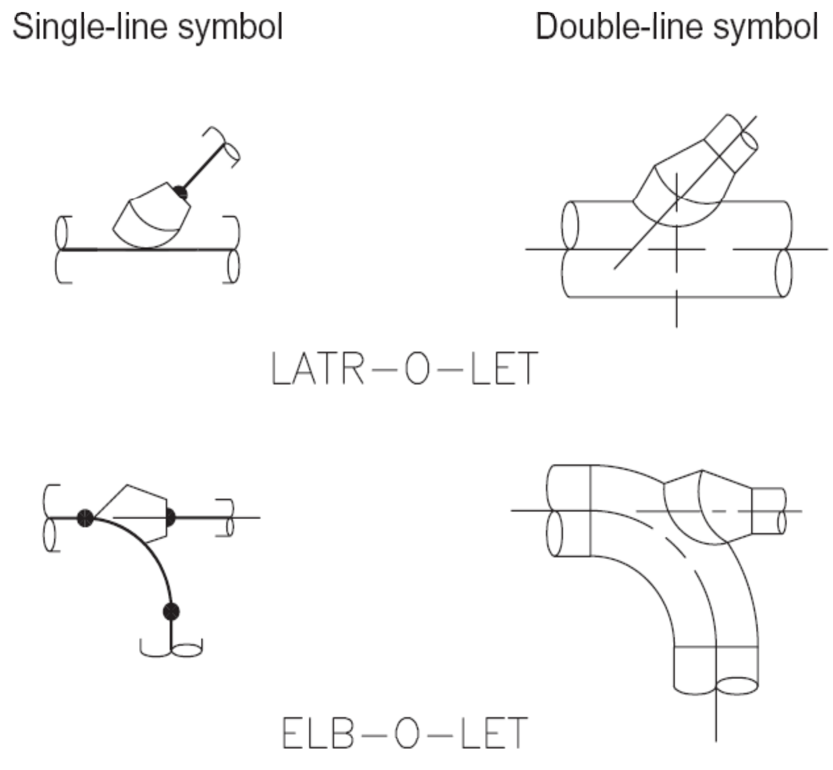


FIGURE 3.38 Latr-o-let and Elb-o-let drawing symbols.

Pipe Fittings – Coupling

Another type of fitting used to make branch connections is the coupling. Used primarily for connecting small-bore screwed or socket-weld pipe to large-bore pipe headers, the coupling is also used extensively where instrument connections are required. There are two common methods used to make branch connections with couplings.

Pipe Fittings – Coupling

1. The coupling rests on the external surface of the pipe header and is welded from the outside (see Figure 3.39).

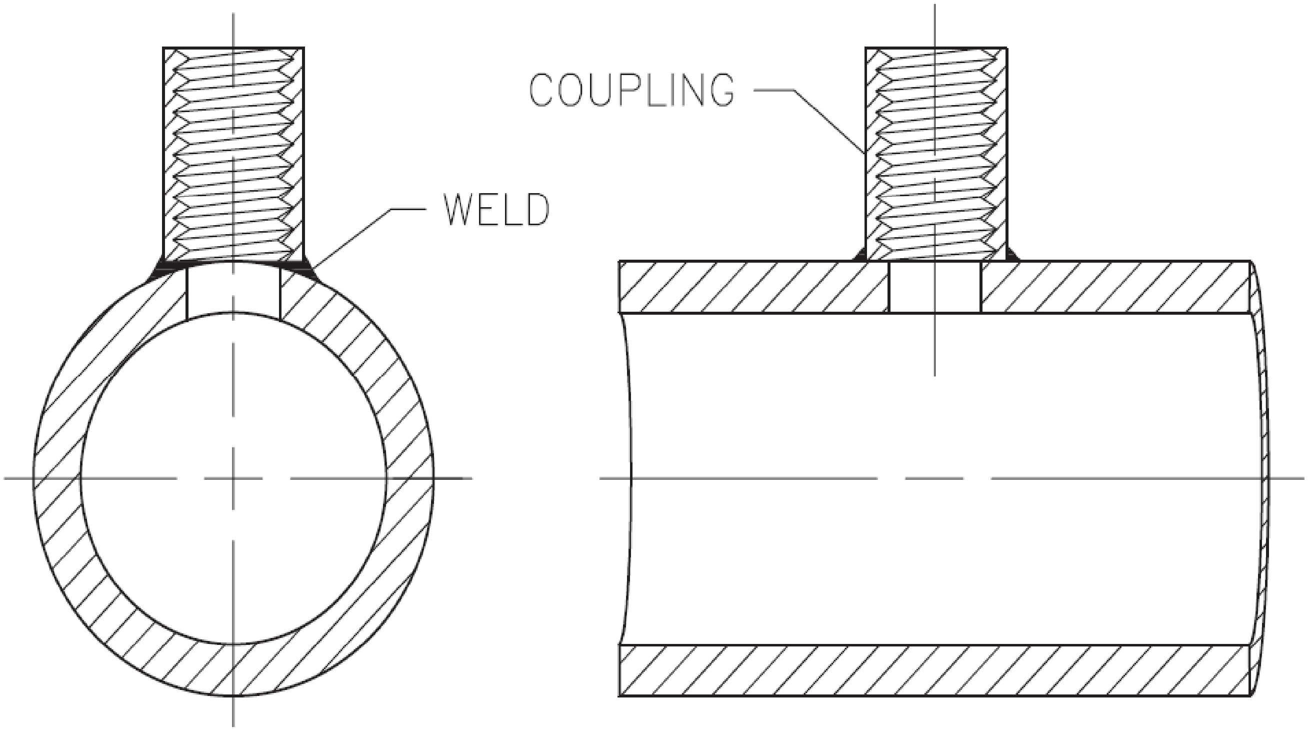


FIGURE 3.39 Welding a coupling onto a pipe header.

Pipe Fittings – Coupling

2. A hole is bored into the pipe header large enough to accept the OD of the coupling. The coupling is inserted into the hole and is then welded (see Figure 3.40).

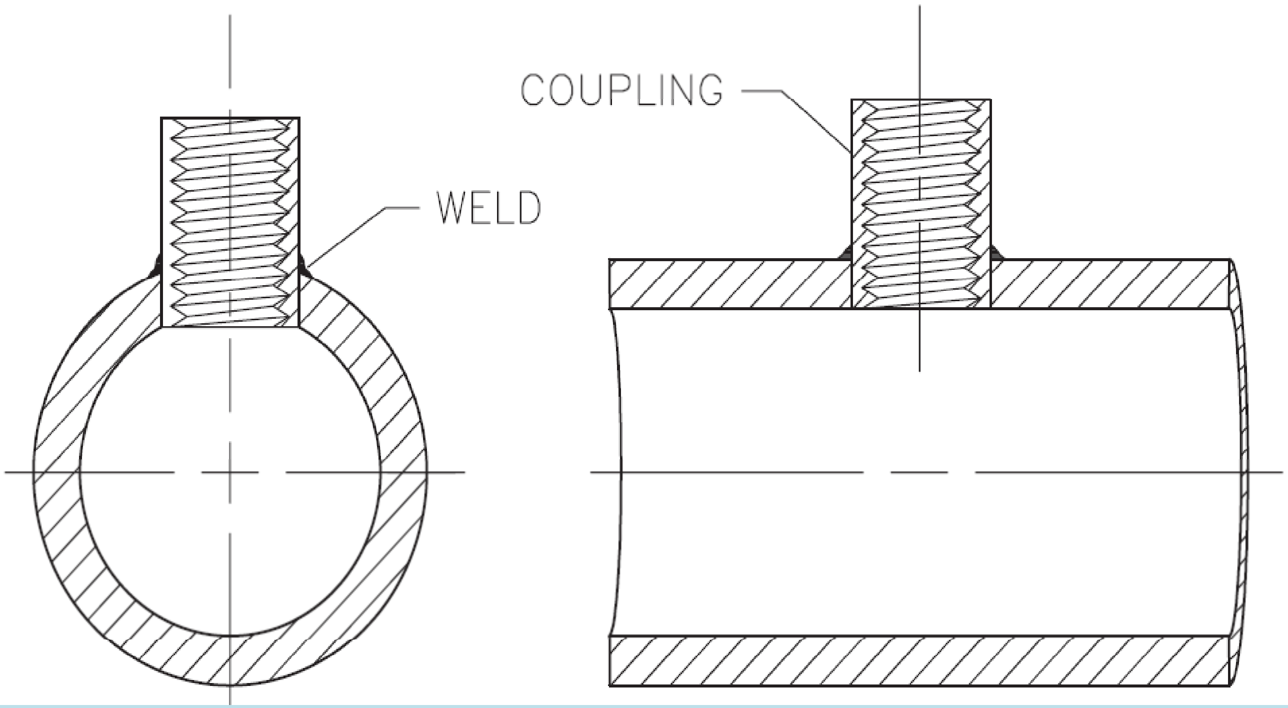


FIGURE 3.40 Inserting a coupling into a pipe header.

Pipe Fittings – Coupling

Figure 3.41 shows the drawing symbols for a coupling. Because of it being a branch connection, the nominal pipe size and the position of a coupling must be provided on a drawing, typically the isometric fabrication drawing .

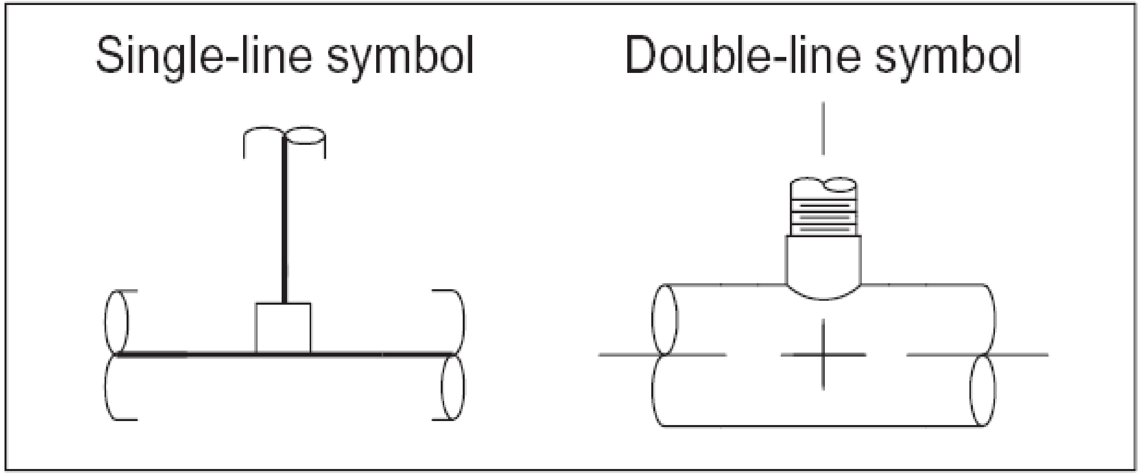


FIGURE 3.41 Couplings as branches.

Pipe Fittings – Reducers

When the piping designer wants to reduce the diameter of a straight run of pipe, a reducing fitting must be used. The reducer is available in two styles as shown in Figure 3.42:

concentric—having a common centerline;

eccentric—having offset centerlines.

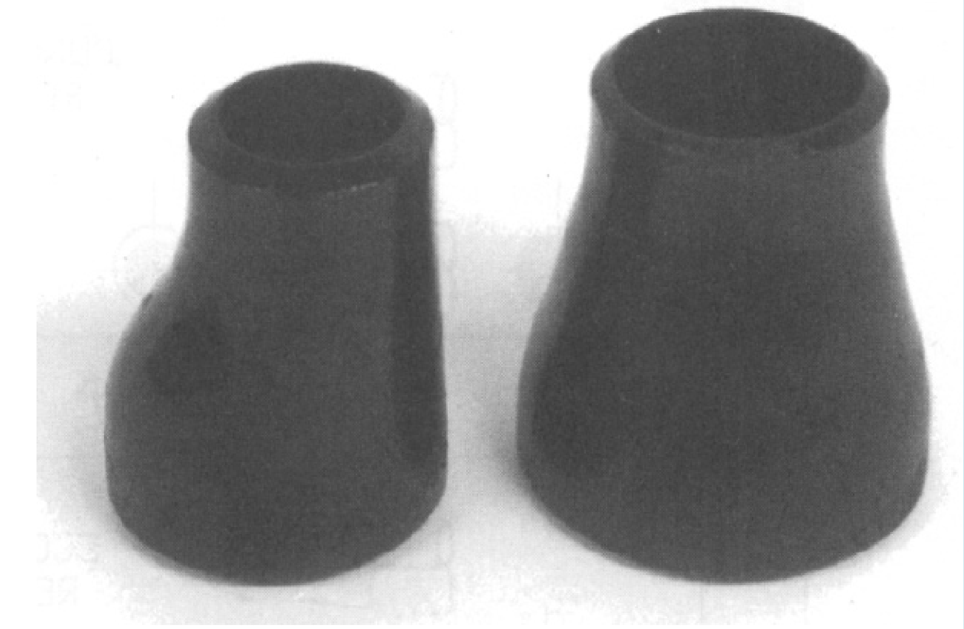


FIGURE 3.42 Eccentric and concentric reducer.

Pipe Fittings – Reducers

The differing characteristics of these two reducers are quite noticeable. The concentric reducer maintains the same centerline through both the large and small ends of the fitting. Conversely, the eccentric reducer has offset centerlines.

Pipe Fittings – Reducers

For example, if that pipe changes its pipe size while in the pipe rack, it will not rest on all the steel supports. The small end will not have a diameter large enough to touch the steel supports. Therefore, an eccentric reducer is used in pipe racks to maintain a constant Bottom of Pipe (BOP) (see Figure 3.43). When representing the reducer on a drawing it is necessary to include a note that identifies the reducer's size and type, as well as its orientation.

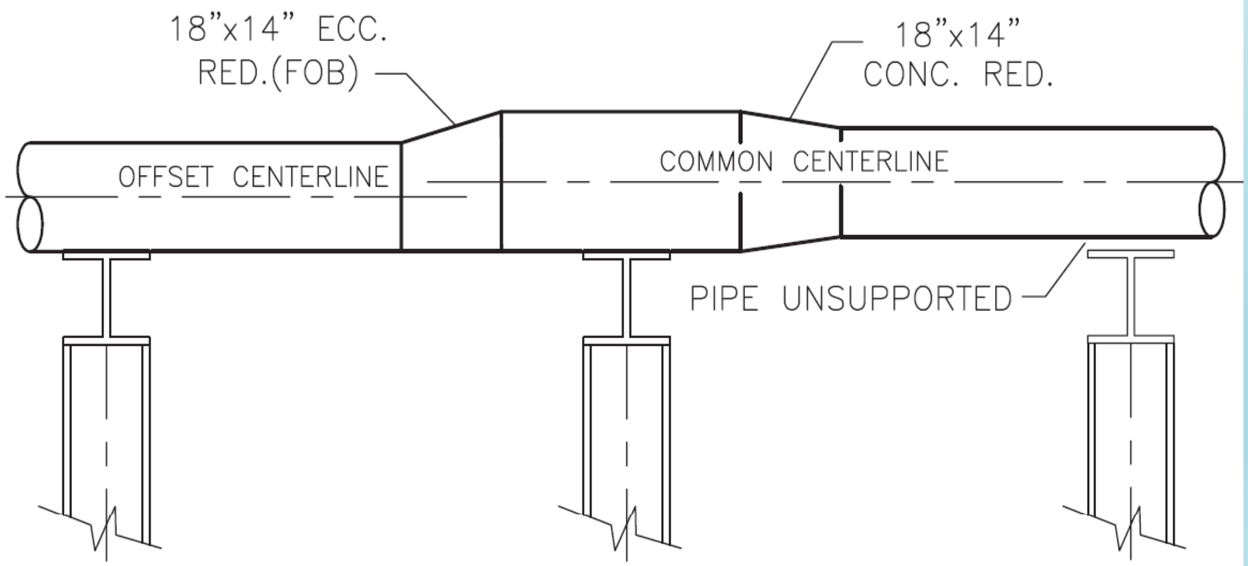


FIGURE 3.43 Reducers in a pipe rack.

Pipe Fittings – Reducers

Eccentric reducers are also used on pump suction nozzles to keep entrained air from entering the pump. By keeping a Flat on Top (FOT) surface, vapor pockets can be eliminated. Figure 3.44 depicts the installation of an 18"×14" eccentric reducer installed on a pump suction nozzle with the flat surface installed on the top.

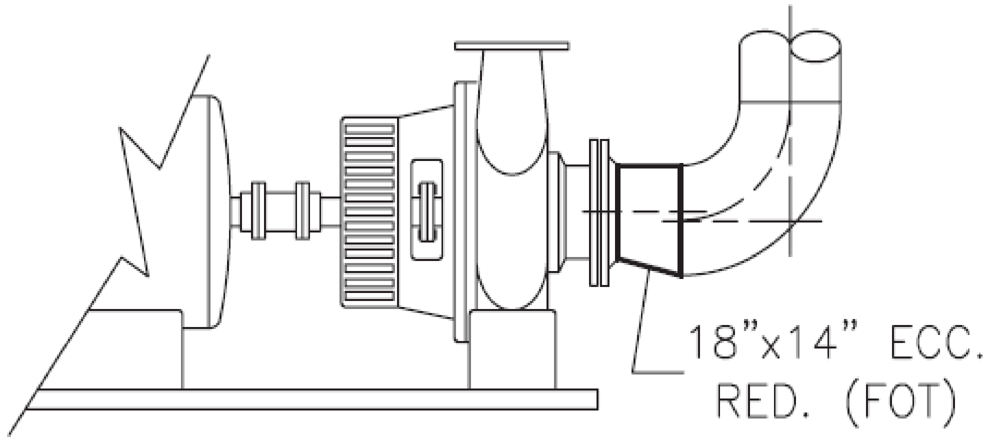


FIGURE 3.44 Eccentric reducer on pump suction nozzle.

Pipe Fittings – Reducers

It is important for a designer not to forget to include the dimensional difference between the two centerlines of an eccentric reducer when calculating the elevations of pipe in a pipe rack. The formula for calculating this difference is

$$\text{Offset} = \frac{\text{large ID} - \text{small ID}}{2}$$

A quicker, though less accurate method, is to take one-half the difference between the two outside diameters.

Pipe Fittings – Reducers

Figure 3.45 shows the method of dimensioning the offset distance between the centerlines of the eccentric reducer in its FOT and FOB orientations

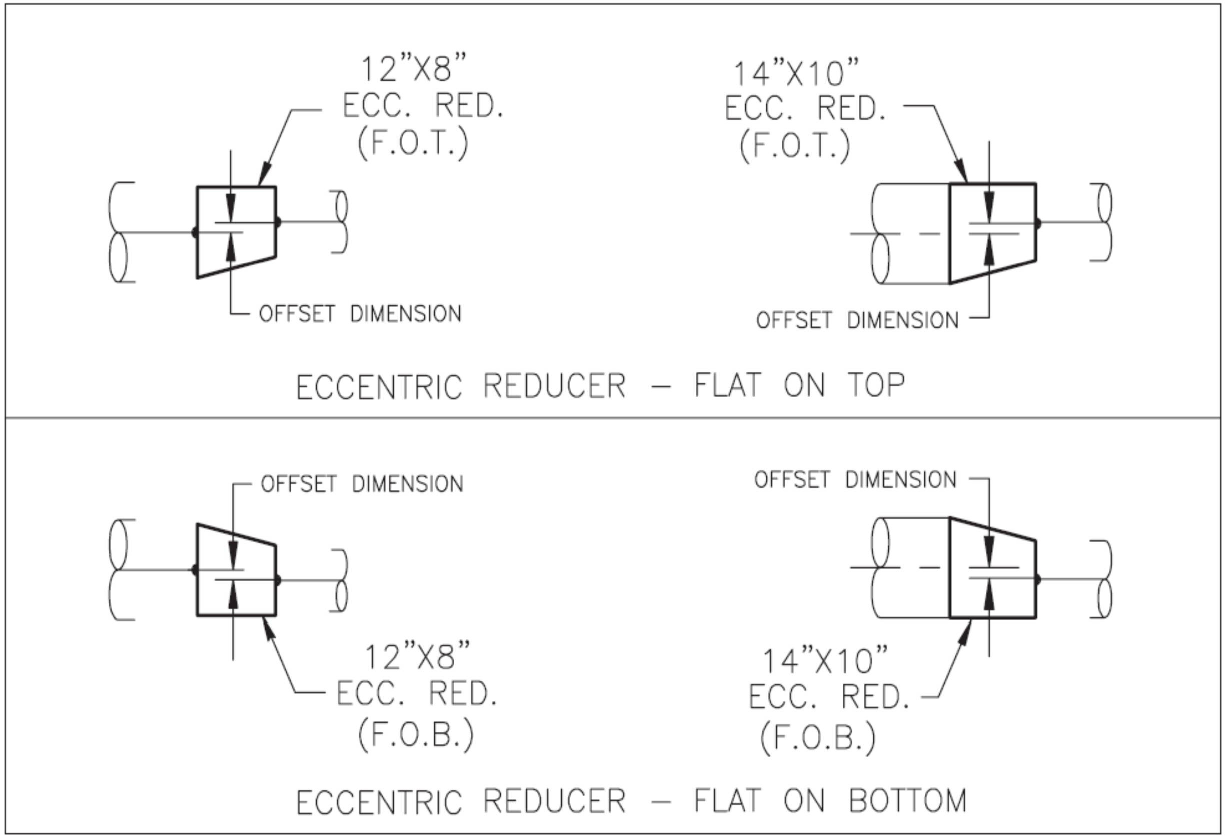
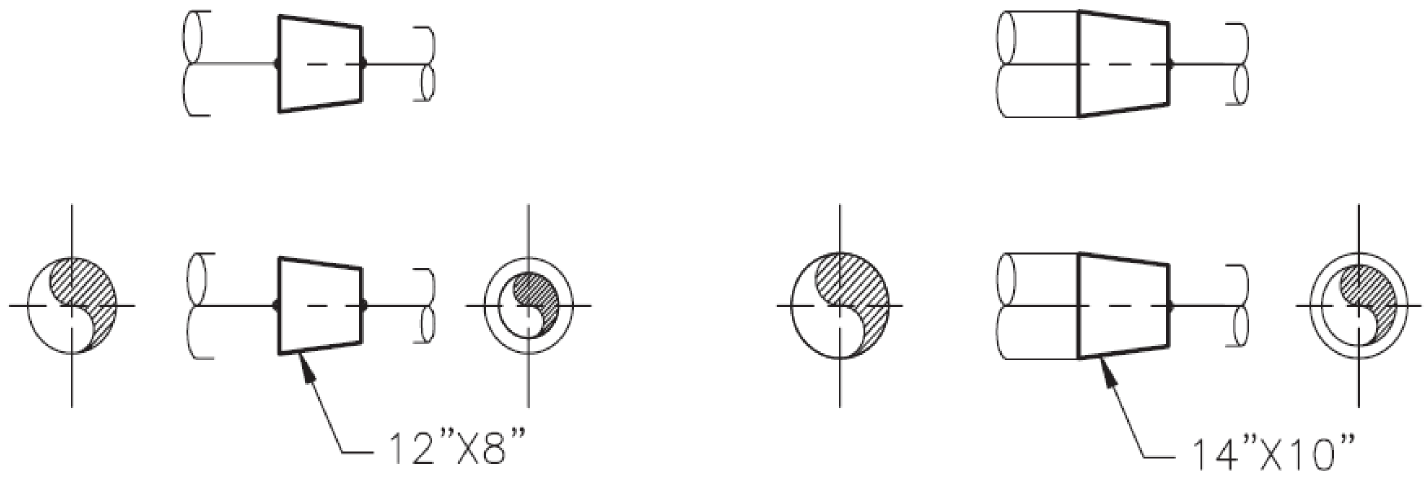


FIGURE 3.45 Offset dimensioning of eccentric reducers.

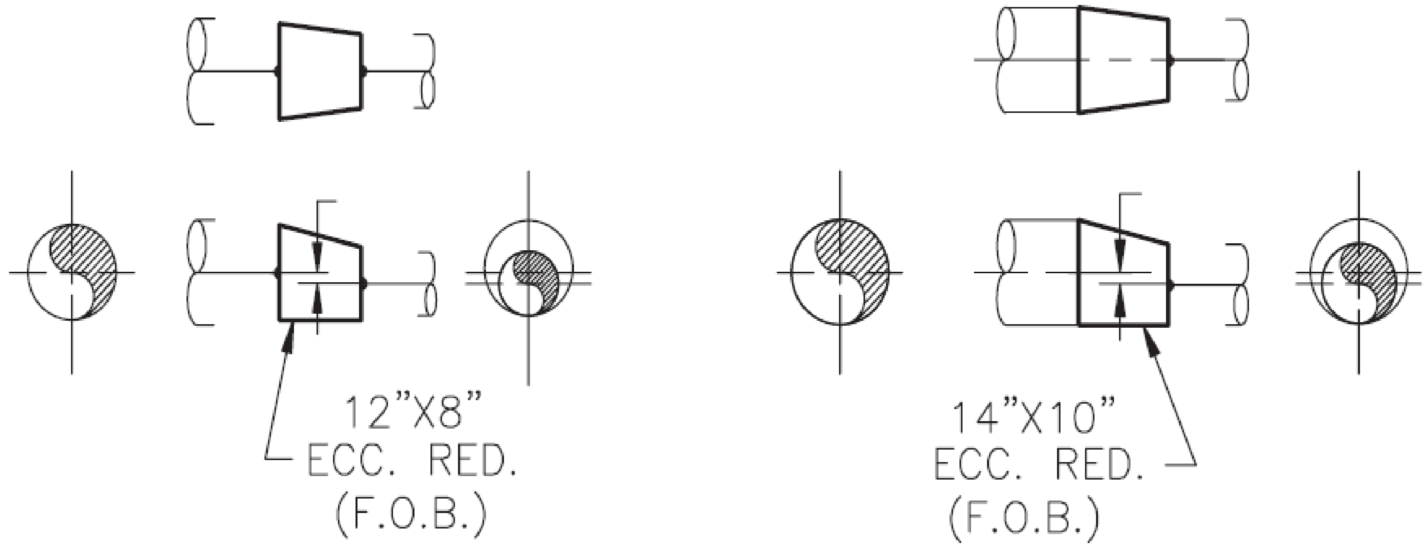
Pipe Fittings – Reducers

Drawing Symbols for the Concentric and Eccentric Reducer

The orthographic views for the concentric and eccentric reducers are shown in Figure 3.46. No matter what the size of the reducer is, it is always drawn as a double-line symbol. Notice the callouts that must be included with the eccentric reducer. The large end is always listed first, no matter what the direction of flow is, and the flat side must be indicated.



CONCENTRIC REDUCER

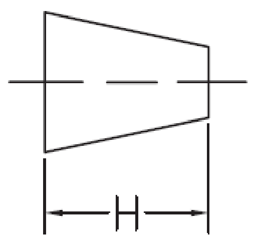


ECCENTRIC REDUCER

Pipe Fittings – Reducers

Drawing the Reducers

Before drawing the reducer, the length of the fitting must be found on the Welded Fittings–Flanges Dimensioning Chart (see Figure 3.47). The H dimension will provide the end-to-end length for either the concentric or eccentric reducer.



NOMINAL PIPE SIZE-(INCHES)	2"	3"	4"	6"	8"	10"	12"	14"
PIPE (OUTSIDE DIAMETER)	2 3/8	3 1/2	4 1/2	6 5/8	8 5/8	10 3/4	12 3/4	14"
Length of Reducer H	3	3 1/2	4	5 1/2	6	7	8	13

FIGURE 3.47 Welded Fittings–Flanges Dimensioning Chart.

Pipe Fittings – Reducers

Drawing the Reducers

Figure 3.48 represents the step-by-step procedures used to draw a 16"× 14" concentric reducer.

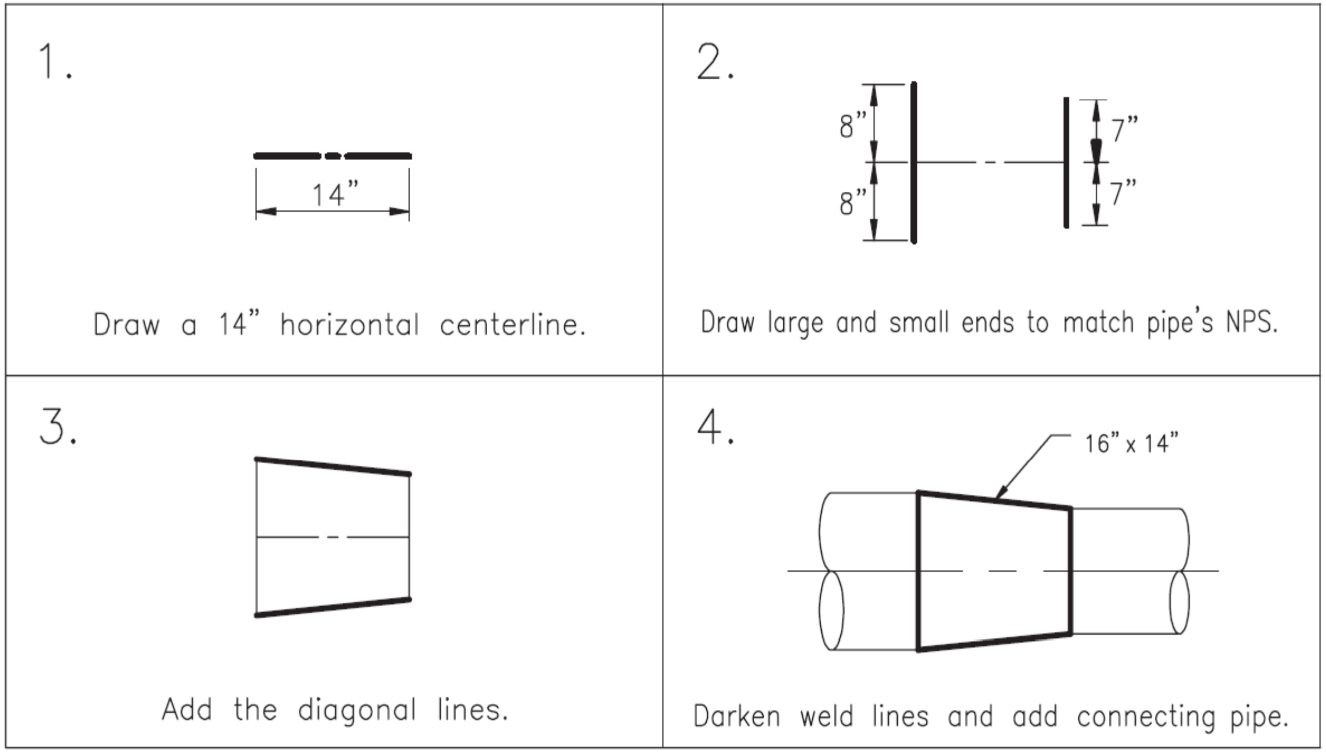


FIGURE 3.48 16″ × 14″ Concentric reducer. Manual step-by-step drafting procedures.

Step 1. Using the *H* dimension found on the Welded Fittings–Flanges Dimensioning Chart, draw a centerline 14″ long.

Step 2. Measure 8″ (one-half the 16″ large end size) on each side of the centerline on one end of the centerline and 7″ (one-half the 14″ small end size) on each side of the opposite end of the centerline.

Step 3. Connect the opposing ends of the fitting by drawing lines from endpoint to endpoint.

Step 4. Darken the sides and weld lines of the reducer then add the connecting pipe.

Pipe Fittings

Fittings are fabricated pipe components that are used to perform specific functions throughout the routing of a pipeline.

Fittings can make directional changes (elbow), create a branch from a main pipe (tee), or make a reduction in the diameter of the pipe (reducer) .

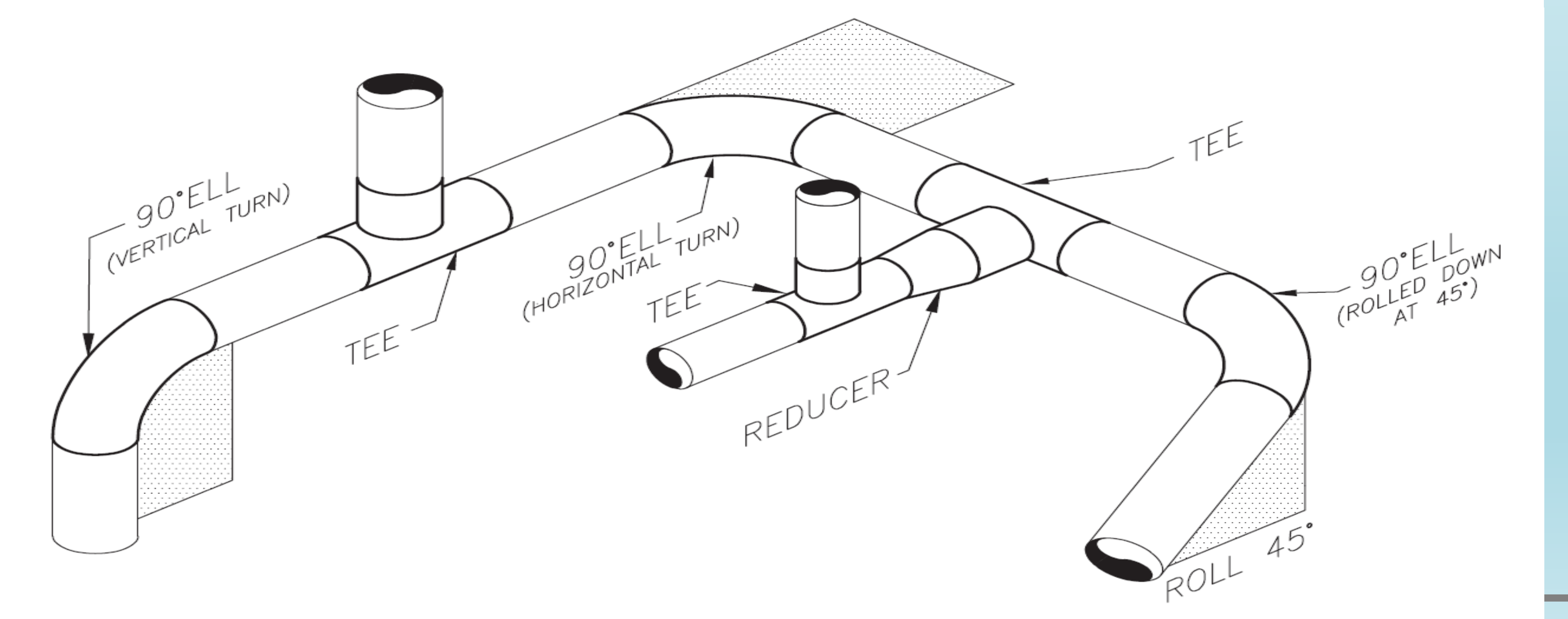


FIGURE 3.1 Fittings.

Review

We have learnt pipe fittings in this chapter:

90^o and 45^o elbows, weld tee, the stub in , coupling , reducers,

Next we learn weld cup fittings.

Pipe Fittings – Weld Cap

The weld cap is used to seal or cap the open end of a run of pipe. The weld cap, like the reducer, is another fitting that is drawn as a double-line symbol, no matter what the pipe's nominal size is.

Figure 3.50 shows the single-line and double-line drawing symbols for a weld cap. Notice the weld dot on the single-line symbol is drawn as a half-circle only.

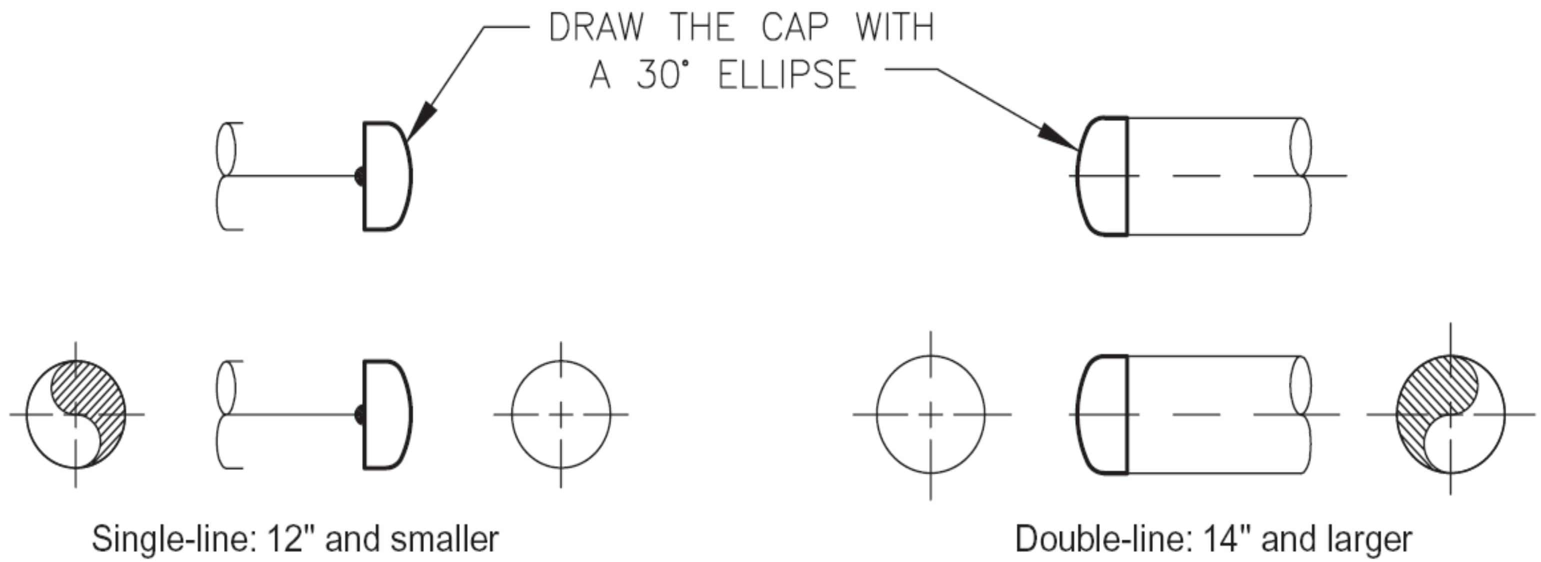
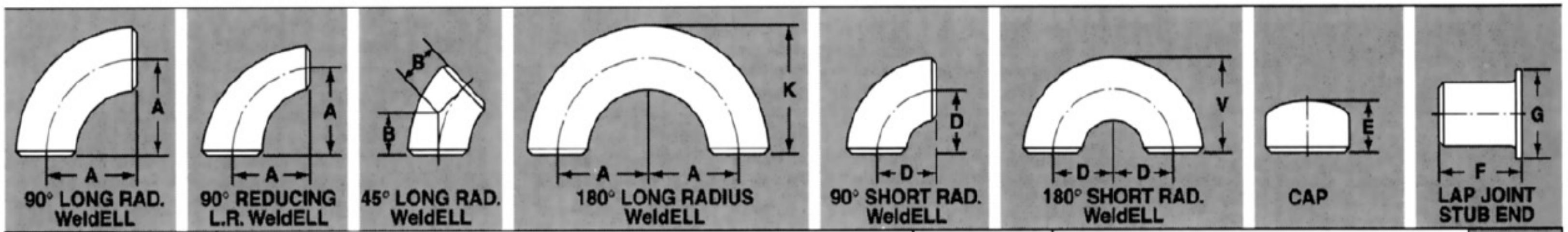


FIGURE 3.50 Weld cap drawing symbols.

Pipe Fittings – Weld Cap

The length of the fitting is found on the Taylor Forge Seamless Welding Fitting Chart in Appendix A.

DIMENSIONS



Nom. Pipe Size	Pipe O.D.	WeldELL A	WeldELL B	WeldELL D	WeldELL K	WeldELL V	CAPS* E	STUB ENDS F ANSI Std.	STUB ENDS G O.D. of Lap	STUB ENDS Corner Radius	Nom. Pipe Size
½	.840	1½	⅝	–	1⅞	–	1	3	1⅜	⅛	½
¾	1.050	1⅛	7/16	–	1 11/16	–	1	3	1 11/16	⅛	¾
1	1.315	1½	⅞	1	2 3/16	1⅝	1½	4	2	⅛	1
1¼	1.660	1⅞	1	1¼	2¾	2 1/16	1½	4	2½	3/16	1¼
1½	1.900	2¼	1⅛	1½	3¼	2 7/16	1½	4	2⅞	¼	1½
2	2.375	3	1⅜	2	4 3/16	3 3/16	1½	6	3⅝	5/16	2
2½	2.875	3¾	1¾	2½	5 3/16	3 15/16	1½	6	4⅛	5/16	2½
3	3.500	4½	2	3	6¼	4¾	2	6	5	⅜	3
3½	4.000	5¼	2¼	3½	7¼	5½	2½	6	5½	⅜	3½
4	4.500	6	2½	4	8¼	6¼	2½	6	6 3/16	7/16	4
5	5.563	7½	3⅛	5	10 5/16	7¾	3	8	7 5/16	7/16	5
6	6.625	9	3¾	6	12 5/16	9 5/16	3½	8	8½	½	6
8	8.625	12	5	8	16 5/16	12 5/16	4	8	10⅝	½	8
10	10.750	15	6¼	10	20⅜	15⅜	5	10	12¾	½	10
12	12.750	18	7½	12	24⅜	18⅜	6	10	15	½	12
14	14.000	21	8¾	14	28	21	6½	12	16¼	½	14
16	16.000	24	10	16	32	24	7	12	18½	½	16
18	18.000	27	11¼	18	36	27	8	12	21	½	18
20	20.000	30	12½	20	40	30	9	12	23	½	20
24	24.000	36	15	24	48	26	10½	12	27½	½	24
30	30.000	45	18½	30	60	45	10½	–	–	–	30
36	36.000	54	22¼	36	–	–	12	–	–	–	36
42	42.000	63	26	42	–	–	12	–	–	–	42
48	48.000	72	29⅞	48	–	–	13½	–	–	–	48

Pipe Fittings – Use of Fittings

Thus far we have discussed each fitting individually. We will now look at how they relate to other fittings when used in the design of various piping systems. Depending on the given situation, fittings will be either welded to each other or separated by lengths of pipe.

Welding one fitting directly to another is called fitting make-up. Single-line and double-line representations of fitting make-up are shown in Figure 3.51.

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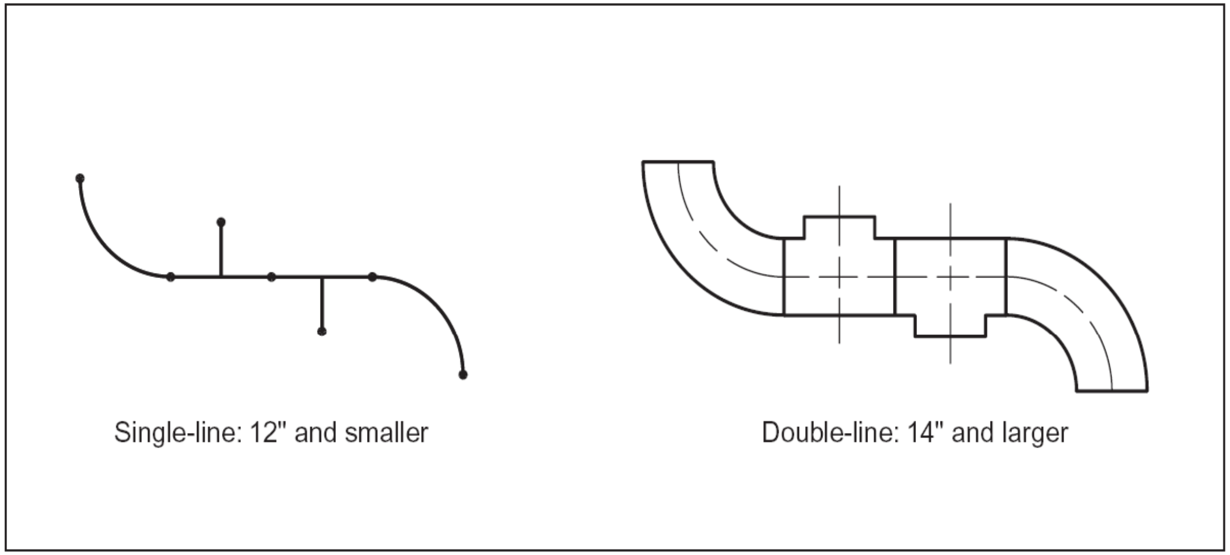

FIGURE 3.51 Fitting make-up.

Pipe Fittings – Use of Fittings

In most situations, the pipe is cut to the required length and then beveled in preparation for welding to a fitting.

When the fittings are separated by a short section of the pipe, most companies stipulate that the pipe must be at least one pipe-diameter long or 3" minimum length, whichever is longest (at least as long as the nominal pipe size of the fitting used).

Pipe Fittings – Use of Fittings

It is important to maintain this minimum spacing because once assembled each weld must be x-rayed and heat treated. If another weld procedure is performed too close to it, the heat from the new weld may have an adverse effect on the first weld.

By maintaining a minimum spacing between welds (a standard), a pipe can be conveniently cut, beveled, and welded without adverse effects on adjacent welds. Figure 3.52 depicts the one pipe-diameter minimum spacing.

Pipe Fittings – Use of Fittings

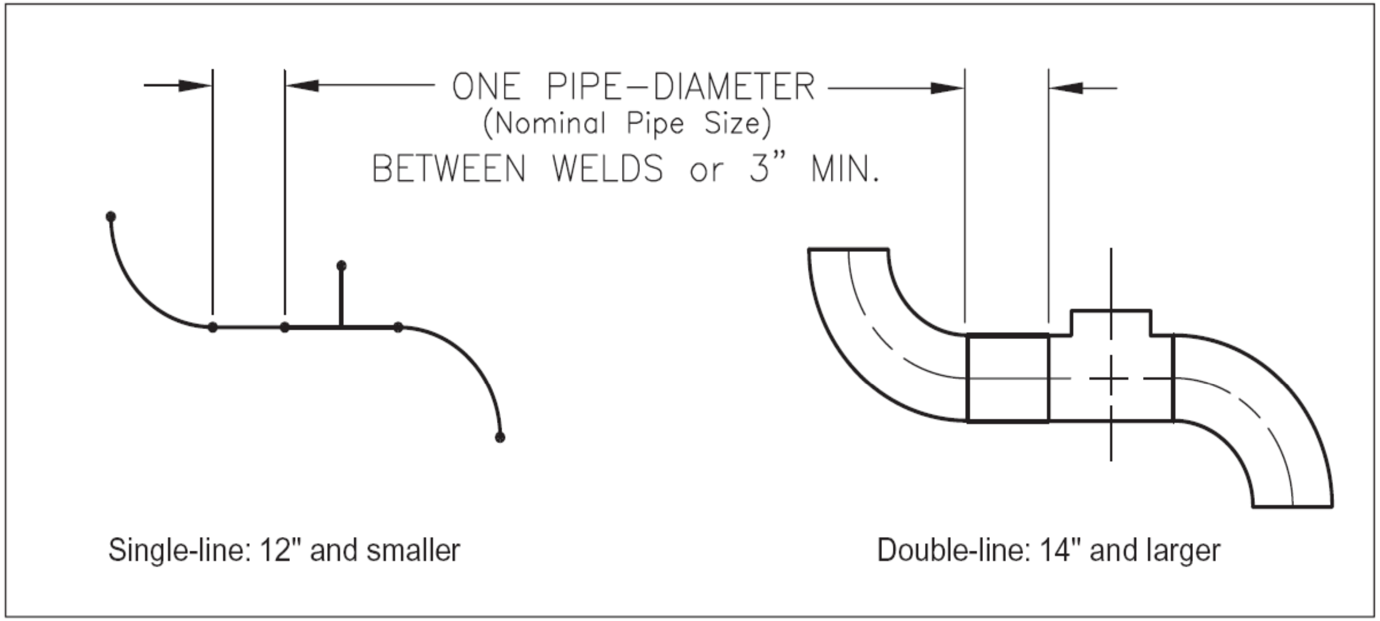

FIGURE 3.52 Minimum pipe cut lengths.

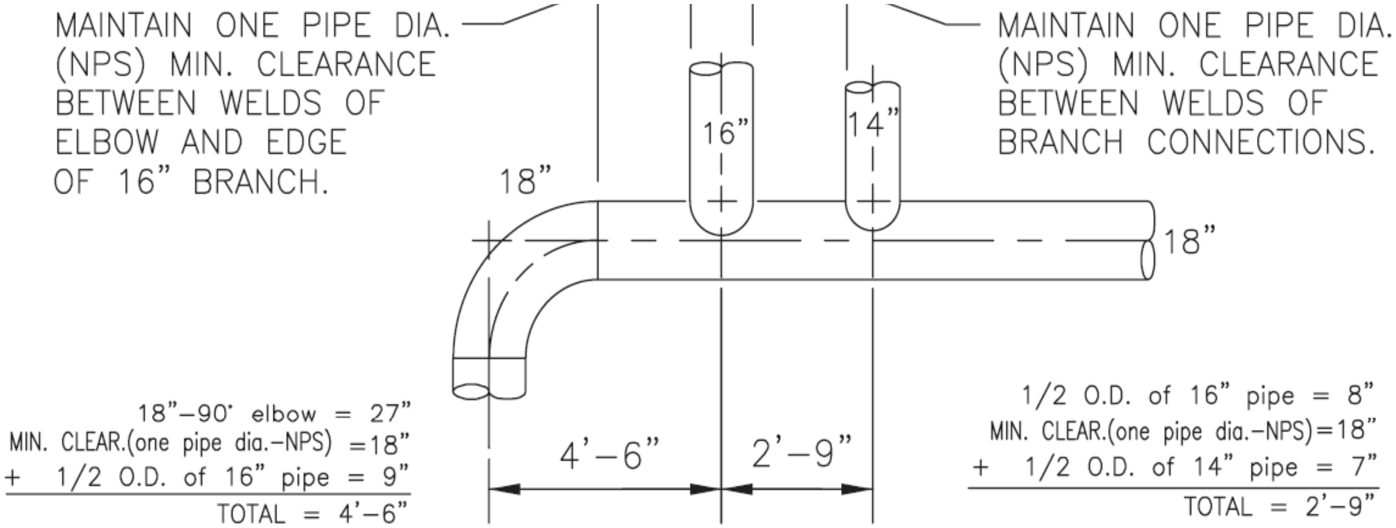

FIGURE 3.34 Spacing minimums for welding stub-ins.

Pipe Fittings – Use of Fittings

Applying Fitting Make-up Dimensions

The next step in the drawing of pipe is the calculation and placement of dimensions on drawings. As a general rule of thumb, there are three methods in which dimensions are placed on butt-weld piping configurations. They are as follows:

- Center-to-center. Place dimensions from center of fitting to center of fitting.
- Center-to-face. Place dimensions from center of fitting to face of flange.
- Face-to-face. Place dimensions from face of flange to face of flange.

Applying Fitting Make-up Dimensions

Figure 3.53 provides some examples for placing dimensions on drawings. Notice though, when a weld cap is installed, the dimension needed is a center-to-end of pipe measurement.

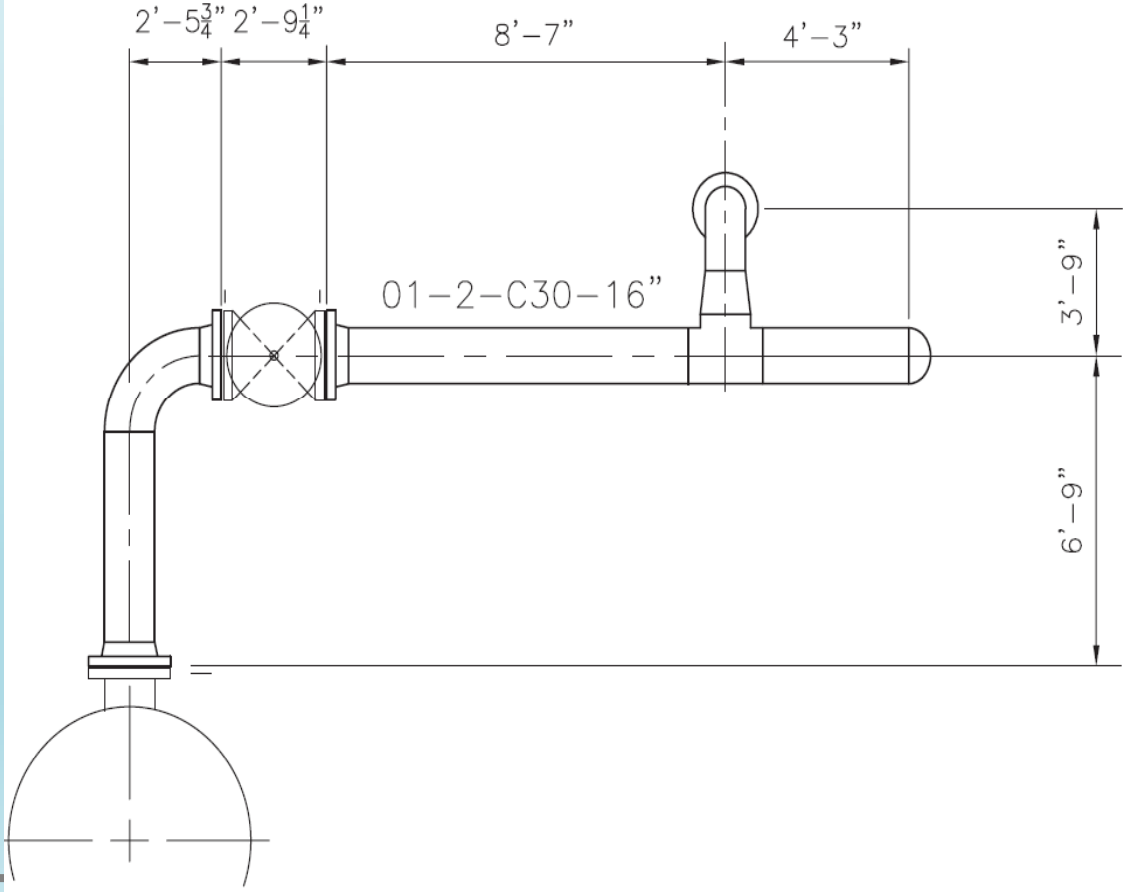

FIGURE 3.53 Placement of dimensions on butt-weld configurations.