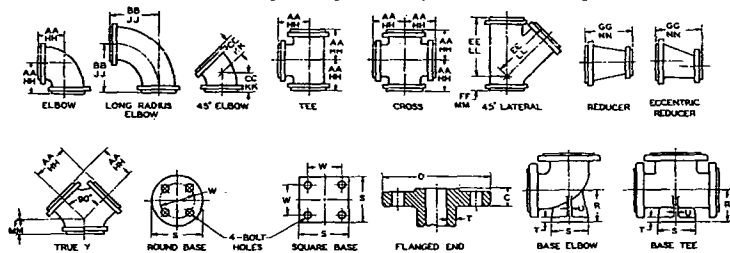


Table 12 . . . Dimensions of Steel Flanged Fittings for Primary Service Pressure Rating of 150 Psi (Gage)

[illegible]

* Actual diameter is same for sizes 1 to 12 in. and is 34 in. less than nominal for sizes 14 to 24 in.

Flange fittings may be welded from sizes 1/2 to 24 in. inclusive (see Table 13).

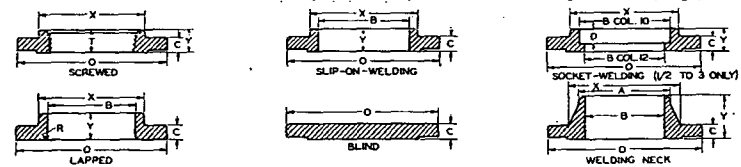
Socket-welding fittings also are commercially available. These fittings have a machined recess for inserting the pipe which is attached by a fillet weld between the pipe wall and socket end. Use of socket-welding fittings generally is restricted to nominal pipe sizes 3 in. and smaller in which range commercial fittings are available. This type of fitting has gained rapid acceptance owing to its ease of installation, low cost, and ability to make a pressure-tight joint without weak-

ening the pipe, as is the case with threading. Dimensions for socket-welding fittings, in accordance with ASA Standard B16.11-1946, are given in Table 14.

EXPANSION AND FLEXIBILITY

Changes in temperature cause a change in dimensions of any matter. The metals that are used for pipe have the same characteristics in that they expand with increasing temperature. If the metal is constrained so that it cannot expand, then an internal compressive stress is set up in the material.

Table 13 . . . Dimensions of Steel Flanges for Primary Service Pressure Rating of 150 Psi (Gage)



1	2	3	4	5	6	7	8	9	10	11	12	13	14
Nominal Pipe Size	Outside Diameter of Flange	Thickness of Flange, in.	Diameter of Hub	Hub Diameter Beginning of Chamfer Welding Neck	Length Through Hub Y			Thread Length Screwed	Bore B			Corner Radius of Bore of Lapped Flange and Pipe	Depth of Socket
					Screwed slip-on socket welding	Lapped	Welding neck		Slip-on socket welding, in.	Lapped, in.	Welding neck socket welding		
1/8	3 3/8	3/16	1 1/8	0.84	3/8	3/8	1 1/8	3/8	0.88	0.90	0.62	3/8	3/8
1/4	3 7/8	3/8	1 1/4	1.05	3/8	3/8	2 1/8	3/8	1.09	1.11	0.82	3/8	3/8
3/8	4 1/4	3/8	1 3/8	1.32	1 1/8	1 1/8	2 3/8	1 1/8	1.38	1.38	1.05	3/8	3/8
1/2	4 7/8	3/8	2 1/8	1.66	1 3/8	1 3/8	2 3/8	1 3/8	1.70	1.72	1.38	3/8	3/8
5/8	5	1 1/16	2 1/8	1.90	3/4	3/4	2 3/8	3/8	1.95	1.97	1.61	3/8	3/8
2	6	3/4	3 1/8	2.38	1	1	2 3/4	1	2.44	2.46	2.07	3/8	1 1/8
2 1/2	7	3/8	3 3/8	2.88	1 1/8	1 1/8	2 3/4	1 1/8	2.94	2.97	2.47	3/8	3/8
3	7 3/4	1 1/8	4 1/4	3.60	1 3/8	1 3/8	2 3/4	1 3/8	3.57	3.60	3.07	3/8	1 1/8
3 1/2	8 1/4	1 1/8	4 1/2	4.00	1 3/4	1 3/4	2 1/2	1 3/8	4.07	4.10	3.55	3/8	3/8
4	9	1 1/8	5 1/8	4.50	1 3/8	1 3/8	3	1 3/8	4.57	4.60	4.03	3/8	3/8
5	10	1 1/8	6 1/8	5.56	1 3/8	1 3/8	3 1/2	1 3/8	5.66	5.69	5.05	3/8	3/8
6	11	1	7 1/8	6.63	1 3/8	1 3/8	3 1/2	1 3/8	6.72	6.75	6.07	3/8	3/8
8	13 1/8	1 1/8	9 1/8	8.63	1 3/4	1 3/4	4	1 3/8	8.72	8.75	7.98	3/8	3/8
10	16	1 1/8	12	10.75	1 3/4	1 3/4	4	1 3/8	10.88	10.92	10.02	3/8	3/8
12	19	1 3/8	14 1/8	12.75	2 1/8	2 1/8	4 1/2	2 1/8	12.88	12.92	12.00	3/8	3/8
14	21	1 3/8	15 3/8	14.00	2 1/2	3 1/8	5	2 1/8	14.14	14.18	To be speci- fied by pur- chaser	3/8	3/8
16	23 1/2	1 3/8	18	16.00	2 1/2	3 1/8	5	2 1/8	16.16	16.19		3/8	3/8
18	25	1 3/8	18 3/8	18.00	2 1/2	3 1/8	5 1/2	2 1/8	18.18	18.20		3/8	3/8
20	27 1/2	1 3/8	22	20.00	2 3/8	4 1/8	5 1/2	2 3/8	20.20	20.25		3/8	3/8
24	32	1 3/8	26 1/8	24.00	3 1/4	4 3/8	6	2 3/8	24.25	24.25	3/8	3/8	

From American Standard for Steel Pipe Flanges and Flanged Fittings, ASA B16.5-1957. All dimensions given in inches.

This stress can be calculated, just as any other stress, by using Hooke's Law.

$$F = \frac{eEA}{L} \quad (1)$$

where

F = force of constraint, pounds.

 δ = deformation, inches.

E = modulus of elasticity, pounds per square inch.

A = area of metal, square inches.

L = length of metal, inches.

This equation is valuable in determining the internal stress of the pipe and also the constraining force on the anchors. This equation assumes that the stress is less than the yield strength of the metal. In other words, the metal will return to its original dimension when the temperature returns to its original level.

Materials such as cast iron are not ductile, hence the *yield strength*, approximately equal to the ultimate strength. These materials have a compressive strength but poor tensile strength. For this reason, it is difficult to bend these materials appreciably. Cast iron, for example, could be put in tension and, from Table 20, it is seen that for a temperature change of 100 deg, a compressive stress of 7140 psi would be developed. If the pipe were straight, this stress would be handled easily. If, however, the stress caused a bending moment, then fracture might occur.

The values of stress found in Table 20 were determined by using Equation 1 and substituting Equation 2 for e

$$e = aI\Delta t \quad (2)$$

where

α = coefficient of linear expansion, inches per inch.
 Δt = temperature change, Fahrenheit degrees.