

Table 5 may be used for sizing piping for steam heating systems by pre-determining the allowable or desired pressure drop per 100 equivalent feet of run and reading from the column for that particular pressure drop. This applies to all steam mains on both one-pipe and two-pipe systems, vapor systems, and vacuum systems. Columns *B* to *G*, inclusive, are used where the steam and condensate flow in the same direction, while Columns *H* and *I* are for cases where the steam and condensate flow in opposite directions, as in risers and runouts that are not dripped. Columns *J*, *K*, and *L* are for one-pipe systems and cover riser, radiator valve and vertical connection sizes, and radiator and runout sizes, all of which are based on the critical velocities of the steam to permit the counter flow of condensate without noise.

Return piping may be sized with the aid of Tables 6 and 7 where pipe capacities for wet, dry, and vacuum return lines are shown for the pressure drops per 100 ft corresponding to the drops in Table 5. *It is customary to use the same pressure drop on both the steam and return sides of a system.*

Example 2. What pressure drop should be used for the steam piping of a system if the measured length of the longest run is 500 ft and the initial pressure is not to be over 2-psi gage?

Solution. It will be assumed, if the measured length of the longest run is 500 ft, that when the allowance for fittings is added the equivalent length of run will not exceed 1,000 ft. Then, with the pressure drop not over one half of the initial pressure, the drop could be 1 psi or less. With a pressure drop of 1 psi and a length of run of 1,000 ft, the drop per 100 ft would be $\frac{1}{10}$ psi, while if the total drop were $\frac{1}{2}$ psi, the drop per 100 ft would be $\frac{1}{20}$ psi. In the first instance the pipe could be sized according to Column *D* for $\frac{1}{10}$ psi per 100 ft, and in the second case, the pipe could be sized according to Column *C* for $\frac{1}{20}$ psi. On completion of the sizing, the drop could be checked by taking the longest line and actually calculating the equivalent length of run from the pipe sizes determined. If the calculated drop is less than that assumed, the pipe size is all right; if it is more, it is probable that there are an unusual number of fittings involved, and either the lines must be straightened or the column for the next lower drop must be used and the lines resized. Ordinarily resizing will be unnecessary.

TABLES FOR PIPE SIZING FOR HIGH PRESSURE SYSTEMS

Many of the recent installations of heating systems for large industrial type buildings have been designed for the use of high pressure steam, that is, without the use of pressure reducing valves. Such systems usually involve the use of unit heaters or large built-up fan units with blast heating coils. Pressures on these systems vary from 30 to 150 psi. Temperatures are controlled by a modulating or throttling type thermostatic valve controlled by the air temperature in the room, fan inlet or outlet.

Tables 8 to 11 may be used for the sizing of steam and return piping for systems of 30 and 150 psi pressure at various pressure drops. These tables are based on Babcock's formula, and have been used as the basis of design for a number of years.

SIZING PIPING FOR ONE-PIPE GRAVITY SYSTEMS

Gravity one-pipe air-vent systems in which the equivalent length of run does not exceed 200 ft should be sized by means of Tables 5, 6 and 7 as follows:

1. For the steam main and dripped runouts to risers where the steam and condensate flow in the same direction, use $\frac{1}{16}$ -psi drop (Column *D*).
2. Where the riser runouts are not dripped and the steam and condensate flow in opposite directions, and also in the radiator runouts where the same condition occurs, use Column *L*.

TABLE 8. STEAM PIPE CAPACITIES FOR 30-PSI STEAM SYSTEMS^a

Capacity Expressed in Pounds per Hour
(Steam and Condensate Flowing in Same Direction)

PIPE SIZE INCHES	DROP IN PRESSURE—POUNDS PER 100 FT IN LENGTH					
	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	1	2
$\frac{1}{8}$	15	22	31	38	45	63
$\frac{1}{4}$	31	46	63	77	89	125
$\frac{3}{8}$	69	100	141	172	199	281
$\frac{1}{2}$	107	154	219	267	309	437
$\frac{3}{4}$	217	313	444	543	627	886
$1\frac{1}{4}$	358	516	730	924	1,030	1,460
2	651	940	1,330	1,630	1,880	2,660
$2\frac{1}{2}$	979	1,410	2,000	2,450	2,830	4,000
3	1,390	2,000	2,830	3,460	4,000	5,660
4	2,560	3,640	5,230	6,400	7,390	10,500
6	4,210	6,030	8,590	10,400	12,100	17,200
8	8,750	12,600	17,900	21,900	25,300	35,100
10	16,300	23,600	33,200	40,600	46,900	66,400
12	25,600	36,900	52,300	64,000	74,000	104,500

^aNote: Steam at an average pressure of 30 psi is used as the basis for calculating the above table.

3. For up-feed steam risers carrying condensate back from the radiators, use Column *J*.
4. For down-feed systems the main risers of which do not carry any radiator condensate use Column *H*.
5. For the radiator valve size and the stub connection, use Column *K*.
6. For the dry return main, use Column *U*.
7. For the wet return main use Column *T*.

On systems exceeding an equivalent length of 200 ft, it is suggested that the total drop be not over $\frac{1}{4}$ psi. The return piping sizes should correspond with the drop used on the steam side of the system. Thus, where $\frac{1}{4}$ -psi drop is being used, the steam main and dripped runouts would be sized from Column *C*; radiator runouts and undripped riser runouts from Column *L*; up-feed risers from Column *J*; the main riser on a down-feed system from Column *C* (it will be noted that if Column *H* is used the drop would exceed the limit of $\frac{1}{4}$ psi); the dry return from Column *R*; and the wet return from Column *Q*.

With a $\frac{1}{32}$ -psi drop the sizing would be the same as for $\frac{1}{4}$ psi except that the steam main and dripped runouts would be sized from Column *B*.

TABLE 9. STEAM PIPE CAPACITIES FOR 150 PSI STEAM SYSTEMS^a

Capacity Expressed in Pounds per Hour
(Steam and Condensate Flowing in Same Direction)

PIPE SIZE INCHES	DROP IN PRESSURE—PSI PER 100 FT IN LENGTH						
	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	1	2	5
$\frac{1}{8}$	29	41	58	71	82	116	184
$\frac{1}{4}$	58	82	117	143	165	233	369
$\frac{3}{8}$	130	185	262	320	370	523	827
$\frac{1}{2}$	203	287	407	497	575	813	1,290
$\frac{3}{4}$	412	583	825	1,010	1,170	1,650	2,600
1	632	899	1,300	1,650	1,920	2,710	4,290
1 $\frac{1}{4}$	1,240	1,750	2,480	3,020	3,500	4,940	7,820
2	1,860	2,630	3,720	4,550	5,250	7,420	11,700
2 $\frac{1}{2}$	2,630	3,720	5,260	6,430	7,430	10,500	16,600
3	4,860	6,880	9,730	11,900	13,800	19,500	30,800
4	7,960	11,300	16,000	19,500	22,600	31,900	50,400
6	16,800	23,500	33,200	40,600	47,000	66,400	105,000
8	30,800	43,400	61,700	75,600	87,300	123,000	195,000
10	48,600	68,800	97,300	119,000	138,000	194,000	307,500

^aNote: Steam at an average pressure of 150 psi is used as the basis for calculating the above table.