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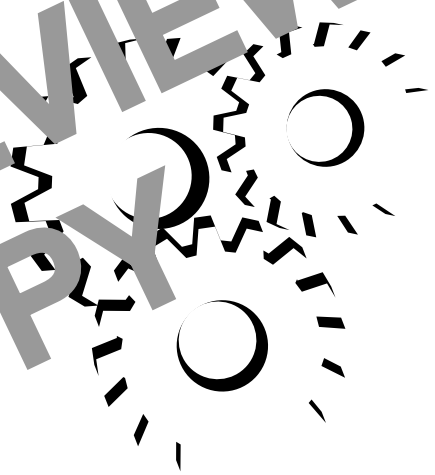
PIPEFITTING

Lesson One

Piping Dimensions and Terminology



TPC Training Systems

34501

Lesson

1 Piping Dimensions and Terminology

TOPICS

Piping Standards
Basic Pipe Dimensions
Piping System Symbols
Pipe Fittings
Flanges
Flange Facings and Finishes
Using Dimensional Tables
Calculating Lengths from Existing Pipes
Straight Offsets
Rolling Offsets

OBJECTIVES

After studying this Lesson, you should be able to…

- State whether ID or OD identifies a given nominal pipe size.
- Given a nominal pipe size and a copy of the American Standard Code for a Pressure Piping, find the wall thickness of a pipe of a given schedule number.
- Name a least four kinds of pipe fittings.
- Given a schematic drawing of a piping system, identify all fittings used in the system.
- Given a drawing showing three lengths of pipe with and without fittings installed, correctly name the application dimension for measuring the pipe length.
- Given a schematic drawing showing two parallel horizontal pipe runs with a 45° run connection, identify the travel, set, and face-to-face length.

KEY TECHNICAL TERMS

Schedule numbers 1.02 numbers which indicate outside and inside diameters, wall thickness, and weight per foot of pipe
Reducing fittings 1.11 fittings which connect pipes of different diameters
Pipe run 1.37 a horizontal section of pipe
Pipe rise 1.37 a vertical section of pipe
Offset (or set) 1.39 change of pipe direction followed by a return to the original direction

Many components make up a piping system. These include the pipes themselves and various fittings. Over the years, the types and classes of fittings have been standardized. This means that the user can purchase pipe and fittings from any supplier and be sure they will fit with, and have the same strength ratings and safety factors as, the fittings from any other supplier.

In this Lesson, you will learn about the sizes of pipe, and the fittings that are used, to-assemble what is essentially your plant's vital circulatory system. It is a system that must operate properly if the plant is to continue to function.

The knowledge you gain will help you maintain existing piping systems, expand them, or install new systems.

Piping Standards

1.01 Over the years, piping systems have been developed to transport many types of fluids. Because of their varying pressures and abrasion and corrosion properties, different fluids require different types of piping material. A wide range of pipe diameters and wall thicknesses is produced, allowing engineers to select the sizes which give the best performance at the lowest cost.

1.02 In 1935, the American Standards Association (which is now called the American National Standards Institute, or ANSI) published *The American*

Table 1-1. ANSI pipe schedules

Nominal pipe size	Outside diameter	NOMINAL WALL THICKNESS FOR Sched. 10	Sched.	Sch.	Standard	Sched. 40	Sched. 60	Extra strong	Sched. 80	Sched. 100	Sched. 120	Sched. 140	Sched. 160	XX strong
1/8	0.405	–		–	0.068	0.06	–	0.0	0.095	–	–	–	–	–
1/4	0.540	–	–	–	0.08	88		0.11	0.119	–	–	–	–	–
3/8	0.675	–	–	–	0	0.	–	0.126	0.126	–	–	–	–	–
1/2	0.840	–	–		0	0.1	–	0.147	0.147	–	–	–	0.188	0.294
3/4	1.050	–	–	–	0.	0.1	–	0.154	0.154	–	–	–	0.219	0.308
1	1.315	–	–	–		33	–	0.179	0.179	–	–	–	0.250	0.358
1 1/4	1.660	–	–			40	0.140	–	0.191	0.191	–	–	–	0.250	0.382
1 1/2	1.900	–	–			145	0.145	–	0.200	0.200	–	–	–	0.281	0.400
36 O.D.	36.000	0.312	0.500	0.625	0.375	0.750	–	0.500□	–	–	–	–	–	–
42 O.D.	42.000	–	0.375	–	–	–	–	0.500	–	–	–	–	–	–

Fig. 1-1. Wall thickness of nominal 1-in. pipe

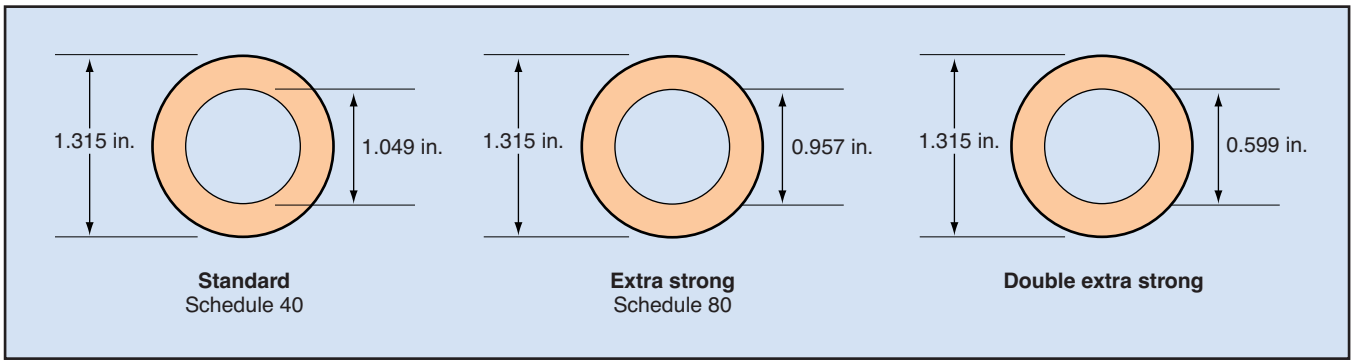
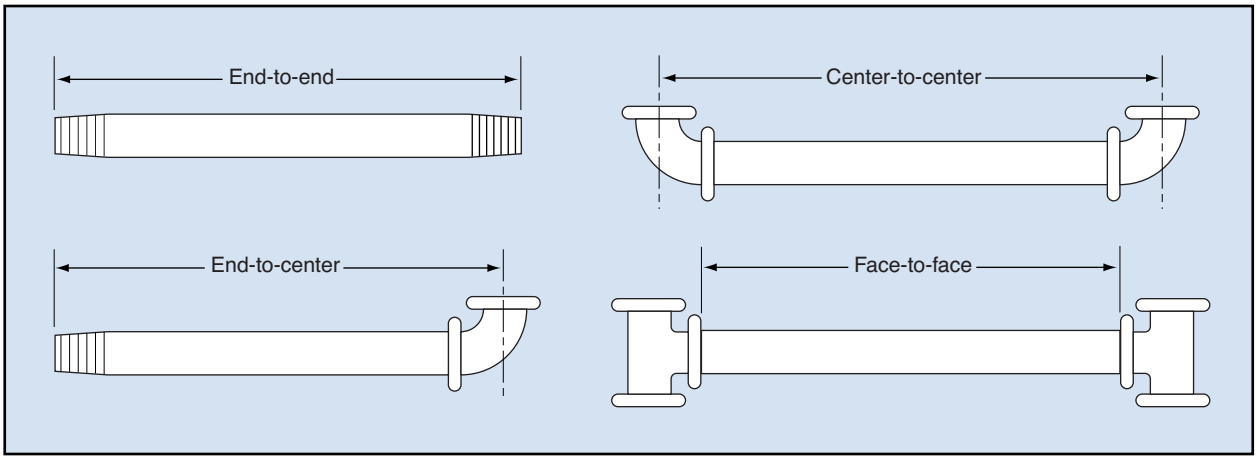


Fig. 1-2. Basic pipe measurements



Standard Code for Pressure Piping. This code of standards established, among other things, *schedule numbers*, which indicate the outside diameter, the inside diameter, the wall thickness, and the weight per foot of the pipe being referred to.

1.03 The schedule numbers range from Schedule 10 to Schedule 160. As the schedule number gets larger, so does the wall thickness of the pipe it refers to. (See Table 1-1 and Fig.1-1. on the previous page)

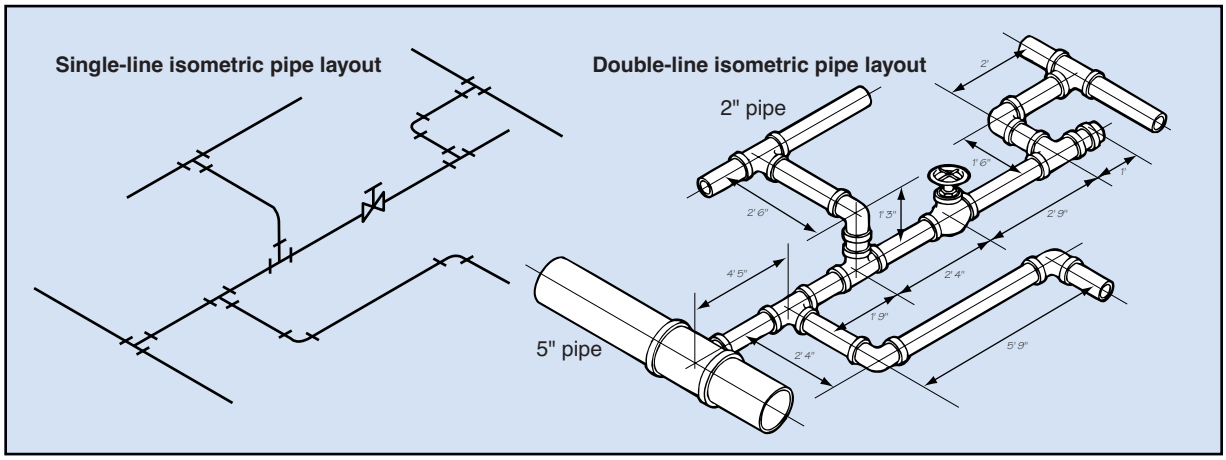
1.04 If a pipe has a nominal diameter of 12 in. or less, it is identified by its inside diameter. If the pipe has a diameter greater than 12 in., it is identified by its outside diameter.

Basic Pipe Dimensions

1.05 There are four methods used for measuring the length of a section of pipe between fittings (refer to Fig. 1-2). These methods are end-to-end, end-to-center, center-to-center, and face-to-face.

1.06 The end-to-end measurement includes the full length of a section of pipe, including the threads at both ends. The end-to-center measurement is used to measure pipe that has a fitting at

Fig. 1-3. Piping system drawings



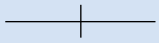
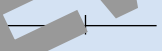
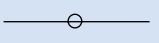
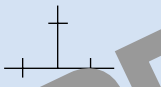
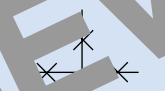
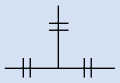
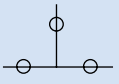
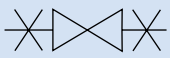
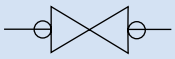
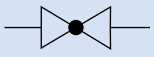
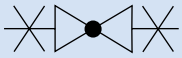
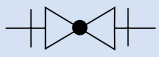
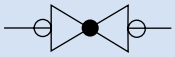
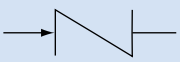
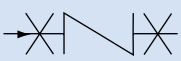
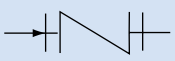
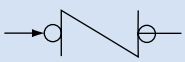
one end only. This measurement includes the threaded end of the pipe to the centerline of the fitting. The center-to-center method is used when pipe has fittings at both ends. It includes the length from the centerline of one fitting to the centerline of the other. The face-to-face method is also used when pipe has fittings at each end, but it includes the length from the face of one fitting to the inside face of the other.

Piping System Symbols

1.07 You may be called upon to build a piping system, or part of one, from engineering drawings. There are several different methods used to identify pipe and fittings on these drawings (Fig. 1-3). The purpose of each method is to indicate the location and size of each pipe, the location of valves and any accessories, and where fittings are needed.

1.08 Very often, single-line isometric drawings are used. Table 1-2 illustrates some of the common symbols, such as the types of connections which must be used. There are also symbols indicating what fluid the pipe will be used to transport. Dimensions on the drawings normally refer to the nominal diameter of the pipe and its center-to-center distance.

Table 1-2. ANSI single-line pipe and valve symbols

Fitting/valve	Threaded	Welded	Flanged	Soldered
Joint				
Tee				
Elbow 90°				
Elbow 45°				
Elbow long radius				
Gate valve				
Globe valve				
Check valve				

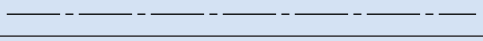
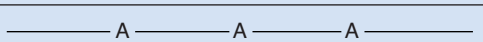
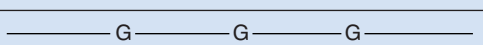
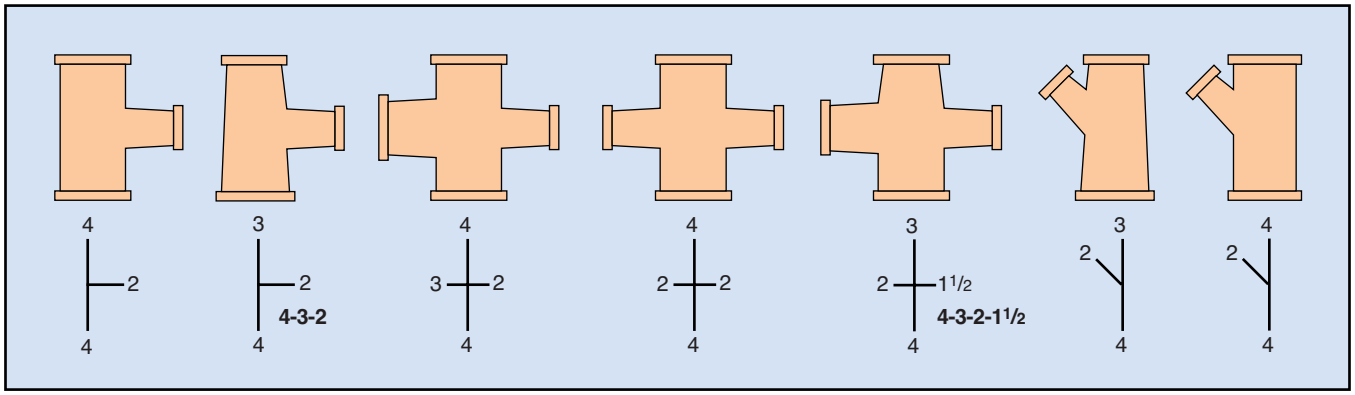
Piping symbols	
Cold water	
Hot water	
Compressed air	
Gas	

Fig. 1-4. Sizes of reducing fittings



1.09 When building a piping system, remember that the standard length of a section of pipe is 21 ft. But other lengths, sometimes called random lengths, are available. They normally range from 12 to 22 ft long.

Pipe Fitting

1.10 All elements in a piping system must be joined in some way. Fittings are used to do this. Many sizes and types of fittings are available. The type you use depends on such things as the piping material, whether sections must be replaced at certain intervals, the fluid being carried, and its temperature, pressure, and abrasion characteristics.

1.11 The common way to describe a fitting is by the material it is made from, the terms that describe it (elbow, tee, and so forth), and the nominal pipe diameter. Some fittings, called *reducing fittings*, connect pipes of different diameters. In this case, the size of both the inlet and the outlet must be specified. Figure 1-4 indicates how the sizes are described. Note that the largest opening is given first. Next is the size on the opposite end. For laterals or tees, the third size is the outlet off the main flow. Cross fittings are described with the third size as the larger side outlet and the fourth size is the opening opposite to it.

1.12 There are four types of pipe joints:

- threaded
- welded
- bolted flanged
- soldered.

Figure 1-5 illustrates an example of each type of joint. You will usually be working with the first three and with their corresponding fittings.

Fig. 1-5. Types of pipe joints

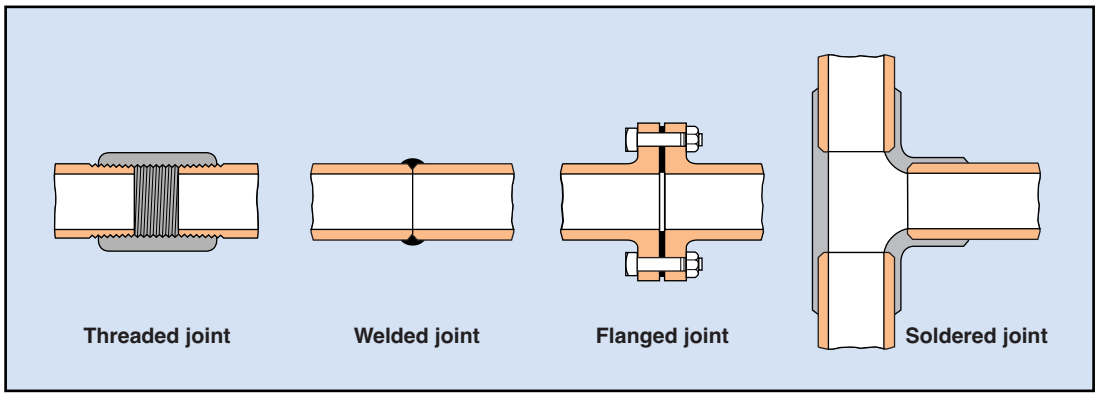
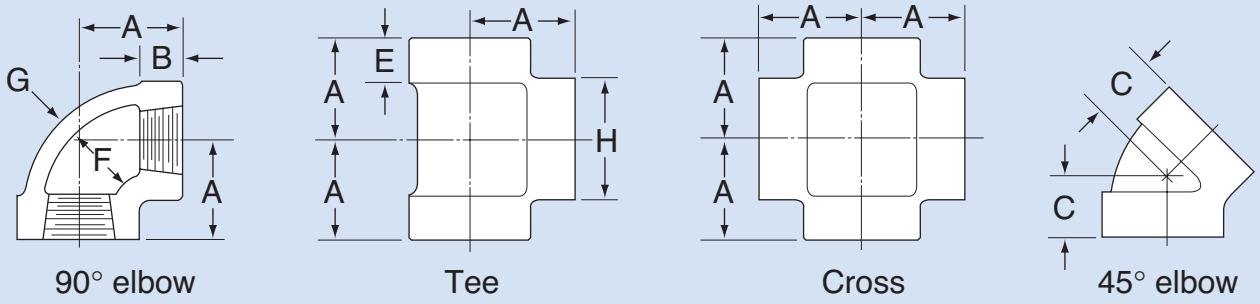
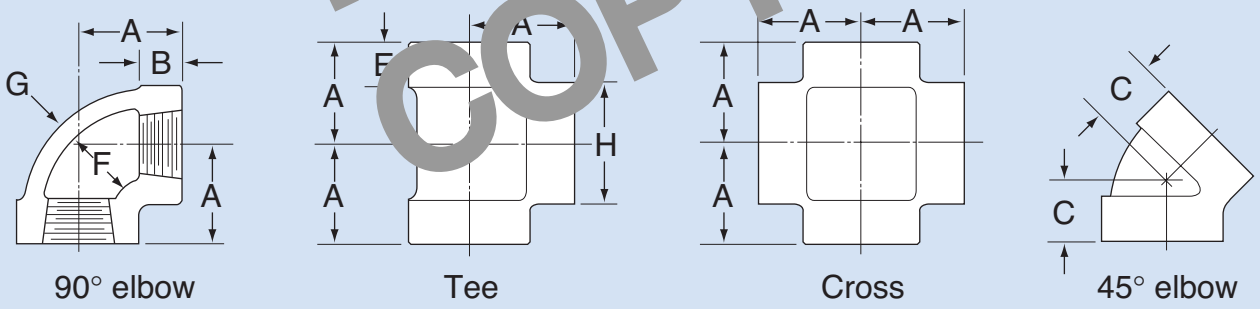


Table 1-3. Dimensions of 125-lb cast-iron screwed 90° and 45° elbows, tees, and crosses (straight sizes) (ASA B16.4)



Nominal pipe size	Center to end, elbows, tees, and crosses *A*	Center to end, 45° elbows *C*	Length of thread, min *B*	Width of band, min *E*	Inside diameter of fitting *F*		Metal thickness *G*	Outside diameter of band, min *H*
					Maximun	Minimum		
1	1.50	1.12	0.58	0.62	1.385	[illegible]	0.170	1.95
1¼	1.75	1.29	0.67	0.69	[illegible]	[illegible]	0.185	2.39
1½	1.94	1.43	0.70	0.75	1.97[illegible]	[illegible]	0.200	2.68
2	2.25	[illegible]	0.75	[illegible]	[illegible]	[illegible]	0.220	3.28

Table 1-4. Dimensions of 150-lb cast-iron screwed 90° and 45° elbows, tees, and crosses (straight sizes) (ASA B16.4)



Nominal pipe size	Center to end, elbows, tees, and crosses *A*	Center to end, 45° elbows *C*	Length of thread, min *B*	Width of band, min *E*	Inside diameter of fitting *F*		Metal thickness *G*	Outside diameter of band, min *H*
					Maximun	Minimum		
1	1.63	1.31	0.75	0.76	1.385	1.315	0.28	2.24
1¼	1.94	1.50	0.84	0.88	1.730	1.660	0.33	2.73
1½	2.13	1.69	0.87	0.97	1.970	1.900	0.35	3.07
2	2.50	[illegible]	1.00	1.12	2.445	2.375	0.39	3.74

1.13 **Threaded fittings** are made from cast iron, malleable iron, cast steel, forged steel, or brass. These fittings allow pipes to be disconnected. They can withstand reasonably high pressures, but care must be taken when threading the pipe and installing the fitting to ensure a tight joint. ANSI publishes Standard

Table 1-5. Normal length of thread engagement

Pipe size (in.)	Thread engagement (in.)	Pipe size (in.)	Thread engagement (in.)
1/8	1/4	2	3/4
1/4	3/8	2 1/2	15/16
3/8	3/8	3	1
1/2	1/2	3 1/2	1 1/16
3/4	9/16	4	1 1/8
1	11/16	5	1 1/4
1 1/4	11/16	6	1 5/16
1 1/2	11/16	8	1 7/16

No. B 16.4 for cast-iron threaded fittings. Table 1-3 on the previous page gives the dimensions of 125 lb fittings, and Table 1-4 on the previous page covers 250 lb fittings. The recommended length of the threads varies with the pipe diameter. Table 1-5 lists the values for pipe diameters from 1/8 to 8 in.

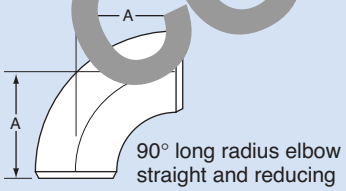
1.14 **Welded fittings** (some flanges are shown in Fig. 1-6) are most often used in systems that operate at high pressures. The main considerations when installing welded fittings are proper joint preparation and quality welding. The fitting should be of the same material as the pipe, to avoid the need for a special welding process. Table 1-6 gives dimensions of two types of welded fittings.

1.15 **Bolted flanged fittings** are often used to connect valves or other devices into the system. This type of fitting makes disassembly easier. Sealing a flanged joint, however, can be difficult. Proper assembly and alignment and the use of the correct gasket material are very important.

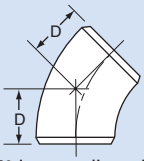
1.16 It is also important that you be certain you are using the correct fitting for a job. First, make sure that the fitting has the proper pressure and temperature rating. Second, make sure that it will properly fit with the pipes being connected.

The Programmed Exercises on the next page will tell you how well you understand the material you have just read. Before starting the exercises, remove the REVEAL KEY from the back of your Book. Read the instructions printed on the Reveal Key. Follow these instructions as you work through the Programmed Exercises.

Table 1-6. Dim[illegible]f steel [illegible] welding fittings



90° long radius elbow straight and reducing



45° long radius elbow

Size	A	B	C	D	E	F	G	H
3/4	1 1/8			9/16	1 1/8*			2 1/4
1	1 1/2	1		7/8	1 1/2*	1 1/2	2	3
1 1/4	1 7/8	1 1/4		1	1 7/8*	1 1/2	2 1/2	3 3/4
1 1/2	2 1/4	1 1/2	3 1/4	1 1/8	2 1/4*	1 1/2	3	4 1/2
2	3	2	4 1/4	1 3/8	2 1/2	1 1/2	4	6
2 1/2	3 3/4	2 1/2	5	1 3/4	3	1 1/2	5	7 1/2
3	4 1/2	3	5 3/4	2	3 3/8	2	6	9

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1-1. In The American Standard Code for Pressure Piping, as the schedule number gets larger, so does the _____ of the pipe.	1-1. WALL THICKNESS Ref: 1.03
1-2. If a pipe has a nominal diameter of 12 in. or less, it is identified by its _____ diameter.	1-2. INSIDE Ref: 1.04
1-3. The standard length of a section of pipe is _____ ft.	1-3. 21 Ref: 1.09
1-4. To join pipes of different diameters, you will need to use _____ fittings.	1-4. REDUCING Ref: 1.11
1-5. An advantage of threaded fittings is that they allow pipes to be _____.	1-5. DISCONNECTED Ref: 1.13
1-6. Bolted flanged fittings are often used to connect _____ or other devices into a piping system.	1-6. VALVES Ref: 1.15
1-7. Sealing a flanged joint requires that you use the correct _____ material.	1-7. GASKET Ref: 1.15
1-8. Be sure your fitting has the proper pressure and _____ ratings.	1-8. TEMPERATURE Ref: 1.16

Flanges

1.17 Flanges are used to allow repeated disassembly of the components within a piping system. Many types of flanges are available, including threaded, welding neck, slip-on, socket welding, and blind types. They are all illustrated in Fig. 1-6.

1.18 **Threaded flanges** (Fig. 1-6A) are often used with alloy steel pipe, which could be weakened by the heat of welding. Threaded flanges are not usable in all applications, however. For instance, they should not be used in situations where the temperature is high, or where they might have to support weight.

1.19 **Welding neck flanges** (Fig. 1-6B) form very strong connections when welded to pipe. The tapered section reinforces the flange and allows it to withstand high loads and temperatures. Welding neck flanges are the first choice when the fluid being moved is potentially dangerous and when leaks or failures must be avoided.

1.20 **Slip-on flanges** (Fig. 1-6C) have lower strength and fatigue ratings than welding neck flanges. Their internal pressure rating is about one-third less, and their fatigue life is about two-thirds shorter. One of the advantages of the slip-on flange is that alignment is not as critical as with some other types of flanges.

1.21 **Socket welding flanges** (Fig. 1-6D) are used with smaller-diameter pipes. Where line pressures will be high, these flanges are welded both to the inside and outside of the pipe. This improves their fatigue strength rating to about 150% that of double-welded slip-on flanges.

1.22 **Blind flanges** (Fig. 1-6E) are used to seal the end of a pipe. The flange retains full line pressure. Because of this, the flange and its bolts are subjected to high stresses. The highest stress occurs at the flange's center.

Flange Facings and Finishes

1.23 A variety of flange facings and finishes are available, as shown in Fig. 1-7. Note that the term facing refers to the type of face, not the surface finish. The common finishes are smooth, used on female faces, and serrated, used on male faces. The purpose of the male-face serration is to grip the gasket material that is placed between the flanges.

1.24 In applications where the fluid should not come in contact with the gasket material, tongue-and-groove facings are often used. The gasket fits in the groove. The inner diameters of the tongue and the groove are larger than the flange bore, to protect the gasket.

1.25 Ring joints use a ring-type seal which fits into matching grooves on each flange face. This type of seal is very efficient because the pressure in the pipe holds the seal against the flanges.

Using Dimensional Tables

1.26 When calculating the length of pipe required between fittings, the first step is to be sure the *dimen-*

Fig. 1-6. Types of flange

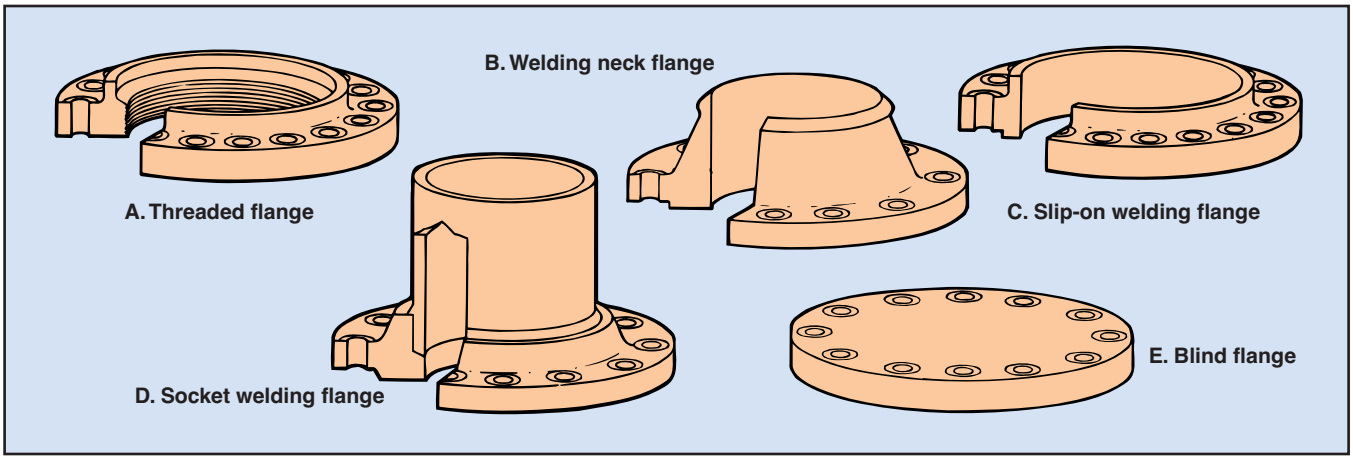
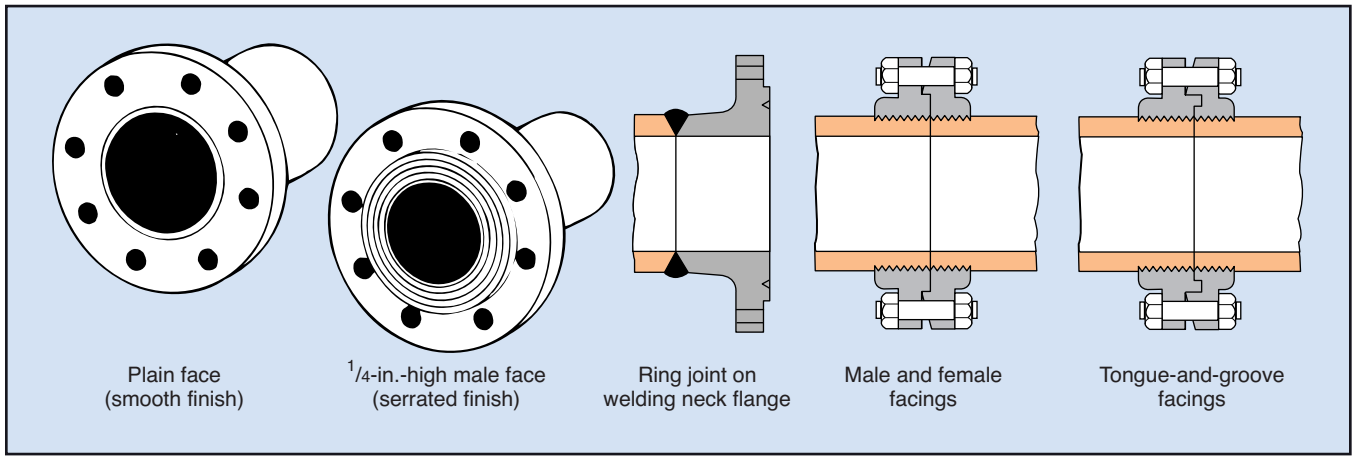


Fig. 1-7. Flange facings



sional table you refer to is the correct one for the fitting. Check to be sure that the material the fitting is made from, and its service rating, match the table.

1.27 In fitting pipe, a dimension you will often use is the distance from the face of a fitting to the intersection of its centerlines. Look at the 90° elbow, tee, or cross in Table 1-4. This is the A dimension. The equivalent dimension for a 45° elbow, also shown in Table 1-4, is the C dimension. These dimensions will be shown on all fitting charts or tables, and most manufacturers provide them in their catalogs.

1.28 Piping system drawings normally give center-to-center dimensions between fittings. Figure 1-8 is a drawing of one section of a system. From this, it is necessary to calculate the length of pipe, including thread length, to fit between the two 90° elbows.

1.29 The drawing tells us that the center-to-center distance between the two fittings is 6 ft 6 in. It also indicates that the diameter of the pipe is 2 in. The fittings are 250 lb, cast-iron elbows.

1.30 The first thing you need to know is the dimension A. Then you can subtract this number from the center-to-center distance to determine the length of pipe between the faces of the fittings. Table 1-4 gives the distance from the center to the face of a 2 in., 250 lb elbow as 2 1/2 in. Now, subtract twice this amount, or 5 in., from the 6-ft 6-in. distance. This leaves 6 ft 1 in. between faces.

1.31 Now it is necessary to add the length of the threads on each end of the pipe. Refer to Table 1-5 for the thread length of a 2 in. pipe. The length is 3/4 in. Because there are threads at each end, add twice this amount, or 1 1/2 in., to the face-to-face distance of

Fig. 1-8. Pipe length from drawing

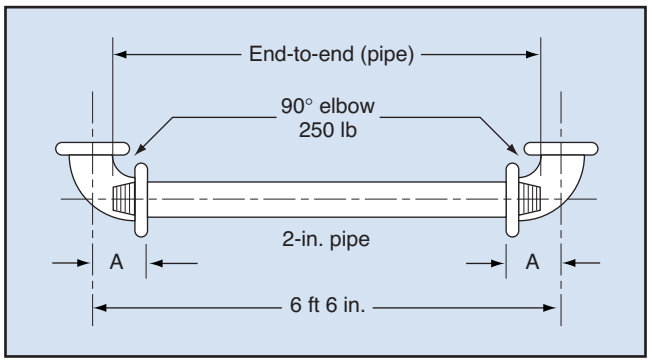


Fig. 1-9. Pipe length from existing pieces

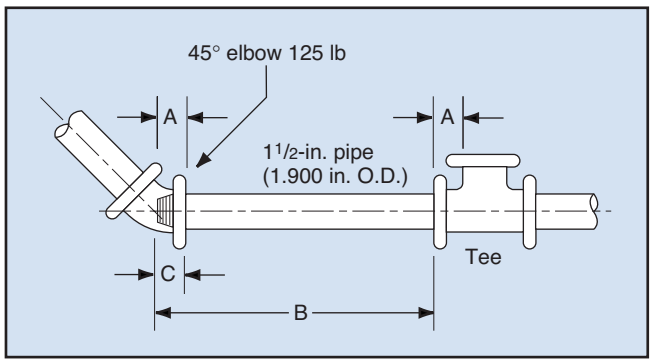
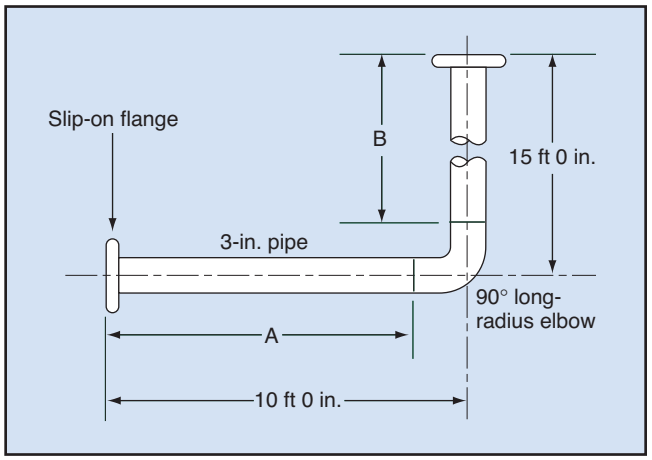


Fig. 1-10. Computing pipe length with welded fittings



6 ft 1 in. You now have determined that the required end-to-end pipe length is 6 ft 2½ in.

Calculating Lengths from Existing Pipes

1.32 Assume that Fig. 1-9 on the previous page represents a section of a piping system in which you must replace the horizontal pipe and fittings, including the 45° elbow (on the left) and the tee (on the right). Because the system cannot be out of service for long, you must calculate the required lengths and cut the pipe before removing the existing elements from the system.

1.33 The first step is to measure the pipe diameter, which you find to be 1.900 in. Referring to Table 1-1, you find that this is the outside diameter of a nominal 1½ in. pipe.

1.34 Now measure the distance B between the faces of the fittings. Let's say you find the distance to be 4 ft 3 in.

1.35 Measure the distance C, center-to-face, of the 450 elbow. This measurement is 1.43 in. Table 1-3 indicates that this dimension corresponds to a 125 lb cast-iron fitting. This means that you should use a 1½ in., 45° elbow and a tee rated at 125 lb service.

1.36 Refer to Table 1-5. There you will find that the thread length for a 1½ in. pipe is 1 1/16 in. (the A dimension in Fig. 1-9). Now add twice this amount, or 1⅜ in., to the 4 ft 3 in. dimension. The total—4 ft 4⅜ in.—is the required end-to-end length of the pipe.

1.37 Figure 1-10 illustrates a piping arrangement using welded fittings on 3 in. pipe. You need to determine the length of the pipe run, A, and of the rise, B. A *pipe run* is usually a section of pipe that is horizontal, and a *pipe rise* is a section of pipe that is vertical.

1.38 Table 1-6 indicates a value of 4½ in. for the center-to-face dimension of a 3 in., 90°, long radius, butt-welded elbow. The pipe's end-to-end run length (A) equals 10 ft 0 in. minus 4½ in., or 9 ft 7½ in. The rise length required (B) equals 15 ft 0 in. minus 4½ in., or 14 ft 7½ in. Note that you will not need to make any allowance for thread length, since this is a welded pipe system.

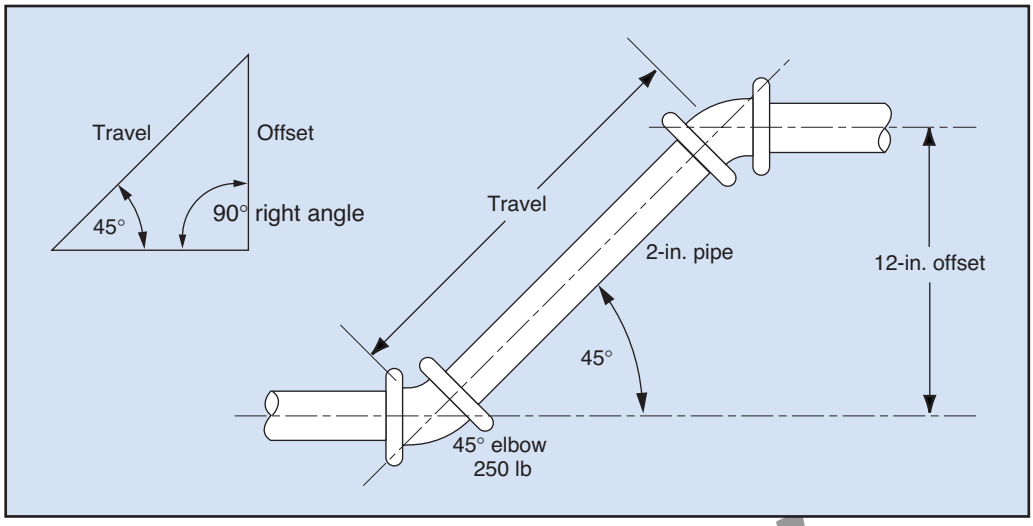
Straight Offsets

1.39 An *offset* (sometimes called *set*) occurs when a pipe changes direction of travel, then returns to its original direction. Figure 1-11 illustrates a *straight offset*. In this case the three pipe sections are in the same vertical—plane—as they would be if they were installed against a wall. An elbow changes the direction of the second pipe which "travels" lower on the wall to the next elbow, where the third pipe continues the horizontal run.

1.40 In this type of piping layout it is necessary to calculate the travel distance, given the amount of offset. *Travel* is defined as the distance from center-to-center of the fittings. Note that together the travel, the centerline of the lowest pipe, and the offset distance form a right triangle, as pointed out in Fig. 1-11. This means that the laws of trigonometry apply to the situation. Rather than going through the calculations involved, just remember this rule of thumb: To find the travel for a 45° straight offset, simply multiply the amount of offset by 1.414. In the example given in Fig. 1-11, for instance, the offset is 12 in. The travel, therefore, is 12 × 1.414, or 16.968 in.

1.41 The pipes in Fig. 1-11 are 2 in. in diameter, connected by two 250 lb, 45° elbows. The center-to-face dimension of the elbows is 2 in. (Table 1-4). Subtract twice this amount—4 in.—from the travel, leaving 12.968 in. Thread length for 2 in. pipe is ¾ in. (Table 1-5). Add twice that, or 1.50 in., for an end-to-end pipe length of 14.468 in.

Fig. 1-11. Straight offset

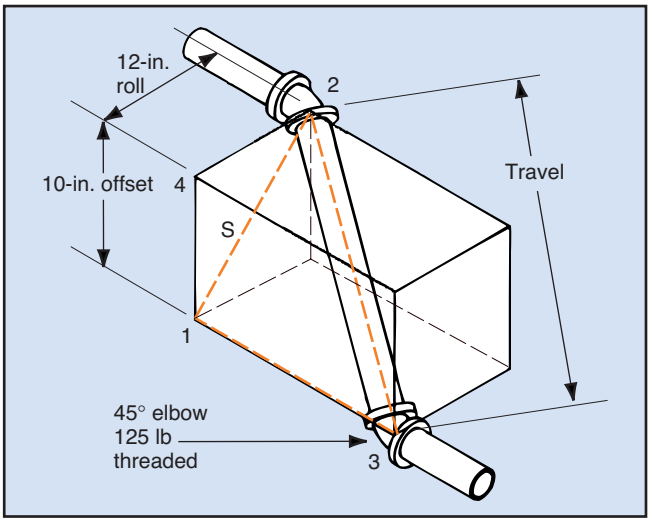


Rolling Offsets

1.42 A *rolling offset* is similar to a straight offset except that the two lines are not in the same vertical or horizontal plane. Figure 1-12 illustrates a rolling offset.

1.43 To find the travel, you must develop the triangle, 1-2-3, which lies in the plane of the travel distance. From the figure you know that the 1 in. pipe is offset 10 in., the roll is 12 in., and the fittings are 125 lb, threaded, 45° elbows. Given these dimensions, you can calculate the distance S. Then, combining this with the travel and fitting angle, you can define the triangle needed to determine the length of the travel.

Fig. 1-12. Rolling offset



1.44 Note that S is the hypotenuse of the right triangle 1-2-4. The offset and the roll are the other two sides. The hypotenuse of a right triangle, remember, is the side opposite the right angle. It is equal to the square root of the sum of the squares of the other two sides. That is:

$$S = \sqrt{(\text{offset})^2 + (\text{roll})^2}$$

For this example:

$$S = \sqrt{(10)^2 + (12)^2}$$

$$= \sqrt{100 + 144}$$

$$= \sqrt{244}$$

$$S = 15.620$$

Using what you learned in the previous example, you can calculate that the travel is equal to 15.620 in. × 1.414, or 22.087 in.

1.45 From the travel, subtract twice the center-to-face dimension for the 45° elbows:

$$22.087 - 2.24 = 19.847$$

Now add twice the thread length for 1 in. pipe to this number:

$$19.847 + 1.375 = 21.222$$

The end-to-end length of the pipe for the travel is 21.222 in.

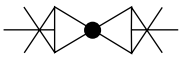
1-9. The purpose of a flange is to allow repeated _____ of the components within a piping system.	1-9. DISASSEMBLY Ref: 1.17
1-10. Slip-on flanges have lower strength and _____ ratings than welding neck flanges.	1-10. FATIGUE Ref: 1.20
1-11. Socket welding flanges are often used with _____ diameter pipe.	1-11. SMALL Ref: 1.21
1-12. A serrated finish is usually used on _____ flange faces.	1-12. MALE Ref: 1.23
1-13. In applications in which the fluid should not come in contact with the gasket material, _____ flange facings are often used.	1-13. TONGUE-AND-GROOVE Ref: 1.24
1-14. For a 90° elbow, tee, or cross joint, the distance from the face of a fitting to the intersection of its centerline is called the _____ dimension.	1-14. A Ref: 1.27, Table 1-4
1-15. Usually, a pipe run is a section of pipe that is _____.	1-15. HORIZONTAL Ref: 1.37
1-16. In a welded pipe system, you do not need to make allowance for _____ length.	1-16. THREAD Ref: 1.38

Answer the following questions by marking an "X" in the box next to the best answer.

1-1. Which of the following methods of measuring the length of a section of pipe includes the threads at both ends?

- ☐ a. Face-to-face
- ☐ b. End-to-end
- ☐ c. End-to-center
- ☐ d. Center-to-center

1-2. The following drawing illustrates a



- ☐ a. soldered gate valve
- ☐ b. threaded check valve
- ☐ c. flanged gate valve
- ☐ d. welded globe valve

1-3. Which of the symbols below indicates that a pipe contains hot water?

- ☐ a. ————————
- ☐ b. – – – – – – – – – – –
- ☐ c. ——·——·——
- ☐ d. ——·——·——

1-4. Which of the following joints is usually used in systems which operate at high pressure?

- ☐ a. Threaded
- ☐ b. Soldered
- ☐ c. Welded
- ☐ d. Bolted flanged

1-5. Which of the following is NOT important in selecting a fitting for your pipe?

- ☐ a. Proper temperature rating
- ☐ b. Proper pressure rating
- ☐ c. Correct size to fit pipe
- ☐ d. Same manufacturer as pipe

1-6. Which of the following is the first choice when leaks and failures must be avoided?

- ☐ a. A threaded flange
- ☐ b. A welding neck flange
- ☐ c. A slip-on flange
- ☐ d. A socket welding flange

1-7. In piping system drawings, the dimensions given between fittings are usually

- ☐ a. end-to-end
- ☐ b. end-to-center
- ☐ c. center-to-center
- ☐ d. face-to-face

1-8. Given a pipe with a 90° elbow at each end, a 4 ft 6 in. center-to-center distance, and a 2½ in. A dimension, the distance between faces is

- ☐ a. 4 ft 1 in.
- ☐ b. 4 ft 8 1/2 in.
- ☐ c. 4 ft 9 in.
- ☐ d. 4 ft 11 in.

1-9. To find the travel for a 450 straight offset, multiply the amount of offset by

- ☐ a. 0. 5
- ☐ b. 1.414
- ☐ c. 2
- ☐ d. 3.141

1-10. In a rolling offset, the formula for finding distance S is

- ☐ a. $\sqrt{(\text{offset})^2 + (\text{roll})^2}$
- ☐ b. $\sqrt{(\text{offset})^2 + (\text{roll})^3}$
- ☐ c. $\sqrt{(\text{offset})^2 + (\text{travel})^2}$
- ☐ d. $\sqrt{(\text{offset})^2 \text{ x } 1.414}$

SUMMARY

The American National Standards Institute, or ANSI, publishes standard specifications for pipes and fittings. The schedule numbers established by these standards insure that pipes from all manufacturers are compatible.

Fittings are used to join pipes in a system, and are described by. their material, shape, and nominal pipe diameter. Reducing fittings, which connect pipes of different diameters, are described by the sizes of both or all openings. Pipe joints may be threaded, welded, bolted flanged, or soldered, according to their particular applications.

Flanges are used to allow repeated disassembly of the parts of a piping system. Some common types of flange are threaded, welding neck, slip-on, socket welding, and blind.

Isometric drawings are used to show size and location of pipes, valves, and fittings. Symbols show types of connections and contents of the pipe.

When calculating the length of pipe needed between two fittings, be sure you refer to the correct dimensional table. The fitting material and its service rating should match those in the table.

Answers to Self-Check Quiz

1-1. b. End-to-end. Ref: 1.06, Fig. 1-2

1-2. d. Welded globe valve. Ref: Table 1-2

1-3. c. ——·——·—— Ref: Table 1-2

1-4. c. Welded. Ref: 1.14

1-5. d. Same manufacturer as pipe. Ref: 1.16

1-6. b. A welding neck flange. Ref: 1.19

1-7. c. Center-to-center. Ref: 1.28

1-8. a. 4 ft 1 in. Ref: 1.27-1.30

1-9. b. 1.414. Ref: 1.40

1-10. a. $\sqrt{(\text{offset})^2 + (\text{roll})^2}$ Ref: 1.43-1.44

Contributions from the following sources are appreciated:

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