

TABLES FOR PIPE SIZING*

Factors determining the size of a steam pipe and its allowable limit of capacity are as follows:

1. Pipe condensate flowing with steam.
2. Pipe condensate flowing against steam.
3. Pipe and radiator condensate flowing with steam.
4. Pipe and radiator condensate flowing against steam.

It is apparent that (3) and (4) are practically limited to one-pipe systems while (1) and (2) cover all other systems.

Tables 8 and 9, worked out for determining pipe sizes, have their columns lettered continuously, Columns A through L being in Table 8, and M through EE in Table 9. In the following text, reference made to columns will be by letter. The tables are based on the actual inside diameters of the pipe and the condensation of $\frac{1}{4}$ lb (4 oz) of steam per square foot of equivalent direct radiation³ (abbreviated EDR) per hour. The drops indicated are drops in pressure per 100 ft of equivalent length of run. The pipe is assumed to be well reamed without unusual or noticeable defects.

Table 8 may be used for sizing piping for steam heating systems by 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 condensation flow in the same direction, while Columns H and I are for cases where the steam and condensation 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 condensation without noise.

Sizing of return piping may be done with the aid of Table 9 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 8. *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-lb 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 lb or less. With a pressure drop of 1 lb and a length of run of 1,000 ft, the drop per 100 ft would be $\frac{1}{10}$ lb, while if the total drop were $\frac{1}{2}$ lb, the drop per 100 ft

*Pipe size tables in this chapter have been compiled in simplified and condensed form for the convenience of the user; at the same time all of the information contained in previous editions of THE GUIDE has been retained. Values of pressure drops, formerly expressed in ounces, are now expressed in fractions of a pound.

³As steam system design has materially changed in recent years so that 240 Btu no longer expresses the heat of condensation from a square foot of radiator surface per hour, and as present day heating units have different characteristics from older forms of radiation, it is the purpose of THE GUIDE to gradually eliminate the empirical expression square foot of equivalent direct radiation, EDR, and to substitute a logical unit based on the Btu. The new terms to express the equivalent of 1000 Btu (Mb), and 1000 Btu per hour (Mbh), have been approved by the A.S.H.V.E.

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would be $\frac{1}{20}$ lb. In the first instance the pipe could be sized according to Column D for $\frac{1}{10}$ lb per 100 ft, and in the second case, the pipe could be sized according to Column C for $\frac{1}{20}$ lb. 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.

TABLE 8. STEAM PIPE CAPACITIES

Capacity Expressed in Square Feet of Equivalent Direct Radiation

(Reference to this table will be by column letter A through L)

This table is based on pipe size data developed through the research investigations of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

CAPACITIES OF STEAM MAINS AND RISERS										SPECIAL CAPACITIES FOR ONE-PIPE SYSTEMS ONLY		
PIPE SIZE IN.	DIRECTION OF CONDENSATION FLOW IN PIPE LINE									Supply Risers Up-Feed	Radiator Valves and Vertical Connections	Radiator and Riser Run-outs
	With the Steam in One-Pipe and Two-Pipe Systems						Against the Steam Two-Pipe Only					
	$\frac{1}{32}$ lb or $\frac{1}{8}$ Oz Drop	$\frac{1}{24}$ lb or $\frac{1}{6}$ Oz Drop	$\frac{1}{16}$ lb or 1 Oz Drop	$\frac{1}{8}$ lb or 2 Oz Drop	$\frac{1}{4}$ lb or 4 Oz Drop	$\frac{1}{2}$ lb or 8 Oz Drop	Vertical	Horizontal				
	A	B	C	D	E	F	G	H _a	I _a			
$\frac{3}{4}$			30					30		25		
1	39	46	56	79	111	157	56	26	45	20	20	
$1\frac{1}{4}$	87	100	122	173	245	346	122	58	98	55	55	
$1\frac{1}{2}$	134	155	190	269	380	538	190	95	152	81	81	
2	273	315	386	546	771	1,091	386	195	288	165	165	
$2\frac{1}{2}$	449	518	635	898	1,270	1,797	635	395	464		260	
3	822	948	1,163	1,645	2,326	3,289	1,129	700	799		475	
$3\frac{1}{2}$	1,228	1,419	1,737	2,457	3,474	4,913	1,548	1,150	1,144		745	
4	1,738	2,011	2,457	3,475	4,914	6,950	2,042	1,700	1,520		1,110	
5	3,214	3,712	4,546	6,429	9,092	12,858		3,150			2,180	
6	5,276	6,094	7,462	10,553	14,924	21,105						
8	10,983	12,682	15,533	21,967	31,066	43,934						
10	20,043	23,144	28,345	40,085	56,689	80,171						
12	32,168	37,145	45,492	64,336	90,985	128,672						
16	60,506	69,671	84,849	121,012	169,698	242,024						
All Horizontal Mains and Down-Feed Risers								Up-Feed Risers	Mains and Undripped Run-outs	Up-Feed Risers	Radiator Connections	Run-outs Not Dripped

Note.—All drops shown are in pounds per 100 ft of equivalent run—based on pipe properly reamed.

^aDo not use Column H for drops of $\frac{1}{24}$ or $\frac{1}{32}$ lb; substitute Column C or Column B as required.

^bDo not use Column J for drop of $\frac{1}{32}$ lb except on sizes 3 in. and over; below 3 in. substitute Column B.

^cOn radiator runouts over 8 ft long increase one pipe size over that shown in Table 8.

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ONE-PIPE GRAVITY AIR-VENT SYSTEMS

One-pipe gravity air-vent systems in which the equivalent length of run does not exceed 200 ft should be sized as follows:

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