

TABLE 5. PIPE SIZES FOR UNDERGROUND SUPPLY MAINS BASED ON A VELOCITY OF 10,000 FT. PER MINUTE—(Continued)

GAGE PRESSURE LB.	LB. STEAM PER MINUTE	TOTAL B.T.U. ABOVE 200 DEG. FAHR. PER HR.	PIPE LOSS B.T.U. PER HOUR, PER FT. LENGTH		LB. STEAM CONDENSED PER FOOT PER FT. LENGTH
			Bare	Covered (10% of Bare)	
6 in. Pipe					
0	74.6	4,504,000	585	58.5	0.0604
10	122	7,260,000	719	71.9	0.0755
20	167	10,020,000	852	85.2	0.0918
40	256	15,360,000	1037	104	0.1135
60	345	20,880,000	1186	119	0.1320
80	427	26,040,000	1311	131	0.1470
100	514	31,440,000	1428	143	0.1630
120	606	37,260,000	1528	153	0.1760
140	690	42,480,000	1620	162	0.1880
160	770	47,400,000	1694	169	0.1980
180	870	53,700,000	1785	178	0.2110
200	950	58,800,000	1872	187	0.2230
8 in. Pipe					
0	134	7,980,000	760.7	76.1	0.0785
10	218	12,960,000	936.7	93.7	0.0985
20	298	17,940,000	1109.5	110.9	0.118
40	458	27,540,000	1351	135.1	0.147
60	617	37,560,000	1543	154.3	0.171
80	765	46,680,000	1707	170.7	0.191
100	917	56,160,000	1859	185.9	0.212
120	1080	66,480,000	1988	198.8	0.229
140	1230	75,300,000	2107	210.7	0.244
160	1375	84,600,000	2207	220.7	0.258
180	1550	95,400,000	2325	232.5	0.275
200	1700	105,600,000	2443	244.3	0.291
10 in. Pipe					
0	211	12,420,000	949	94.9	0.0978
10	345	19,520,000	1170	117.0	0.1230
20	474	28,380,000	1384	138.4	0.1480
40	730	43,860,000	1685	168.5	0.1840
60	983	59,760,000	1927	192.7	0.2130
80	1210	73,800,000	2132	213.2	0.2390
100	1455	89,100,000	2322	232.2	0.264
120	1670	102,600,000	2486	248.6	0.286
140	1960	120,600,000	2635	263.5	0.306
160	2180	134,400,000	2755	275.5	0.323
180	2470	152,400,000	2903	290.3	0.343
200	2700	166,800,000	3051	305.1	0.364
12 in. Pipe					
0	297	17,460,000	1125	112.5	0.116
10	485	28,860,000	1387	138.7	0.146
20	664	39,900,000	1641	164.1	0.175
40	1020	62,100,000	1999	199.9	0.218
60	1372	83,400,000	2240	224.0	0.248
80	1700	103,800,000	2529	252.9	0.284
100	2040	124,800,000	2753	275.3	0.314
120	2410	148,200,000	2945	294.5	0.340
140	2750	169,200,000	3121	312.1	0.362
160	3060	182,400,000	3266	326.6	0.383
180	3460	213,600,000	3440	344.0	0.406
200	3800	235,200,000	3616	361.6	0.430

The offset lengths which are required for expansion in the case of wrought iron pipe may also be used for brass pipes, using in each case the actual amount of expansion in the piping.

CAPACITY OF RETURNS WITH VARIOUS GRADES

In general, return lines when installed follow the contour of the land and Table 3 gives sizes of return pipes for various grades. It is evident that at points where the grade is great, smaller pipes can be installed.

Table 4 gives the number of pounds of steam condensed to water for various steam pressures which can be used in determining the size of steam main or return line.

Table 5 gives the capacity of various sizes of pipes under various steam velocity of 10,000 ft. per minute. The pipe loss will not vary under other velocities. For other velocities, the capacity may be determined by dividing by 10,000 and multiplying by actual velocity.

HEATING CONDUITS

Conduits for steam pipes buried underground should be water-proof, able to withstand earth loads and take care of the expansion and contraction of the piping without strain or stress on the couplings, also without affecting the installation or conduit. Expansion of the piping must be carefully controlled by means of anchors and expansion joints or bends so that the pipes can never come in contact with the conduit. Anchors can be anchor fittings or U-shaped steel straps which partially encircle the pipes and are firmly bolted to a short length of structural steel set in concrete.

In laying out conduits of this type the following points should be borne in mind:

1. The conduit should be laid out in successive straight runs between manholes or anchor pits.
2. An anchor should be placed wherever the line changes direction.
3. An expansion joint offset or bend should be placed between each two anchors.
4. Manholes should be provided at each expansion joint. Where slip joints are used manholes should be vented.
5. Branches should be taken off at or near an anchor.
6. If the distance between buildings is 150 ft. or less and the steam line contains high-pressure steam, it may be anchored in the basement of one building and allowed to expand into the basement of the second building. If the steam line contains low-pressure steam (up to 4-lb. pressure), this method may be used if buildings are 250 ft. or less apart.
7. If the distance between buildings is between 150 ft. and 300 ft. and the steam line contains high-pressure steam, the lines should be anchored midway between the buildings and allowed to expand into the basements of both buildings. If the steam line contains low-pressure steam this method may be used if buildings are between 250 ft. and 600 ft. apart. No manhole is required at the anchor, and a blind pit is all that is necessary.
8. For longer lines, manholes must be located according to judgment and depending upon the expansion value of the type of expansion joint or bend that is used. The minimum number of manholes will be required when an expansion bend or