Table 1 . . . . Dimensions and Properties of Steel Pipe

Nominal[a] Size	ASTM[b] Schedule	Diameter OD in.	Diameter ID in.	Wall Thickness in.	Surface Area Sq Ft/Lin Ft OD	Surface Area Sq Ft/Lin Ft ID	Section Area Sq In. OD	Section Area Sq In. ID	Area of Metal Sq In.	Volume Gal/Lin Ft	Weight[c] (plain end) lb/Lin Ft	Working Pressure[d] Psia
⅛	40 (s)	0.405	0.269	0.068	0.106	0.0704	0.129	0.0568	0.0720	0.00295	0.244	314 (a)
	80 (x)	0.405	0.215	0.095	0.106	0.0563	0.129	0.0363	0.0925	0.00189	0.314	1084 (a)
¼	40 (s)	0.540	0.364	0.088	0.141	0.0953	0.229	0.104	0.125	0.00541	0.424	649 (a)
	80 (x)	0.540	0.302	0.119	0.141	0.0791	0.229	0.0716	0.157	0.00372	0.535	1353 (a)
⅜	40 (s)	0.675	0.493	0.091	0.177	0.129	0.358	0.191	0.167	0.00992	0.567	574 (a)
	80 (x)	0.675	0.423	0.126	0.177	0.111	0.358	0.140	0.217	0.00730	0.738	1191 (a)
½	40 (s)	0.840	0.622	0.109	0.220	0.163	0.554	0.304	0.250	0.0158	0.850	697 (a)
	80 (x)	0.840	0.546	0.147	0.220	0.143	0.554	0.234	0.320	0.0122	1.09	1266 (a)
	XX	0.840	0.252	0.294	0.220	0.0660	0.554	0.0499	0.504	0.00259	1.71	3824 (a)
¾	40 (s)	1.050	0.824	0.113	0.275	0.216	0.886	0.533	0.333	0.0277	1.13	604 (a)
	80 (x)	1.050	0.742	0.154	0.275	0.194	0.866	0.432	0.434	0.0225	1.47	1078 (a)
	XX	1.050	0.434	0.308	0.275	0.114	0.866	0.148	0.718	0.00768	2.44	3134 (a)
1	40 (s)	1.315	1.049	0.133	0.344	0.275	1.36	0.864	0.494	0.0449	1.68	651 (a)
	80 (x)	1.315	0.957	0.179	0.344	0.251	1.36	0.719	0.639	0.0374	2.17	1083 (a)
	XX	1.315	0.599	0.358	0.344	0.157	1.36	0.282	1.08	0.0146	3.66	2963 (a)
1¼	40 (s)	1.660	1.380	0.140	0.435	0.361	2.16	1.50	0.669	0.0777	2.27	440 (a)
	80 (x)	1.660	1.278	0.191	0.435	0.335	2.16	1.28	0.881	0.0666	3.00	805 (a)
	XX	1.660	0.896	0.382	0.435	0.235	2.16	0.630	1.53	0.0328	5.21	2318 (a)
1½	40 (s)	1.900	1.610	0.145	0.497	0.421	2.84	2.04	0.800	0.1058	2.72	417 (a)
	80 (x)	1.900	1.500	0.200	0.497	0.393	2.84	1.77	1.07	0.0918	3.65	756 (a)
	XX	1.900	1.100	0.400	0.497	0.288	2.84	0.950	1.89	0.0494	6.41	2122 (a)
2	40 (s)	2.375	2.067	0.154	0.622	0.541	4.43	3.36	1.07	0.174	3.65	376 (a)
	80 (x)	2.375	1.939	0.218	0.622	0.508	4.43	2.95	1.48	0.153	5.02	690 (a)
	XX	2.375	1.503	0.436	0.622	0.393	4.43	1.77	2.66	0.0922	9.03	1861 (a)
2½	40 (s)	2.875	2.469	0.203	0.753	0.646	6.49	4.79	1.70	0.249	5.79	505 (a)
	80 (x)	2.875	2.323	0.276	0.753	0.608	6.49	4.24	2.25	0.220	7.66	806 (a)
	XX	2.875	1.771	0.552	0.753	0.364	6.49	2.46	4.03	0.128	13.7	2048 (a)
3	40 (s)	3.500	3.068	0.216	0.916	0.803	9.62	7.39	2.23	0.384	7.57	454 (a)
	80 (x)	3.500	2.900	0.300	0.916	0.759	9.62	6.61	3.02	0.343	10.3	734 (a)
	XX	3.500	2.300	0.600	0.916	0.602	9.62	4.15	5.47	0.216	18.5	1829 (a)
3½	40 (s)	4.000	3.548	0.226	1.05	0.929	12.6	9.89	2.68	0.514	9.11	425 (a)
	80 (x)	4.000	3.364	0.318	1.05	0.881	12.6	8.89	3.68	0.462	12.5	692 (a)
	XX	4.000	2.728	0.636	1.05	0.714	12.6	5.85	6.72	0.304	22.9	1699 (a)
4	40 (s)	4.500	4.026	0.237	1.18	1.05	15.9	12.7	3.17	0.661	10.8	403 (a)
	80 (x)	4.500	3.826	0.337	1.18	1.00	15.9	11.5	4.41	0.597	14.9	663 (a)
	XX	4.500	3.152	0.674	1.18	0.825	15.9	7.80	8.10	0.405	27.5	1602 (a)
5	40 (s)	5.563	5.047	0.258	1.46	1.32	24.3	20.0	4.30	1.04	14.6	498 (b)
	80 (x)	5.563	4.813	0.375	1.46	1.26	24.3	18.2	6.11	0.945	20.8	825 (b)
	XX	5.563	4.063	0.750	1.46	1.06	24.3	13.0	11.3	0.673	38.6	1951 (b)
6	40 (s)	6.625	6.065	0.280	1.73	1.59	34.5	28.9	5.58	1.50	18.0	467 (b)
	80 (x)	6.625	5.761	0.432	1.73	1.51	34.5	26.1	8.40	1.35	28.6	825 (b)
	XX	6.625	4.897	0.864	1.73	1.28	34.5	18.8	15.6	0.978	53.1	1912 (b)
8	30 (s)	8.625	8.071	0.277	2.26	2.11	58.4	51.2	7.26	2.66	24.7	351 (b)
	40 (s)	8.625	7.981	0.322	2.26	2.09	58.4	50.0	8.40	2.60	28.6	431 (b)
	80 (x)	8.625	7.625	0.500	2.26	2.00	58.4	45.7	12.8	2.37	43.4	753 (b)
	XX	8.625	6.875	0.875	2.26	1.80	58.4	37.1	21.3	1.93	72.4	1460 (b)
10	(s)	10.750	10.192	0.279	2.81	2.67	90.8	81.6	9.18	4.24	31.2	285 (b)
	30 (s)	10.750	10.136	0.307	2.81	2.65	90.8	80.7	10.1	4.19	34.2	324 (b)
	40 (s)	10.750	10.020	0.365	2.81	2.62	90.8	78.9	11.9	4.10	40.5	405 (b)
	60 (x)	10.750	9.750	0.500	2.81	2.55	90.8	74.7	16.1	3.88	54.7	600 (b)
12	30 (s)	12.750	12.090	0.330	3.34	3.17	128.	115.	12.9	5.96	43.8	299 (b)
	(s)	12.750	12.000	0.375	3.34	3.14	128.	113.	14.6	5.88	49.6	352 (b)
	(x)	12.750	11.750	0.500	3.34	3.08	128.	108.	19.2	5.63	65.4	503 (b)
14	30 (s)	14.000	13.250	0.375	3.67	3.46	154.	138.	16.0	7.17	54.6	458 (c)
	(x)	14.000	13.000	0.500	3.67	3.15	154.	133.	21.2	6.70	72.1	653 (c)

Table 1 . . . . Dimensions and Properties of Steel Pipe (Concluded)

Nominal[a] Size	ASTM[b] Schedule	Diameter OD in.	Diameter ID in.	Wall Thickness in.	Surface Area Sq Ft/Lin Ft OD	Surface Area Sq Ft/Lin Ft ID	Section Area Sq In. OD	Section Area Sq In. ID	Area of Metal Sq In.	Volume Gal/Lin Ft	Weight[c] (plain end) lb/Lin Ft	Working Pressure[d] Psia
16	30 (s)	16.000	15.250	0.375	4.18	3.99	201.	183.	18.4	9.48	62.4	400 (c)
	40 (x)	16.000	15.000	0.500	4.18	3.93	201.	177.	24.3	9.18	82.8	570 (c)
18	(s)	18.000	17.250	0.375	4.71	4.52	254.	234.	20.7	12.1	70.6	355 (c)
	(x)	18.000	17.000	0.500	4.71	4.45	254.	227.	27.4	11.8	93.5	506 (c)
20	20 (s)	20.000	19.250	0.375	5.23	4.51	314.	291.	23.2	15.2	78.6	319 (c)
	30 (s)	20.000	19.000	0.500	5.23	4.97	314.	284.	30.6	14.7	104.2	454 (c)
24	20	24.000	23.250	0.375	6.29	6.08	452.	426.	26.8	22.1	94.6	265 (c)
	(s)	24.000	23.000	0.500	6.29	6.03	452.	415.	36.9	21.5	125.5	378 (c)

[a] 3½ double extra strong is no longer considered in *ASTM* specification but some pipe of this size is still manufactured.

[a] The sizes for wrought iron are approximately the same except wall thickness is slightly heavier. See *ASTM* A-72.

[b] *American Society for Testing Materials* Schedule. The numbers 30, 40, etc., refer to the *ASTM* Schedule; the letter (s) refers to the former designation *Standard Weight*; the letter (x) refers to the former designation *Extra Strong*; the letters XX refer to the former designation *Double Extra Strong*.

[c] Weight per foot is based on plain end pipe. Threaded and coupled (T and C) pipe is slightly heavier.

[d] Working pressure for welded joints—see formula in Table 2.

(1) Working pressure based on an allowable fiber stress of 6325 psi (for 250 F).

(2) Working pressure based on an allowable fiber stress of 8400 psi (for 250 F).

(3) Working pressure based on an allowable fiber stress of 12000 psi (for 250 F).

Note: Standard-weight pipe is generally furnished with threaded ends in random lengths of 16 to 22 ft., although when ordered with plain ends, 5 percent may be in lengths of 12 to 16 ft. Five percent of the total number of lengths ordered may be jointers which are two pieces coupled together. Extra-strong pipe is generally furnished with plain ends in random lengths of 12 to 22 ft., although 5 percent may be in lengths of 6 to 12 ft.

Listed in Table 3 is the formula for allowable working pressures as given in the *American Standard Code for Pressure Piping*.[1] In this formula is a factor *c*, which is intended as an allowance for corrosion, mechanical injury, manufacturing tolerances, etc. At times this factor seems too conservative; for example, with ⅛-in., Schedule 40, steel pipe, the allowable working pressure is 314 psi. Yet this pipe is tested at 700 psi. The reasoning in establishing the factor *c* which influences the working pressure, is that after nominal use the pipe may not be as sturdy as it was at the time of manufacture. Note that the joint factor, *c*, is not included for plain end non-ferrous pipe as listed in Table 2.

In addition to IPS copper pipe, several varieties of copper tubing are in use with either flared or compression couplings or soldered joints. Dimensions of copper water tube intended for plumbing, underground water service, fuel-oil lines, gas lines, etc., have been standardized by the U. S. Government and the American Society for Testing Materials.

Copper tube is classified in accordance with the wall thickness as follows:

Type K—Heavy Wall.
Type L—Medium Wall.
Type M—Light Wall.
Type DWV—Light Wall—for drainage, waste, and vent service.

In general, Type K is used for underground services and for general plumbing service where corrosion conditions are severe. Type L is used for general plumbing and heating service where conditions may be considered normal. Type M is used for sanitary drainage and other non-pressure applications, for heating, and sometimes for other services less severe than those for which Types K or L are recommended. Type DWV is of lighter weight than Type M, and is used for sanitary drainage and other non-pressure applications. Type DWV tube should not be used underground. Type L is suitable for underground drainage applications. Unless adequately protected, no copper tube should be embedded in a cinder fill. Where flexibility is essential as in hidden replacement work, or where as few joints as possible are desired as in fuel-oil lines, the soft temper is commonly used. In new or exposed work copper tube of a hard temper is generally used. All three types are extensively used with soldered fittings.

Standard dimensions, weights, and diameter and wall-thickness tolerances for these classes of copper tube are obtainable from Table 2. Copper pipe is also available with dimensions of steel pipe.

In refrigeration lines, used in connection with air-conditioning equipment, copper tube is used extensively. For refrigeration use where tube absolutely free from scale and dirt is required, bright annealed copper tube that has been cleaned, dehydrated, and sealed is used. This tube is available in a variety of sizes and wall thicknesses.

THREADING PRACTICE

In all threaded pipe for heating and ventilating installations the American Standard taper pipe thread, ASA B2.1-1945 is used. This thread is cut with a taper of 1 in 16 measured on the diameter of the pipe so as to secure a tight joint. The number of threads per inch varies with the pipe size. Threads for fittings are the same, except that it is regular practice to furnish straight tapped couplings for Schedule 40 pipe 2 in. and smaller. For steam pressures in excess of 25 psi, it is recommended that taper-tapped couplings be used to obtain a tight joint. These may be secured by ordering *line* pipe[2] which is used for oil piping, the couplings of which are provided with taper-tapped threads and may be used with regular mill-threaded standard weight pipe. Thread lengths should be in accordance with ASA B2.1. Right-hand threads are used unless otherwise ordered. To facilitate drainage, some elbows have the thread tapped at an angle to provide a pitch of the connecting pipe of ¼ in. to the foot. These elbows are known to the trade as