

RESULTS OF LABORATORY EXPERIMENTS

The Research Laboratory of the AMERICAN SOCIETY HEATING AND VENTILATING ENGINEERS has investigated this subject¹, and has found the critical velocity for quiet operation to be about .22 in. per second for the sizes of pipe investigated and apparently increasing with the size of pipe. The maximum velocity, however, with counter flow of condensate where noise is not objectionable is considerably higher and increases rapidly with size of pipe. In the case of horizontal runs both the critical velocity for quiet operation and the maximum velocity where noise is not objectionable, depend upon the pitch of the pipe. The maximum capacity and velocity where noise is not objectionable for horizontal pipes with various pitches are given in Table 44.

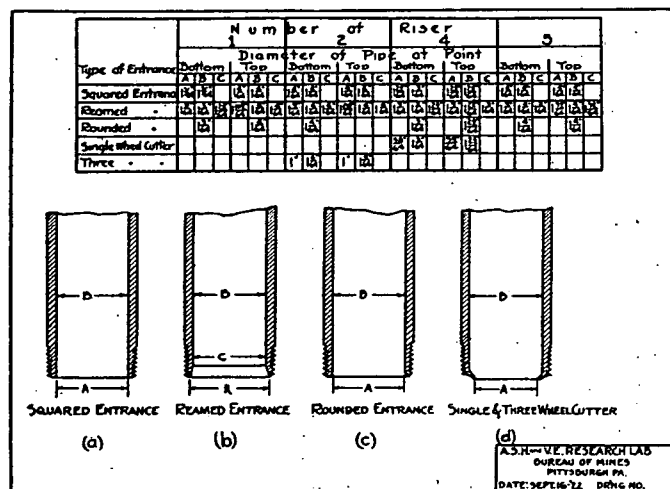


FIG. 22. EFFECT OF REAMING ENTRANCE TO ONE-PIPE RISERS

Where the velocity of steam is the limiting factor of the capacity of a pipe, care must be taken that this velocity is not exceeded in any part of the pipe or fittings by a constriction, since the velocity at any one constriction will limit the whole system. For this reason, particular care must be taken to ream such pipe and guard against dope constricting it at joints. Iron pipe should also be examined for constricting blisters, Fig. 22 and Table 46, from the Laboratory reports already mentioned show the importance of these factors.

¹Reports by Houghten & Ehin, JOURNAL AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, September, 1922; March, 1923; February, 1924; June, 1924; February, 1925.

TABLE 44. MAXIMUM CAPACITY OF ONE-PIPE LINES AT VARIOUS PITCHES
Pitch of Pipe in Inches per 10 Ft.

Pipe Size	Pitch of Pipe— $\frac{1}{4}$ IN.		$\frac{1}{2}$ IN.		1 IN.		$1\frac{1}{2}$ IN.		2 IN.		3 IN.		4 IN.		5 IN.	
	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.	Sq. Ft. Rad. Based on 240 B.t.u.	Max. Vel.
$\frac{3}{8}$ "	25.0	12	30.3	14	37.3	18	40.4	19	42.5	20	46.1	21	47.5	22	49.3	23
$\frac{1}{2}$ "	45.8	12	52.6	15	63.0	17	70.0	20	75.2	22	83.0	23	87.9	25	90.2	26
$\frac{5}{8}$ "	104.9	18	117.2	20	133.0	23	144.5	25	154.0	27	165.0	28	172.6	29	178.2	31
$1\frac{1}{8}$ "	142.6	18	159.0	21	181.0	23	196.5	25	209.3	27	224.0	28	234.8	30	242.6	31
$1\frac{1}{2}$ "	236.0	19	263.5	20	299.5	23	325.5	25	346.5	27	371.5	28	388.4	30	401.1	30

TABLE 45. RESULTS OF TESTS ON ANGLE AND GLOBE VALVES

NOMINAL SIZE OF PIPE IN.	AREA OF PIPE SQ. IN.	AREA VALVE SEAT OPENING SQ. IN.	PER CENT OF AREA OF PIPE	MAXIMUM PIPE AND VALVE	CAPACITY PIPE ALONE	PER CENT OF CAPACITY OF PIPE ALONE
$\frac{3}{4}$	0.537	0.4418	82.2	9.68	13.52	71.6
1	0.835	0.822	98.4	22.10	23.30	95.0
$1\frac{1}{4}$	1.459	1.258	86.2	30.00	47.5	63.1
$1\frac{1}{2}$	1.927	1.773	92.2	46.13	68.5	67.4

NOMINAL SIZE IN.	-VALVE STEM—VERTICAL		VALVE STEM—HORIZONTAL	
	Capacity of Pipe and Valve Lb. per Hr.	Per Cent of Capacity of Pipe Alone	Capacity of Pipe and Valve Lb. per Hr.	Per Cent of Capacity of Pipe Alone
¾	1.38	11.8	8.83	76.3
1	7.73	35.7	14.06	66.1
1¼	13.20	31.2	22.88	54.3
1½	18.81	33.0	32.00	56.7

The capacity of risers with various shaped entrances is very important and those shown in Fig. 22 gave the following maximum capacities:—

		Per Cent Decrease
Reamed entrances.....	24.7 lb. per hr.	0.0
Rounded entrances.....	23.9 lb. per hr.	3.2
Squared entrances.....	22.2 lb. per hr.	10.1
Three wheel cutter.....	19.2 lb. per hr.	22.2
Single wheel cutter.....	17.6 lb. per hr.	28.7

Table 46 shows variation in capacity of a pipe as affected by variation of size and smoothness of pipe generally found on the market. The maximum and minimum results were obtained by picking out very smooth and very rough pipe from the stock room of a large manufacturer.

TABLE 46. PER CENT DIFFERENCE IN CAPACITY DUE TO VARIATION OF PIPE SIZE AND SMOOTHNESS

	MAXIMUM CONDENSATION, LB. PER HR.			
Capacity of Pipe.....	$\frac{3}{4}$ "	1"	$1\frac{1}{4}$ "	$1\frac{1}{2}$ "
Minimum.....	14.00	24.89	45.42	70.50
Maximum.....	15.20	30.08	52.08	82.00
Per Cent Variation.....	8.6	20.8	14.7	16.3