

FLOW OF STEAM IN PIPES

Pressure Drop in Ounces	$87\sqrt{\frac{\text{Drop}}{100}}$	Inside Dia. Pipe Inches	$\sqrt{\frac{D^5}{1 + \frac{3.6}{D}}}$	Steam Pressure	$\sqrt{\text{Density}}$	Length Pipe in Inches	$\sqrt{\frac{100}{\text{Length}}}$
1	2.175	1	.522	0	.193	20	2.240
2	3.076	1 1/4	1.177	.3	.195	40	1.580
3	3.767	1 1/2	1.828	1.3	.201	60	1.290
4	4.350	2	3.709	2.3	.207	80	1.120
5	4.863	2 1/2	6.109	5.3	.223	100	1.000
6	5.328	3	11.183	10.3	.248	120	.912
7	5.754	3 1/2	16.705	15.3	.270	140	.841
8	6.152	4	23.630	20.3	.290	160	.793
10	6.878	4 1/2	32.098	30.3	.326	180	.741
12	7.534	5	43.719	40.3	.358	200	.710
14	8.138	6	69.718	50.3	.388	250	.632
16	8.700	7	105.35	60.3	.415	300	.578
20	9.727	8	150.33	75.3	.452	350	.538
24	10.655	9	205.37	100.3	.507	400	.500
28	11.509	10	271.16	125.3	.557	450	.477
32	12.290	12	437.51	150.3	.603	500	.447
40	13.756	14	733.90	175.3	.645	600	.407
48	15.069	16	925.19	200.3	.648	700	.378
80	19.454					800	.354
160	27.512					900	.333
320	38.863					1000	.316
480	47.652					1400	.267

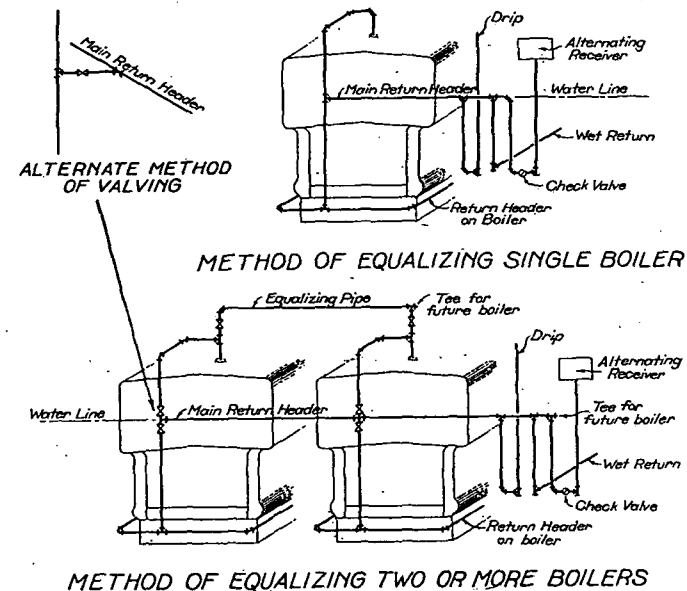
$A \times B \times C \times D$ = lbs. steam per minute will flow through a pipe for a given condition. Example
 $4.35 \times 11.183 \times 223 \times 1.00 = 10.84$ lbs. per minute— $10.84 \times 60 = 650.4$ lbs. per hour.

p = Drop in pressure in lbs.
 d = inside dia. pipe in inches
 L = Length of pipe in feet
 D = Density of steam per cu.ft.
 W = lbs. of steam per minute

$$W = \sqrt{\frac{PDd^5}{(1 + \frac{3.6}{D})L}}$$

$$P = .000131 \left(1 + \frac{3.6}{D}\right) \frac{W^2 L}{Dd^5}$$

METHODS OF EQUALIZING BOILERS



WATER HAMMER



Water hammer in steam pipes is caused by condensation in the pipe forming waves and allowing pockets to form holding steam—similar to A. The air around the pipe being cooler than the steam causes the steam to condense, thereby making a vacuum which pulls the water B-B together with a slap or bang. If the pipe is large enough to permit the steam to travel at a low velocity it will not pick up the water and form waves; like the above drawing and water hammer will not occur.