TABLE 1. STANDARD WROUGHT PIPE

Table of Standard Dimensions

Size Inches	Diameters		Nominal Thickness Inches	Circumference		Transverse Areas			Length of Pipe per Square Foot of		Nominal Weight per Foot	
	External Inches	Approximate Internal Inches		External Inches	Internal Inches	External Sq In	Internal Sq In	Metal Sq In	External Surface	Internal Surface	Plain Ends	Threaded and Coupled
⅛	0.405	0.269	0.068	1.272	0.845	0.129	0.057	0.072	9.431	14.199	0.244	0.245
¼	0.540	0.364	0.088	1.696	1.144	0.229	0.104	0.125	7.073	10.493	0.424	0.425
⅜	0.675	0.493	0.091	2.121	1.549	0.358	0.191	0.167	5.658	7.747	0.567	0.568
½	0.840	0.622	0.109	2.639	1.954	0.554	0.304	0.250	4.547	6.141	0.850	0.852
¾	1.050	0.824	0.113	3.299	2.589	0.866	0.533	0.333	3.637	4.635	1.130	1.134
1	1.315	1.049	0.133	4.131	3.296	1.358	0.864	0.494	2.904	3.641	1.678	1.684
1¼	1.660	1.380	0.140	5.215	4.335	2.164	1.495	0.669	2.301	2.767	2.272	2.281
1½	1.900	1.610	0.145	5.969	5.058	2.835	2.036	0.799	2.010	2.372	2.717	2.731
2	2.375	2.067	0.154	7.461	6.494	4.430	3.355	1.075	1.608	1.847	3.652	3.678
2½	2.875	2.469	0.203	9.032	7.757	6.492	4.788	1.704	1.328	1.547	5.793	5.819
3	3.500	3.068	0.216	10.996	9.638	9.621	7.393	2.228	1.091	1.245	7.575	7.616
3½	4.000	3.548	0.226	12.566	11.146	12.566	9.886	2.680	0.954	1.076	9.109	9.202
4	4.500	4.026	0.237	14.137	12.648	15.904	12.730	3.174	0.848	0.948	10.790	10.889
5	5.563	5.047	0.258	17.477	15.856	24.306	20.006	4.300	0.686	0.756	14.617	14.810
6	6.625	6.065	0.280	20.813	19.054	34.472	28.891	5.581	0.576	0.629	18.974	19.185
8	8.625	8.071	0.277	27.096	25.356	58.426	51.161	7.265	0.442	0.473	24.696	25.000
8	8.625	7.981	0.322	27.096	25.073	58.426	50.027	8.399	0.442	0.478	28.554	28.809
10	10.750	10.192	0.279	33.772	32.019	90.763	81.585	9.178	0.355	0.374	31.201	32.000
10	10.750	10.136	0.307	33.772	31.843	90.763	80.691	10.072	0.355	0.376	34.240	35.000
10	10.750	10.020	0.365	33.772	31.479	90.763	78.855	11.908	0.355	0.381	40.483	41.132
12	12.750	12.000	0.375	40.055	37.699	127.676	113.097	14.579	0.299	0.318	49.562	50.706

there is little difference in the appearance of wrought-iron and steel pipe but there are several tests which readily identify the materials. The fracture of wrought-iron pipe is ragged, dull gray, and fibrous. By hammering a piece of pipe flat the fracture can easily be observed. The fracture of steel is even, bright and crystalline. Wrought-iron pipe, when threads are cut on it, gives a crumbled chip, due to the fibrous structure. Steel pipe, when threaded, gives a long spiral chip. A microscopic examination of polished and etched specimens is an infallible test. The presence of slag in the wrought iron is unmistakable, while the steel is almost without slag.

Seamless Pipe. Steel pipe or *tubing* without the lap or butt weld is frequently used for high-pressure work. Its advantages are its somewhat greater strength, permitting the use of a thinner wall, and in the small sizes its freedom from the tendency of welded pipe to split at the weld occasionally when bent. Furthermore, the inherent physical properties of the steel used in its manufacture are somewhat better, and a variety of combinations of carbon content and heat treatment are available.

Seamless pipe is made by either of two different processes, depending upon the size. The piercing process is used in the smaller sizes and the cupping process is sometimes used for tubing of 6 to 8 in. diameter.

Cast Ferrous Pipe. There are now available several types of cast ferrous metal pipe made of a good grade of cast-iron with additions of nickel, chromium, etc. This pipe is available in sizes from 1½ in. to 6 in. and standard lengths of 5 or 6 ft with external and internal diameters closely approximating those of extra strong wrought pipe. Cast ferrous pipe may be had coupled, bevelled for welding, or with ends plain or grooved for the several types of couplings. It is readily cut, and threaded, as well as welded. The fact that it is readily welded enables the manufacturers to supply the pipe in any lengths practical for handling.

Alloy Metal Pipe. Steel pipe bearing a small alloy of copper is somewhat more resistant to corrosion than plain steel pipe. It is recommended usually for atmospheric corrosive conditions, *i.e.*, for corrosion caused by alternate exposure to air and water.

Copper Pipe. Copper and brass pipe are used to some extent in heating work. Special fittings are also available. While the friction loss through copper pipe is slightly greater than for steel (for hot water), this is offset by the smaller loss in the fittings[1]. Therefore, for practical purposes there is little difference between the two. (See Chapter 33).

EXPANSION AND CONTRACTION

The proper provision for the expansion and contraction of piping must be made in all cases where water, steam, or gas is to be used at high temperatures, and is usually accomplished by directional changes, long sweep bends or expansion joints. In instances where it is impracticable to install the piping to obtain the required flexibility by directional changes, it may be advantageous to insert expansion bends in the line. Such expansion bends may be (1) a complete unit such as the expansion *U*-bend, the

[1]See Loss of Head in Copper Pipe and Fittings, by F. E. Giesecke and W. H. Badgett (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932).