where W = Weight of steam flowing through the pipe in lb. per minute.
P = Difference of pressure between the two ends of the pipe.
C = Density of steam in lb. per cu. ft.
d = Actual inside diameter of pipe.
L = Length of pipe in feet.

This formula with the capacity expressed in sq. ft. of radiation on the basis of each sq. ft. of radiation with connected piping condensing 0.3 lb. of steam per hr. will be as follows:

$$R = 17400\sqrt{\frac{P\ C\ d^5}{L\ (d+3.6)}}$$

where R = Sq. ft. of radiation.

Capacities of dry returns have been calculated by the Chezy formula for flow in open conduits which is expressed in the form

$$Q = a\ c\sqrt{r\ s}$$

where Q = Discharge in cu. ft. per sec.
a = Wet area of pipe in sq. ft.
r = Hydraulic mean depth (areas of wet cross-section divided by the wet-perimeter.)
c = Constant from Kutter's formula.
s = Slope or grade.

In the tables for one-pipe, two-pipe and vapor systems without the use of thermostatic traps the tables have been calculated on the basis of the water occupying ⅛ the area of the pipe while for vapor systems using thermostatic traps the capacity is based on water occupying 3/16 the area.

All supply mains, branches to risers, when dripped, where steam and condensation flow in the same direction, and supply risers, (with the exception of up feed one-pipe risers) are based on a pressure drop of 1 oz. per 100 ft. length of pipe or equivalent.

All supply mains, branches to risers, not dripped where condensation and steam are flowing in opposite directions and up feed one-pipe risers are based on a velocity of 16 ft. per sec.

Branches to radiators 5 ft. in length or less are based on velocities from 10 to 19 ft. per sec. depending on the size of branch while branches to radiators 5 to 10 ft. in length are based on a velocity of approximately 10 ft. per sec.

Wet returns are calculated on a drop of ½ oz. per 100 ft. length of pipe or equivalent.

Radiator valve sizes for one and two pipe gravity systems are based on standard practice.

An allowance must be made for ells and fittings in the line of flow by adding the number of feet given in the table to the straight run of pipe to obtain the total equivalent length.

Table 1.

ONE PIPE STEAM

CAPACITY IN SQ. FT. OF RADIATION

Commercial Pipe Sizes	B Supply Main Branch to Risers (dripped) Steam and water flowing same direction	C Supply Main Branch to Risers Up-feed Risers Steam and water flowing opposite direction	D Branches to Radiators 5 ft. in length or less	D Branches to Radiators 5 ft. to 10 ft. in length	E Wet Drip Main	Vertical or 1 inch in 5 ft.	F Dry Drip Grade	F Main 1 inch in 20 ft.	1 inch in 30 ft.	G Radiator Valve Sizes	H Allowance in ft. of pipe for Ells	H Allowance in ft. of pipe for Globe Valves
¾	.....	...	...	...	800	180	140	100	80	...	0.8	1.2
1	40	40	24	...	1,800	420	300	210	170	24	1.3	1.9
1¼	75	75	60	24	3,000	900	650	450	370	60	2.1	3.2
1½	150	100	100	60	6,000	1,500	1,000	700	600	100	2.8	4.2
2	300	170	200	100	10,000	3,000	2,100	1,500	1,200	200	4.3	6.5
2½	500	220	...	...	18,000	4,900	3,500	2,500	1,800	...	6.	9.
3	900	340	...	...	26,000	9,000	6,400	4,500	3,700	...	8.	12.
3½	1,500	460	...	...	37,000	.....	9,800	6,800	5,600	...	10.	15.
4	2,000	600	...	...	.....	DRIPS FOR RISERS	14,000	9,700	8,000	...	12.	19.
4½	2,800	...	...	Steam	Drips to Returns	Steam	Drips to Returns	...	...	...	15.	22.
5	3,600	For Down Feed	...	Risers	Wet	Risers	Wet	...	...	...	18.	26.
6	6,000	Risers See Note	...	1	¾	2½	1	...	...	...	22.	34.
7	9,000	...	...	1¼	¾	3	1	...	...	...	27.	41.
8	13,000	...	...	1½	¾	3½	1¼	...	...	...	33.	48.
10	23,000	...	...	2	1	4	1½	...	...	...	45.	68.
12	37,000	...	...	...	...	...	1½	...	...	...	57.	86.

Length Factors—For supply mains where steam and water are flowing in the same direction and for wet returns where lengths are other than 100 ft. multiply the factor here given by the sq. ft. of radiation to determine the carrying capacity of the pipe.

Length in Feet	200	300	400	500	1000
Factor.....	0.710	0.576	0.500	0.447	0.316

To obtain size of supply mains (not dripped) and down feed risers where steam and water are flowing in the same direction, add amount of radiaiton the pipe is to supply steam to, and ¼ the radiation the pipe is carrying water from, and size as for steam mains (Column B). Where main is dripped at each point of reduction or oftener use Column B.

The end of steam mains, if reduced, to be one size larger than table calls for. On circuit mains where reduced and not dripped use eccentric coupling for making reduction.

In installations in buildings 3 stories or more in height each up-feed riser should be separately dripped into wet drip main. In tall buildings where risers are 100 ft. in length, or over, horizontal run-outs, to permit expansion or, where necessary, due to the design of building, should have separate drips carried down to basement into drip return line.