

supports fitted with rollers, machined blocks, elliptical or circular rings of larger diameter than the pipe giving contact only at the bottom or trolley hangers. In all cases, allowance should be made for rod clearance to permit swinging without setting up severe bending action in the rods.

For pipes of small size, perforated metal strip is often used. For horizontal mains, the rod or strip usually is attached to the joists or steel

TABLE 5. THERMAL EXPANSION OF PIPE IN INCHES PER 100 FT^a
(For superheated steam and other fluids refer to temperature column)

SATURATED STEAM			ELONGATION IN INCHES PER 100 FT FROM -20 F UP				SATURATED STEAM		ELONGATION IN INCHES PER 100 FT FROM -20 F UP			
Vacuum Inches of Hg.	Pressure Pounds per Square Inch Gage	Temper- ature Degrees Fahren- heit	Cast- Iron Pipe	Steel Pipe	Wrought Iron Pipe	Copper Pipe	Pressure Pounds per Square Inch Gage	Temper- ature Degrees Fahren- heit	Cast- Iron Pipe	Steel Pipe	Wrought Iron Pipe	Copper Pipe
		-20	0	0	0	0	664.3	500	3.847	4.296	4.477	6.110
		0	0.127	0.145	0.152	0.204	795.3	520	4.020	4.487	4.677	6.352
		20	0.255	0.293	0.306	0.442	945.3	540	4.190	4.670	4.866	6.614
		40	0.390	0.430	0.465	0.655	1115.3	560	4.365	4.860	5.057	6.850
29.39		60	0.518	0.593	0.620	0.888	1308.3	580	4.541	5.051	5.268	7.123
28.89		80	0.649	0.725	0.780	1.100	1525.3	600	4.725	5.247	5.455	7.388
27.99		100	0.787	0.898	0.939	1.338	1768.3	620	4.896	5.437	5.660	7.636
26.48		120	0.926	1.055	1.110	1.570	2041.3	640	5.082	5.627	5.850	7.893
24.04		140	1.051	1.209	1.265	1.794	2346.3	660	5.260	5.831	6.067	8.153
20.27		160	1.200	1.368	1.427	2.008	2705	680	5.442	6.020	6.260	8.400
14.63		180	1.345	1.528	1.597	2.255	3080	700	5.629	6.229	6.481	8.676
6.45		200	1.495	1.691	1.778	2.500		720	5.808	6.425	6.673	8.912
	2.5	220	1.634	1.852	1.936	2.720		740	6.006	6.635	6.899	9.203
	10.3	240	1.780	2.020	2.110	2.960		760	6.200	6.833	7.100	9.460
	20.7	260	1.931	2.183	2.279	3.189		780	6.389	7.046	7.314	9.736
	34.5	280	2.085	2.350	2.465	3.422		800	6.587	7.250	7.508	9.992
	52.3	300	2.233	2.519	2.630	3.665		820	6.779	7.464	7.757	10.272
	74.9	320	2.395	2.690	2.800	3.900		840	6.970	7.662	7.952	10.512
	103.3	340	2.543	2.862	2.988	4.145		860	7.176	7.888	8.195	10.814
	138.3	360	2.700	3.029	3.175	4.380		880	7.375	8.098	8.400	11.175
	180.9	380	2.859	3.211	3.350	4.628		900	7.579	8.313	8.639	11.360
	232.4	400	3.008	3.375	3.521	4.870		920	7.795	8.545	8.867	11.625
	293.7	420	3.182	3.566	3.720	5.118		940	7.989	8.755	9.089	11.911
	366.1	440	3.345	3.740	3.900	5.358		960	8.200	8.975	9.300	12.180
	451.3	460	3.511	3.929	4.096	5.612		980	8.406	9.196	9.547	12.473
	550.3	480	3.683	4.100	4.280	5.855		1000	8.617	9.421	9.776	12.747

^aFrom Piping Handbook, by Walker and Crocker. This table gives the expansion from -20 F to the temperature in question. To obtain the amount of expansion between any two temperatures take the difference between the figures in the table for those temperatures. For example, if a steel pipe is installed at a temperature of 60 F and is to operate at 300 F, the expansion would be 2.519 - 0.593 = 1.926 in.

work of the floor above. For long runs of vertical pipe subject to considerable thermal expansion, either the hangers should be designed to prevent excessive load on the bottom support when expansion takes place, or the bottom support should be designed to withstand the entire load.

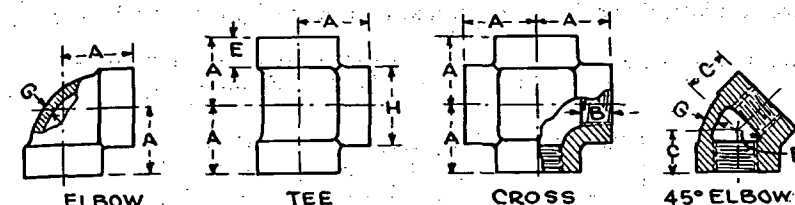
FITTINGS

Fittings for joining the separate lengths of pipe together are made in a variety of forms, and are either screwed or flanged, the former being

generally used for the smaller sizes of pipe up to and including 3½ in., and the latter for the larger sizes, 4 in. and above. Screwed fittings of large size as well as flanged fittings of small size are also made and are used for certain classes of work at the proper pressure.

The material used for fittings is generally cast-iron, but in addition to this malleable-iron, steel and steel alloys are also used, as well as various

TABLE 6. TENTATIVE AMERICAN STANDARD DIMENSIONS OF ELBOWS, 45 DEG ELBOWS, TEES, AND CROSSES (STRAIGHT SIZES) FOR 125 LB CAST-IRON SCREWED FITTINGS



NOMINAL PIPE SIZE	A CENTER TO END, ELBOWS, TEES AND CROSSES	C CENTER TO END, 45 DEG ELBOWS	B LENGTH OF THREAD MIN.	E WIDTH OF BAND, MIN.	F INSIDE DIAMETER OF FITTING		G METAL THICKNESS, MIN.	H OUTSIDE DIAMETER OF BAND, MIN.
					Min.	Max.		
¼	0.81	0.73	0.32	0.38	0.540	0.584	0.110	0.93
½	0.95	0.80	0.36	0.44	0.675	0.719	0.120	1.12
¾	1.12	0.88	0.43	0.50	0.840	0.897	0.130	1.34
1	1.31	0.98	0.50	0.56	1.050	1.107	0.155	1.63
1 ¼	1.50	1.12	0.58	0.62	1.315	1.385	0.170	1.95
1 ½	1.75	1.29	0.67	0.69	1.660	1.730	0.185	2.39
2	1.94	1.43	0.70	0.75	1.900	1.970	0.200	2.68
2 ½	2.25	1.68	0.75	0.84	2.375	2.445	0.220	3.28
3	2.70	1.95	0.92	0.94	2.875	2.975	0.240	3.86
3 ½	3.08	2.17	0.98	1.00	3.500	3.600	0.260	4.62
4	3.42	2.39	1.03	1.06	4.000	4.100	0.280	5.20
5	3.79	2.61	1.08	1.12	4.500	4.600	0.310	5.79
6	4.50	3.05	1.18	1.18	5.563	5.663	0.380	7.05
8	5.13	3.46	1.28	1.28	6.625	6.725	0.430	8.28
10	6.56	4.28	1.47	1.47	8.625	8.725	0.550	10.63
12	8.08	5.16	1.68	1.68	10.750	10.850	0.690	13.12
14	9.50	5.97	1.88	1.88	12.750	12.850	0.800	15.47
14 O.D.	10.40		2.00	2.00	14.000	14.100	0.880	16.94
16 O.D.	11.82		2.20	2.20	16.000	16.100	1.000	19.30

All dimensions given in inches.

grades of brass or bronze. The material to be used depends on the character of the service and the pressure.

As in the case of pipe, there are several weights of fittings manufactured. Recognized American Standards for the various weights are as follow:

Cast-iron pipe flanges and flanged fittings for 25 lb (sizes 4 in. and larger), 125 lb, and 250 lb maximum saturated steam pressure.