

Table 6 Pipe Fittings

90, 60, 45 & 22½° Standard	90 & 45° Flanged
90 & 45° Street	90° Side outlet
90 & 45° Male union	90° Railing
90 & 45° Female union	90° Side outlet railing
90 & 45° Butt-welding	Base
90 & 45° Socket-welding	Drop
TEES	
Standard	Service
Flanged	Flanged side outlet
Female union	Female union outlet
Flanged base	Butt-welding
Railing	Side outlet railing
COUPLINGS	
Wrought	Cast
Screwed	Socket-welding
CROSSES	
Screwed	Flanged
Y-BENDS	
45° Screwed	45° Flanged
	45° Double
	screwed
RETURN BENDS	
Butt-welding	Back outlet
	Screwed
REDUCERS	
Standard	Eccentric
	Flanged paper
	but-welding
	Flanged ec-
	centric
BUSHINGS	
Outside hexagon	Eccentric
	Face
CAPS	
Standard	Socket-welding
	Butt-welding
PLUGS	
Countersunk	Square-head
	Bar
NIPPLES	
Close	Long
	Tank
UNIONS	
Female	Male & female
	Flange
	Tongue & groove
	flange
BUSHINGS	
Outside	Eccentric
	Face
CAPS	
Standard	Socket-welding
	Butt-welding
PLUGS	
Counter-	Square head
sunk	Bar
NIPPLES	
Close	Long
	Task
UNIONS	
Female	Male & female
	Flange
	Tongue & groove
	flange
FLANGES	
Blind	Screwed
Floor	Slip-on
	Welding neck
	Reducing

Allowable pressures for solder-type fittings are given in Table 7. Allowable pressures for ferrous screwed, flanged, and welding fittings according to ASA specifications are given in Table 8.

Steel welding (butt or socket type) fittings may be used for the same pressure as the pipe, providing wall thickness (or schedule number), and also the material, are the same as the pipe on which they are used.

Screwed fittings include: couplings, elbows (45° or 90°), return bends (close and open), tees, crosses, laterals (Y-branches), plugs, caps, lock nuts, flanges, bushings, and reducing fittings (elbows, tees, and couplings). Reducing fittings and bushings may be eccentrically tapped to permit drainage of condensate.

Sometimes nipples are erroneously called fittings. Actually a nipple is a piece of pipe less than 12 in. long that has been threaded on both ends. Pipe 12 in. or longer is regarded as cut pipe. Nipples are classified as close or full thread, shoulder, short, and long. A close nipple is about twice the length of

Table 7 Service Pressure Ratings for Wrought-Copper or Bronze Solder Joint Fittings*

Type of Solder	Service Temp., F	Maximum Service Pressure, Psi			
		Water 1/4 to 1 in. ^b	Water 1 1/4 to 2 in. ^b	Water 2 1/4 to 3 in. ^b	Steam (AS)
50-50 Tin-lead (ASTM B32 Alloy Grade 50A)	100	200	175*	150*	—
	150	150	125*	100*	—
	200	100	90*	75*	—
	250	85	75*	60*	15*
95-5 Tin-antimony or 95-5 Lead-tin (ASTM B32 Alloy Grade 5A)	100	500	400	300	—
	150	400	350	275	—
	200	300	250	200	—
	250	200	175	150	15
Solders with melting point 1100 F or above	350	270	190	155	120

Note: Ratings other than specified here may be used upon the recommendation of the manufacturer as to the proper solder that should be used.

* Extracted from American Standard for Wrought Copper and Bronze Solder Joint Fittings, B16.13-1951.

^b Standard water tube size except 1.5 in., which is 3/4 in. OD seamless copper tubing for refrigerator service, etc. (ASTM B88).

* These pressures may be used for cast-brass fittings (ASA B16.18-1950) for sizes 1 in. and smaller.

* These pressures may be used for cast-brass fittings (ASA B16.18-1950) for sizes 2 1/4 in. and above.

* Also allowable for cast-brass fittings (ASA B16.18-1950).

the pipe thread since the threads actually meet. A shoulder nipple has a shoulder between the threads and is further classified as *short* or *long*. All shoulder nipples are cut to specific lengths and sold in that manner.

As a general rule, flanged joints are used when it is expected that the line will be disassembled quite often. There are three types of joints for attaching the flange to the pipe; screwed, welded, or lapped. Types of contact surface will be discussed in the next section.

Tables 9 to 15 give data on various types of ferrous fittings.

Fittings for copper tubing are available in soldered, flared, or compression types (see Figure 2). Fittings for copper pipe of IPS dimensions are available in screwed or soldered types. Table 16 gives size data for screwed fittings and Tables 17 and 18 give data for solder-type fittings for copper tube and pipe.

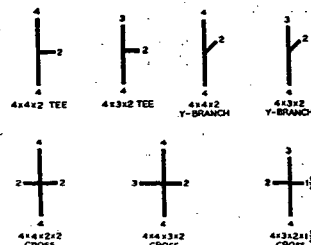


Fig. 1 Description of Tees and Laterals (ASA B16.3-1951)

Table 8 ASA Specifications and Pressures for Ferrous Screwed, Flanged, and Welded Fittings

Type of Fitting	Specification	Saturated Steam Pressure, Psi ^a
Cast Iron—Flanged	B16.1	125
Cast Iron—Flanged	B16b	250
Cast Iron—Flanged	B16b1	800
Cast Iron—Flanged (refrigeration)	B16.16	300
Cast Iron—Screwed	B16.4	125 and 150
Malleable Iron—Screwed	B16.3	150
Malleable Iron—Screwed	B16.19	300
Brass or Bronze—Screwed	B16.15	125
Brass or Bronze—Screwed	B16.17	250
Steel—Flanged	B16.5	2500

* Pressure may reduce with increasing size. This pressure is the maximum allowed in this specification for saturated steam. Higher pressures may be allowed with lower temperatures.

The compression-type fitting is generally limited to small sizes of tube, while the flared and soldered types are used in both large and small sizes. An American Standard, ASA A40.2 (1936), has been prepared to standardize dimensions of brass fittings for flared copper tube. Flared tube fittings are widely used in refrigeration work where SAE dimensions and a 45-deg flare render most fittings interchangeable, although for refrigeration use, thread fits and tolerances on thread gages must be maintained within close limits. Brass fittings with SAE dimensions are not interchangeable with the American Standard fittings for water tube.

FLANGE FACINGS AND GASKETS

There are many types of flange facings. The simplest, and the one most commonly used, is the plain face. This type of face is used with fittings shown in Table 10. Other facings, with varying complexity, are used for higher pressures. They include: male and female face (an insert type face), tongue-and-groove (an adaptation of the male and female type), lapped pipe to flange, lapped pipe to pipe, and ring and groove inside neck flanges.

As it is too expensive to machine flange faces sufficiently to provide watertight joints, a gasket is usually inserted be-

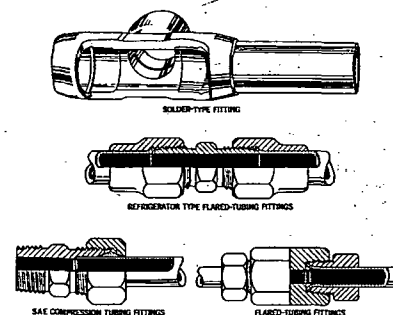


Fig. 2 Copper or Brass Tube Fittings

Table 9 Dimensions of Screwed Cast-Iron 90- and 45-Deg Elbows, Tees, and Crosses (Class 125) (Straight Sizes)

Nominal Pipe Size	Center to End, Elbows, Tees, and Crosses		Length of Thread, Min	Width of Band, Min	Inside Diameter of Fitting		Metal Thick- ness	Outside Diameter of Band, Min
	A	C			F	G		
					Max	Min		H
1/2	0.81	0.73	0.32	0.38	0.584	0.540	0.110	0.93
3/4	0.95	0.80	0.36	0.44	0.719	0.675	0.120	1.12
1	1.12	0.88	0.43	0.50	0.897	0.840	0.130	1.34
1 1/4	1.31	0.98	0.50	0.56	1.107	1.050	0.155	1.63
1 1/2	1.50	1.12	0.58	0.62	1.385	1.315	0.175	1.95
2	1.75	1.29	0.67	0.69	1.730	1.660	0.180	2.39
2 1/2	1.94	1.43	0.70	0.75	1.970	1.900	0.200	2.68
3	2.25	1.68	0.75	0.84	2.445	2.375	0.220	3.28
3 1/2	2.70	1.95	0.92	0.94	2.975	2.875	0.240	3.86
4	3.08	2.17	0.98	1.00	3.600	3.500	0.260	4.62
5	3.42	2.39	1.03	1.06	4.100	4.000	0.280	5.20
6	3.79	2.61	1.08	1.12	4.600	4.500	0.310	5.79
8	4.50	3.05	1.18	1.18	5.663	5.563	0.380	7.05
10	5.13	3.46	1.28	1.28	6.725	6.625	0.430	8.28
12	6.56	4.28	1.47	1.47	8.725	8.625	0.550	10.63
14	8.08*	5.16	1.68	1.68	10.850	10.750	0.690	13.12
16	9.50*	5.97	1.88	1.88	12.850	12.750	0.800	15.47

From American Standard Dimensions of Cast-Iron Screwed Fittings, Class 125, AAS B16.4-1949. All dimensions given in inches.

* This applies to elbows and tees only.

tween the contact faces of the flanges. The flange bolts then draw the faces up so tight that the gasket deforms into the face imperfections and thereby provides a tight joint.

Gaskets are made of numerous materials, such as cork, paper, fiber, asbestos, metal (iron, steel, copper, etc.), and combinations of metal and some soft material. The proper gasket material to use depends upon the service of the pipe. The material should not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

VALVES

Valves are made with the same end connections as fittings. A brief description of each type follows.

1. **Flanged Ends:** Made in sizes from 1/2 in. up. Used whenever line fittings are flanged and if frequent removal is contemplated. Flanged valves facilitate installation when large sizes are used.

2. **Screwed Ends:** Most common-type end. Can be used for all pressures. Usually confined to smaller size because of difficulty in making large screwed joints.

3. **Welding Ends:** Available in steel only. Generally employed for high-temperature, high-pressure work. Difficult to disassemble in a welded line. This type includes butt-welding or socket-welding. See Tables 11 and 14 for size of fittings available in each class. The valves are made in the same range.

4. **Brazing Ends:** These ends are available on brass valves. The ends have a special shape to facilitate use of brazing alloys. These valves are used for higher temperatures than solder end valves.