TABLE 1. FLOW OF STEAM IN PIPES

Flow of Steam in Pipes

P = Loss in Pressure in Lbs.
d = Inside Diameter of Pipe in Inches
L = Length of Pipe in Feet
D = Weight of 1 Cu Ft. of Steam
W = Lbs. of Steam per Min.

$$W = 87.0\sqrt{\frac{PDd^5}{\left(1+\frac{3.6}{d}\right)L}}$$

$$P = 0.000132\left(1+\frac{3.6}{d}\right)\frac{W^2L}{Dd^5}$$

Pressure Loss in Ozs.	Col. 1 $87.0\sqrt{\frac{P}{100}}$	Pipe Size Nominal	Pipe Size Actual Internal Diameter	Internal Area of Pipe Sq. Ins	Col. 2 $\sqrt{\frac{d^5}{1+\frac{3.6}{d}}}$	Steam Press. by Gage	Col. 3 $\sqrt{D}$	Length of Pipe in Feet	Col. 4 $\sqrt{\frac{100}{L}}$
0.25	1.088	1	1.049	0.864	0.536	-1.0 *	0.187	20	2.240
0.50	1.538	1¼	1.380	1.496	1.178	-0.5 *	0.190	40	1.580
1.00	2.175	1½	1.610	2.036	1.828	0.0	0.193	60	1.290
2	3.076	2	2.067	3.356	3.710	0.3	0.195	80	1.120
3	3.767	2½	2.469	4.788	6.109	1.3	0.201	100	1.000
4	4.350	3	3.068	7.393	11.183	2.3	0.207	120	0.912
5	4.863	3½	3.548	9.887	16.705	5.3	0.223	140	0.841
6	5.328	4	4.026	12.730	23.631	10.3	0.248	160	0.793
7	5.755	4½	4.506	15.947	32.134	15.3	0.270	180	0.741
8	6.152	5	5.047	20.006	43.719	20.3	0.290	200	0.710
10	6.878	6	6.065	28.886	71.762	30.3	0.326	250	0.632
12	7.534	7	7.023	38.743	106.278	40.3	0.358	300	0.578
14	8.138	8	7.981	50.027	149.382	50.3	0.388	350	0.538
16	8.700	9	8.941	62.706	201.833	60.3	0.415	400	0.500
20	9.727	10	10.020	78.854	272.592	75.3	0.452	450	0.477
24	10.655	12	12.000	113.098	437.503	100.3	0.507	500	0.447
28	11.509	14	13.250	137.880	566.693	125.3	0.557	600	0.407
32	12.304	16	15.250	182.655	816.872	150.3	0.603	700	0.378
40	13.756	Column 1 × 2 × 3 × 4 = lb. of steam per minute that will flow through a straight pipe for a given condition.				175.3	0.645	800	0.354
48	15.069					200.3	0.685	900	0.333
80	19.454	*Example.*—1 oz. drop — 2 in. pipe — 1.3 lb. press. — 100 ft. equivalent length:						1000	0.316
160	27.512	2.175 × 3.710 × 0.201 × 1 = 1.6219 lb. per min. 1.6219 × 60 × 4 = 389.3 sq. ft. equivalent radiation.						1200	0.289
320	38.908	Table 1 does not allow for entrained water in low-pressure steam, condensation in covered pipe and roughness in commercial pipe as found in practice.						1500	0.258
480	47.652							2000	0.224

lb. per sq. in. gage = 2.04 in. Vacuum, Mercury Column.

STEAM DISTRIBUTION

The piping for steam distribution will be divided into two classes: (1) transmission mains, (2) service piping.

Transmission mains are defined as those that convey steam for a considerable distance either through or between buildings such as in district heating plants. In this type the steam is usually generated and transmitted to the building under high pressure where by means of a pressure reducing valve it is lowered to the pressure required in the building. The velocities of flow used in the transmission mains are limited by the available or allowable drop in pressure. See Table 2 for capacity of pipes at various pressures.

Service piping is defined as that which conveys the steam and condensate in the building, starting either at the boiler or other source of supply and comprising of the mains, branches, risers, radiator connections and return piping. This part of the system is usually low pressure and the pipe sizes are larger, as the velocity of the steam is lower and the available or allowable drop in pressure is small. See Tables 10 to 18 for the service pipe sizes for various systems.

STEAM HEATING PIPE SIZES

Generally, in using tables for steam heating pipe sizes, it is difficult to determine the length of run upon which they are based. Usually some allowance is made for one or more such items as: condensation in the pipe, equivalent length of pipe, for fittings, valves, etc., but it is generally difficult to determine what factors have been allowed for, and what percentage of allowance has been made. In compiling the Tables 1–18 and other data for THE GUIDE, 1929, every attempt has been made to eliminate such indefinite and conflicting factors.

The principal factors upon which the determination of pipe sizes for steam heating depends, are:

1. The equivalent length of the run from the boiler, or source of steam supply, to the farthest heating unit.
2. The total pressure drop, which may be allowed, between the source of supply and the end of the return system.
3. The maximum velocity of steam allowable for quiet and dependable operation of the system.
4. Unusual conditions in the building to be heated.

Length of Run

The length of run must not only include the actual linear feet of straight pipe, but also the proper allowance for fittings, valves and other items which cause drop in pressure. (See Table 4.)

Pressure Drop

Theoretically there are several factors to be considered such as initial pressure and the pressure required at the end of the line, but it is most important that (1) the total pressure drop does not exceed the initial pressure of the system, (2) that the pressure drop is not so great as to