

Table 2 Dimensions and Properties of Copper Tube
(All Types Except DWV are based on ASTM B-88)

Nominal Size	Type	Diameter		Wall Thickness	Surface Area		Section Area		Area of Metal	Volume	Weight*	Working Pressure*
		OD in.	ID in.		OD	ID	OD	ID		Gal./lin. ft.	lb./lin. ft.	
1/4	K*	0.375	0.305	0.035	0.0882	0.0798	0.110	0.0730	0.0374	0.00379	0.145	918
	L*	0.375	0.315	0.030	0.0882	0.0825	0.110	0.0779	0.0324	0.00404	0.126	764
3/8	K	0.500	0.402	0.049	0.131	0.105	0.196	0.127	0.0695	0.00660	0.269	988
	L	0.500	0.430	0.035	0.131	0.113	0.196	0.145	0.0512	0.00753	0.198	677
1/2	K	0.625	0.527	0.049	0.164	0.138	0.306	0.218	0.0887	0.0113	0.344	779
	L	0.625	0.545	0.040	0.164	0.143	0.306	0.233	0.0735	0.0121	0.285	625
5/8	K	0.750	0.652	0.049	0.193	0.171	0.441	0.334	0.108	0.0174	0.418	643
	L	0.750	0.666	0.042	0.193	0.174	0.441	0.348	0.0934	0.0181	0.362	547
3/4	K	0.875	0.745	0.065	0.229	0.195	0.601	0.436	0.165	0.0227	0.641	747
	L	0.875	0.785	0.045	0.229	0.206	0.601	0.484	0.117	0.0250	0.455	497
1	K	1.125	0.995	0.065	0.295	0.260	0.994	0.778	0.216	0.0405	0.839	574
	L	1.125	1.025	0.050	0.295	0.268	0.994	0.825	0.169	0.0442	0.655	432
1 1/4	K	1.375	1.245	0.065	0.360	0.326	1.48	1.22	0.268	0.0534	1.04	466
	L	1.375	1.265	0.055	0.360	0.331	1.48	1.26	0.228	0.0555	0.884	387
	M	1.375	1.291	0.042	0.360	0.338	1.48	1.31	0.176	0.0681	0.682	293
	DWV	1.375	1.295	0.040	0.360	0.339	1.48	1.32	0.163	0.0684	0.650	—
1 1/2	K	1.625	1.481	0.072	0.425	0.388	2.07	1.72	0.351	0.0594	1.36	421
	L	1.625	1.505	0.060	0.425	0.394	2.07	1.78	0.295	0.0925	1.14	359
	M	1.625	1.527	0.049	0.425	0.400	2.07	1.83	0.243	0.0950	0.940	289
	DWV	1.625	1.541	0.042	0.425	0.403	2.07	1.86	0.205	0.0969	0.809	—
2	K	2.125	1.959	0.083	0.556	0.513	3.56	3.01	0.532	0.157	2.06	376
	L	2.125	1.985	0.070	0.556	0.520	3.56	3.10	0.452	0.161	1.75	316
	M	2.125	2.009	0.058	0.556	0.526	3.56	3.17	0.377	0.164	1.46	255
	DWV	2.125	2.041	0.042	0.556	0.534	3.56	3.27	0.288	0.142	1.07	—
2 1/2	K	2.625	2.435	0.095	0.687	0.638	5.41	4.66	0.755	0.242	2.93	352
	L	2.625	2.465	0.080	0.687	0.645	5.41	4.77	0.640	0.247	2.48	295
	M	2.625	2.495	0.065	0.687	0.653	5.41	4.89	0.523	0.254	2.03	234
	DWV	2.625	2.507	0.058	0.687	0.653	5.41	4.89	0.523	0.254	2.03	234
3	K	3.125	2.907	0.109	0.818	0.761	7.67	6.64	1.03	0.345	4.00	343
	L	3.125	2.945	0.090	0.818	0.771	7.67	6.81	0.895	0.354	3.33	278
	M	3.125	2.981	0.072	0.818	0.780	7.67	6.98	0.691	0.362	2.68	220
	DWV	3.125	3.035	0.045	0.818	0.796	7.67	7.23	0.435	0.376	1.69	—
3 1/2	K	3.625	3.385	0.120	0.949	0.886	10.3	9.00	1.32	0.468	5.12	324
	L	3.625	3.425	0.100	0.949	0.897	10.3	9.21	1.11	0.478	4.29	268
	M	3.625	3.459	0.083	0.949	0.906	10.3	9.40	0.924	0.489	3.58	218
	DWV	3.625	3.459	0.083	0.949	0.906	10.3	9.40	0.924	0.489	3.58	218
4	K	4.125	3.857	0.134	1.08	1.01	13.3	11.7	1.68	0.607	6.51	135
	L	4.125	3.905	0.110	1.08	1.02	13.3	12.0	1.39	0.623	5.33	256
	M	4.125	3.935	0.095	1.08	1.03	13.3	12.2	1.20	0.634	4.66	217
	DWV	4.125	4.009	0.058	1.08	1.05	13.3	12.6	0.67	0.656	2.87	—
5	K	5.125	4.805	0.160	1.34	1.26	20.7	18.1	2.50	0.940	9.67	307
	L	5.125	4.875	0.125	1.34	1.28	20.7	18.7	1.96	0.971	7.61	234
	M	5.125	4.907	0.109	1.34	1.29	20.7	18.9	1.72	0.981	6.66	203
	DWV	5.125	4.907	0.109	1.34	1.29	20.7	18.9	1.72	0.981	6.66	203
6	K	6.125	5.741	0.192	1.60	1.50	29.4	25.9	3.50	1.35	13.9	308
	L	6.125	5.945	0.140	1.60	1.53	29.4	26.8	2.63	1.39	10.2	221
	M	6.125	5.881	0.122	1.60	1.54	29.4	27.2	2.30	1.42	8.92	190
	DWV	6.125	5.959	0.083	1.60	1.56	29.4	27.9	1.58	1.55	6.10	—
8	K	8.125	7.583	0.271	2.13	1.99	51.8	45.2	6.69	2.34	25.9	330
	L	8.125	7.725	0.200	2.13	2.02	51.8	46.9	4.98	2.43	19.3	229
	M	8.125	7.785	0.170	2.13	2.04	51.8	47.6	4.25	2.47	16.5	200
	DWV	8.125	7.785	0.170	2.13	2.04	51.8	47.6	4.25	2.47	16.5	200
10	K	10.125	9.449	0.338	2.65	2.47	70.5	70.1	10.4	3.65	40.3	332
	L	10.125	9.625	0.250	2.65	2.52	70.5	72.8	7.76	3.79	30.1	241
	M	10.125	9.701	0.212	2.65	2.54	70.5	73.9	6.60	3.84	25.6	202
	DWV	10.125	9.701	0.212	2.65	2.54	70.5	73.9	6.60	3.84	25.6	202
12	K	12.125	11.315	0.405	3.17	2.96	115	101	14.9	5.24	57.8	334
	L	12.125	11.565	0.280	3.17	3.03	115	105	10.4	5.45	40.4	225
	M	12.125	11.617	0.254	3.17	3.04	115	106	9.47	5.50	36.7	204
	DWV	12.125	11.617	0.254	3.17	3.04	115	106	9.47	5.50	36.7	204

Pipe, Fittings, Welding

Notes for Table 2

* Weight per foot is based on tube without couplings.
 * Working pressure is based on the American Standard Code for Pressure Piping, published by the ASME, 1955 edition for plain end and tubing (sweet joints).
 $P = \frac{2St}{D_o - 0.8t}$
 where P = allowable pressure, pounds per square inch, gage.
 S = 6000 psi allowable fiber stress, pounds per square inch.
 t = minimum wall thickness, inches.
 D_o = maximum outside diameter, inches.
 * Types K and L, furnished in both hard and soft tempers, Type M in hard only. Standard straight lengths are 20 ft. Standard coils (3/4 to 1 1/4 inch) are 60 ft.

Table 3 Table of Availability for Steel Pipe

Material	Specification	Available Sizes (Inches Dia)	Allowable Fiber Stress 5° psi
Butt-weld	A-120	3/4 to 4	6,225
	A-53	3/4 to 4	6,750
Lap-weld	A-120	2 to 12	8,400
	A-53	2 to 24	9,000
Electric-resistance	A-53 Grade A	2 to 24	10,200*
	A-53 Grade B	2 to 24	12,750*
Seamless	A-53 Grade A	2 to 24	12,000
	A-53 Grade B	2 to 24	15,000
	A-120	2 to 12	10,400

* For use in the equation $P = \frac{2St}{D_o - 0.8t}$
 where P = working pressure, pounds per square inch.
 S = fiber stress, pounds per square inch.
 t = 0.875 x wall thickness, inches.
 D_o = outside diameter, inches.
 c = joint factor = 0.05 for 1-in. and smaller size or 0.065 for larger than 1-in. size.

See American Standard Code for Pressure Piping, published by ASME, 1955 edition.

* For electric resistance welded pipe for applications where the temperature is below 650 F, and where pipe furnished under this classification is subjected to supplemental tests and/or heat treatments as agreed to by the supplier and the purchaser, and whereby such supplemental tests and/or heat treatments demonstrate the strength characteristics of the weld to be equal to the minimum tensile strength specified for the pipe, the S values equal to the corresponding seamless grades may be used.

pitch elbows and are commercially available. All threaded pipe joints should be made up with a thread paste suitable for the service for which the pipe is to be used.

Table 4 contains pertinent threading data for standard weight, extra strong and double extra strong steel, and wrought-iron pipe. The normal engagement of pipe threads is given in Table 5.

PIPE FITTINGS

Pipe is joined by butt welding one length to another or by the use of fittings. Pipe fittings are made in a variety of forms (the common types are listed in Table 6), and are screwed, flanged, or welded. The type of fitting to be used is determined by the pressure of the fluid being carried, or by the intended use of the pipe line. The materials generally used are steel, cast iron, malleable iron (heat treated cast iron), copper, brass, stainless steel, alloy steel, or bronze. The material used also depends upon the pressure or characteristics of the fluid.

Fittings are designated and sized in accordance with American Standards Association specifications and are identified by their nominal pipe sizes.

In the case of reducing tees, crosses, and Y-branches (laterals), the size of the largest run opening is given first, fol-

Table 4 Threading Data for Pipe

Nominal Size*	Pipe OD	Standard Weight			Extra and Double Extra Strong		
		Threads per inch ^b	Coupling OD	Coupling Length	Threads per inch	Coupling OD	Coupling Length
1/4	0.405	27	0.563	1 1/4	27	0.563	1 1/4
3/8	0.540	18	0.719	1 1/4	18	0.719	1 1/4
1/2	0.675	18	0.875	1 1/4	18	0.875	1 1/4
3/4	0.840	14	1.063	1 1/4	14	1.063	2 1/4
1	1.050	14	1.313	1 1/4	14	1.313	2 1/4
1 1/4	1.315	11 1/4	1.576	2	11 1/4	1.576	2 1/4
1 1/2	1.660	11 1/4	1.900	2 1/4	11 1/4	2.054	2 1/4
2	1.990	11 1/4	2.200	2 1/4	11 1/4	2.200	2 1/4
2 1/2	2.375	11 1/4	2.750	2 1/4	11 1/4	2.875	2 1/4
3	2.875	8	3.250	3 1/2	8	3.375	2 1/4
3 1/2	3.500	8	4.000	3 1/2	8	4.000	4 1/4
4	4.000	8	4.625	3 1/2	8	4.625	4 1/4
5	4.600	8	5.000	3 1/2	8	5.000	4 1/4
6	5.563	8	6.296	3 1/2	8	6.296	4 1/4
8	6.625	8	7.390	4	8	7.390	4 1/4
10	8.625	—	—	—	8	9.625	5 1/4
12	10.750	—	—	—	8	11.750	5 1/4
14	12.750	—	—	—	8	14.000	6 1/4
16	14.000	—	—	—	8	15.000	6 1/4
18	16.000	—	—	—	8	17.000	6 1/4
20	18.000	—	—	—	8	19.000	7 1/4
24	20.000	—	—	—	8	21.000	7 1/4

* All dimensions in inches.

^b Taper of threads is 1/4 in. per ft on diameter on all sizes of pipe, and in couplings of 3/4 in. and over. Couplings 3 in. and smaller are straight tapered.

* 5.663 for copper and red brass pipe.

Note: The wall thickness and inside diameter shown in Table 1 do not apply to copper and red brass pipe.

Table 5 Normal Engagement of Tight-Fit Male and Female Pipe Threads
For American Standard and API Pipe Threads

Pipe Sizes	Engaged length ^a in.	Pipe Sizes	Engaged length ^a in.
3/4	3/4	2 1/4	1 1/4
1	1	3	1
1 1/4	3/4	3 1/4	1 1/4
1 1/2	3/4	4	1 1/2
2	3/4	5	1 3/4
2 1/2	1 1/4	6	1 3/4
3	1 1/4	8	1 3/4
3 1/2	1 1/4	10	1 3/4
4	1 1/2	12	1 3/4