ENGINEERING

Flow Tables

Criteria for Selection of the proper components for a fluid flow system:
• Line Pressure (Usually a fixed quantity)
• Flow Rate Required
• Size of Pipe and Valves (Variable which needs to be chosen)

At a given flow, the pressure drop of the components in a pipe system will add up to a sum equal to the line pressure if the components are properly sized.

The tables are designed to offer a quick reference of pressure drop values for a valve and a given length of pipe. Adding the values together will yield an estimated total pressure drop. The tables are not meant for designing pipe systems.

The first column shows the Flow Rate, you can assume readings half-way between the readings shown to have a pressure drop approximately half-way between the pressure drop readings shown.

WATER & OIL* FLOW TABLES:
Due to water's low compressibility, the flow and pressure drop can be shown with a uniform length of pipe of 100 feet. The pressure drops for other lengths of pipe are simple fractions or multiples thereof.
* For light oil up to #3, use the same readings as water.
For medium heavy oil add 70% to the pressure readings shown**.**

GAS FLOW TABLES:
Natural (heating) gas also has low compressibility, however the flow and pressure drop is shown for two different lengths of pipe as the pressure drop at higher pressures are not proportional.

AIR & STEAM FLOW TABLES:
For compressed air or steam, the ratio between quantity and volume changes continuously as the air or steam flows through the pipes and accessories (valves).

Two tables are presented:
• One calculated using a pressure drop through a valve equal to 10% of inlet pressure
• The other using a pressure drop through a valve equal to 20% of inlet pressure.

Each table shows the pressure drop for two lengths of pipe, enabling the user to estimate the drop for a shorter or greater length of pipe.

NOTE(S):
• All pressure drops shown are for new pipe. Older piping may yield pressure drops several times higher.
• Due to the various components that make up a flow system it is difficult to establish an accurate pressure drop. If the flow rate is critical, an adequate safety margin should be determined.
• If it is necessary to limit flow to a certain maximum value, the FLOW CONTROL option can be added to most Magnatrol valves (provided they are not equipped with any other bottom mounted option).
• If a separate hand operated throttling valve or pressure regulator is used, it is recommended that they be installed downstream of the solenoid valve.

ENGINEERING
For Dependable ● Packless Solenoid Valves

Flow Tables

For Valve Type "N" and "NR"

Port Size	WATER DISCHARGE Gal./Hr. Pressure Drop PSI								AIR DISCHARGE Cu. Ft./Hr. Pressure Drop PSI						
	1/2	1	2	5	10	25	50	100	1/2	1	2	5	10	25	50
3/32	9	13	17	25	44	70	100	135	55	75	110	150	210	335	450
1/8	18	25	33	50	85	140	195	270	105	150	220	300	420	670	900
5/32	25	35	50	80	120	190	260	360	135	200	290	390	550	870	1150
3/16	35	50	80	130	180	280	400	540	175	255	360	480	655	1030	1440
1/4	53	75	100	185	250	380	530	740	225	320	450	700	930	1500	2220
5/16	73	100	135	225	320	500	700		300	430	610	980	1300	2100	3000
3/8	100	120	165	275	400	630	910		390	560	800	1300	1730	2720	3770
1/2	125	180	260	430	640	1000	1400		540	800	1100	1700	2400	3840	5400

For Valve Type "M" and "MR"

Port Size	STEAM DISCHARGE - Pounds of Steam Per Hour									
	Inlet 5 Lbs. Pressure Drop		Inlet 25 Lbs. Pressure Drop			Inlet 50 Lbs. Pressure Drop		Inlet 100 Lbs. Pressure Drop		Inlet 150 Lbs. Pressure Drop	
	2 #	4 #	5 #	10 #	20 #	7#	30 #	10 #	50 #	20 #	50 #
1/8	4.8	6.8	11	13	15	16	23	24	42	40	57
5/32	7.4	11	17	21	23	25	35	38	65		
3/16	11	15	24	30	33	36	50	54	93	90	127
1/4	14	21	33	40	45	50	68	74	126		
5/16	24	34	54	68	74	82	113				
3/8	36	51	82	102	112	124	170				
1/2	67	95	152	190	210						

GAS - Flow Table

PRESSURE DROP

IN INCHES OF WATER (27.7 INCHES = 1 PSI) THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED

FLOW CUBIC FEET OF GAS PER HOUR SPECIFIC GRAVITY 0.6	3/8" V	3/8" PIPE 25'	3/8" PIPE 50'	1/2" V	1/2" PIPE 25'	1/2" PIPE 50'	3/4" V	3/4" PIPE 25'	3/4" PIPE 50'	1" V	1" PIPE 25'	1" PIPE 50'	1-1/4" V	1-1/4" PIPE 50'	1-1/4" PIPE 100'	1-1/2" V	1-1/2" PIPE 50'	1-1/2" PIPE 100'	2" V	2" PIPE 50'	2" PIPE 100'	2-1/2" V	2-1/2" PIPE 100'	2-1/2" PIPE 200'	3" V	3" PIPE 100'	3" PIPE 200'
25	.06	.10	.20																								
35	.12	.20	.40	.06	.05	.09																					
50	.26	.40	.80	.10	.10	.21																					
75	.53	.85	1.8	.23	.23	.46	.06	.05	.09																		
100	.93	1.5	3.1	.40	.39	.80	.09	.09	.17																		
150	2.0	2.9	6.5	.90	.85	1.8	.20	.19	.37	.06	.05	.11															
200	3.5	4.6	11	1.6	1.5	3.2	.35	.33	.66	.11	.09	.19	.05	.05	.09												
300	7.3	8.2	20	3.4	2.9	6.8	.78	.71	1.5	.24	.21	.42	.10	.11	.22	.06	.05	.09									
400	12	12	31	5.7	4.6	12	1.3	1.2	2.6	.44	.35	.70	.18	.19	.38	.10	.08	.17									
600	22	20	52	12	8.2	23	3.0	2.5	5.7	.97	.79	1.7	.41	.42	.84	.22	.19	.38	.08	.05	.09						
800	33	28	75	18	12	37	5.1	3.9	9.7	1.7	1.1	2.9	.72	.70	1.4	.39	.32	.65	.14	.08	.17	.07	.07	.13			
1,000	46	37	128	25	16	51	7.4	5.5	14	2.7	2.0	4.6	1.1	1.1	2.3	.62	.51	1.0	.21	.13	.26	.11	.10	.21	.06	.05	.09
1,500	76	57	204	44	26	90	14	9.8	28	5.5	3.8	9.7	2.4	2.4	5.0	1.4	1.1	2.3	.47	.29	.59	.24	.24	.48	.11	.08	.16
2,000	–	–	–	63	37	128	23	14	43	9.1	6.0	16	4.1	4.0	8.6	2.4	1.9	4.0	.84	.51	1.0	.44	.41	.83	.26	.15	.29
3,000	–	–	–	103	57	208	40	23	78	17	10	31	8.6	7.6	18	5.1	4.0	8.6	1.7	1.1	2.3	.97	.92	1.8	.44	.33	.66
4,000	–	–	–	–	–	–	58	32	113	27	15	48	14	12	28	8.3	6.5	14	3.2	1.9	4.0	1.7	1.6	3.2	.77	.58	1.2
6,000	–	–	–	–	–	–	95	50	180	47	25	85	26	21	52	16	12	28	6.7	4.0	8.6	3.6	3.5	7.2	1.7	1.3	2.5
8,000	–	–	–	–	–	–	–	–	–	67	34	122	38	30	78	25	18	44	11	6.5	14	6.0	5.9	12	2.9	2.2	4.6
10,000	–	–	–	–	–	–	–	–	–	88	44	158	51	40	104	34	24	61	15	9.2	22	9.1	8.6	19	4.4	3.4	7.1
15,000	–	–	–	–	–	–	–	–	–	–	–	–	85	64	173	58	40	104	28	16	40	17	17	39	9.1	7.1	15
20,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	83	56	150	42	24	61	27	26	62	15	12	26
30,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	70	40	104	47	45	112	27	22	51
40,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	99	50	149	67	65	166	40	33	80
60,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	108	108	308	67	57	142
80,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	96	80	208

PROBLEM: Gas is required at the rate of 1,500 cubic feet per hour. Pressure at the gas mains is not less than 3-1/2 inches of water column. Pressure at the burner should be not less than 2 inches. Layout requires one Magnatrol On-and-Off control valve, one safety shut-off valve, 80 feet of piping, plus miscellaneous fittings such as elbows and tees.

SOLUTION: Glancing from left to right along 1,500 cu. ft. line, the first likely reading is that of the 2-inch size. Drop for the valves is 0.47 inches each. The miscellaneous fittings can be assumed to have a resistance equal to 20 feet of pipe, this together with the 80 feet of pipe is the equivalent of 100 feet of pipe, which in the table is shown as having a drop of 0.59 inches; a total of 1.53 inches for the entire layout. Pressure at the burner would be indicated as being just less than 2 inches. If a better safety margin is desired, the 2-1/2 inch pipe size should be selected.

PROBLEM: Same as layout above, except gas consumption is at the rate of 350 cubic feet per hour.

SOLUTION: 30 cu. ft. being half-way between 300 and 400, the 1-1/4 inch size shows an in-between reading of 0.14 inches drop per valve and 0.3 for the pipe and fittings; a total drop of 0.58 inches, giving an indicated pressure of 2.9 at the burner.

WATER & OIL - Flow Table

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FLOW GALLONS OF WATER PER MINUTE	PRESSURE DROP — IN POUNDS PER SQUARE INCH THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED																	
	3/8"		1/2"		3/4"		1"		1-1/4"		1-1/2"		2"		2-1/2"		3"	
	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'	V	PIPE 100'
1	.35	3.3	0.13	.84														
2	1.3	12	.54	3.0														
3	2.8	25	1.1	6.4	.29	1.4												
5	7.2	66	3.1	17	.77	3.6	.25	1.1										
7	13	120	5.7	31	1.4	6.8	.48	2.0	.22	.55								
10	26	250	11	61	2.8	12	.96	3.9	.42	1.1	.22	.42						
15	56	510	23	130	6.5	28	2.0	8.3	.89	2.3	.46	.88						
20	94	900	40	220	9.7	48	3.4	14	1.5	3.9	.79	1.6	.28	.48				
25	140	1,300	59	330	15	73	5.3	22	2.3	5.9	1.2	2.3	.43	.72	.25	.26		
35	–	–	115	590	29	140	11	41	4.3	11	2.2	4.5	.81	1.3	.47	.55	.22	.20
50	–	–	220	1,200	55	270	19	79	8.4	21	4.3	8.5	1.6	2.6	.95	1.1	.45	.40
75	–	–	–	–	120	570	37	170	18	46	9.5	18	3.4	5.6	1.9	2.3	.93	.85
100	–	–	–	–	200	990	71	290	30	78	16	31	5.7	9.5	3.3	3.9	1.6	1.4
150	–	–	–	–	–	–	150	610	65	170	34	66	12	20	7.2	8.3	3.4	3.1
200	–	–	–	–	–	–	–	–	110	290	58	110	21	35	12	14	5.9	5.3
300	–	–	–	–	–	–	–	–	230	610	120	230	45	70	26	30	12	11
400	–	–	–	–	–	–	–	–	–	–	210	410	77	130	44	52	21	19
500	–	–	–	–	–	–	–	–	–	–	–	–	120	190	67	78	32	29
750	–	–	–	–	–	–	–	–	–	–	–	–	220	410	140	170	70	62
1,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	240	290	120	110
1,500	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	250	230

* For light oil up to # 3, use same readings as for water.   **For medium heavy oil add 70% to the above pressure drop readings.**

PROBLEM: Water is required at the rate of 35 gallons per minute. Pressure in water mains is 40 PSI. Layout calls for one Magnatrol valve, one hand operated globe valve, 50 feet of pipe, various tees, elbows and unions.

SOLUTION: Checking the 1 inch size, the Magnatrol valve is found to have a pressure drop of 11 pounds; therefore the other globe valve also will have a drop of 11 pounds. The pipe at 41 pounds per hundred feet will show a drop of about 21 pounds for a length of 50 feet. Assuming that the other fittings together have a resistance equal to 15 feet of pipe, this comes to a drop of 6 pounds; or a total of about 40 pounds for the whole installation, which is too high. Repeating this procedure with the 1-1/4 inch size, we find that the Magnatrol valve accounts for 4.3 pounds, hand valve 4.3 pounds, 60 feet of pipe about 6 pounds, fittings about 2 pounds, a total of about 17 pounds, amply sufficient for the requirement.

PROBLEM: Same as above, except job calls for a gallonage of 60 per minute.

SOLUTION: Rate of 60 gallons per minute is not shown in the table, but by taking it as roughly half-way between 50 and 75, the various drops can be found by interpolation on the same basis.

Thus for 1-1/4 inch valves the drop of 8.4 plus 18, divided by 2, is 13 pounds each, omitting the fraction; drop for the pipe, taking 21 plus 46, divided by 2, is about 34 pounds per 100 feet, or 17 pounds per 50 feet, plus a about 5 pounds for the miscellaneous fittings, a total indicated pressure drop of 48 pounds, which is rather high. By the same token a layout of 1-1/2 inch pipe size would add up to a drop of 23 pounds, giving a more favorable safety margin.

AIR - Flow Table

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Table A - Based upon inlet pressure 10 times higher than drop through valve
(valve pressure drop is 10% of inlet pressure)

FLOW CUBIC FEET OF FREE AIR PER HOUR	3/8" V	3/8" PIPE 25'	3/8" PIPE 50'	1/2" V	1/2" PIPE 25'	1/2" PIPE 50'	3/4" V	3/4" PIPE 25'	3/4" PIPE 50'	1" V	1" PIPE 25'	1" PIPE 50'	1-1/4" V	1-1/4" PIPE 50'	1-1/4" PIPE 100'	1-1/2" V	1-1/2" PIPE 50'	1-1/2" PIPE 100'	2" V	2" PIPE 50'	2" PIPE 100'	2-1/2" V	2-1/2" PIPE 50'	2-1/2" PIPE 100'	3" V	3" PIPE 100'	3" PIPE 200'
400	.50	.55	1.4	.23	.23	.55																					
600	.99	.91	2.4	.46	.39	1.0																					
800	1.3	1.3	3.4	.71	.58	1.5	.21	.20	.47																		
1,000	1.7	1.7	4.4	1.0	.77	2.0	.33	.27	.65																		
1,500	3.1	2.6	7.0	1.7	1.2	3.3	.61	.50	1.2	.24	.21	.49															
2,000	4.3	3.5	9.5	2.5	1.7	4.6	.93	.67	1.8	.38	.31	.76	.19	.23	.50												
3,000	6.8	5.4	15	4.0	3.0	7.2	1.6	1.1	3.0	.71	.50	1.4	.38	.41	.99	.23	.23	.50									
4,000	9.5	7.2	20	5.6	3.7	10	2.4	1.5	4.2	1.1	.78	2.0	.60	.61	1.5	.38	.34	.83	.14	.11	.24						
6,000	15	11	31	8.8	5.6	15	3.6	2.4	6.5	1.6	1.2	3.3	1.1	1.2	2.8	.71	.61	1.5	.30	.23	.50	.16	.10	.21			
8,000	20	15	42	12	7.5	21	5.5	3.3	9.0	2.7	1.7	4.6	1.6	1.5	4.0	1.1	.91	2.3	.47	.34	.83	.26	.16	.36	.13	.12	.24
10,000	25	19	53	15	9.3	27	6.8	4.2	12	3.6	2.2	6.0	2.2	2.0	5.3	1.5	1.2	3.1	.67	.49	1.2	.38	.24	.54	.19	.17	.38
15,000	38	26	84	24	14	41	11	6.3	18	5.7	3.5	9.3	3.4	3.3	8.6	2.5	2.0	5.3	1.2	.82	2.1	.72	.44	1.0	.39	.36	.80
20,000	–	–	–	32	20	55	15	8.6	24	7.6	4.5	13	4.9	4.4	12	3.6	2.8	7.2	1.8	1.2	3.1	1.1	.65	1.6	.61	.57	1.3
30,000	–	–	–	–	–	–	23	13	36	12	7.1	20	8.1	6.8	19	5.7	4.3	12	3.0	2.0	5.3	1.9	1.2	2.9	1.1	1.0	2.6
40,000	–	–	–	–	–	–	31	18	50	17	9.5	26	11	9.3	26	7.8	6.1	16	4.2	2.8	7.2	2.8	1.6	4.2	1.6	1.5	4.0
60,000	–	–	–	–	–	–	–	–	–	26	15	41	17	14	39	12	9.2	26	6.9	4.4	12	4.4	2.6	6.9	2.8	2.6	6.6
80,000	–	–	–	–	–	–	–	–	–	35	19	55	23	19	53	17	12	35	9.1	6.0	17	6.3	3.8	9.7	3.9	3.7	9.8
100,000	–	–	–	–	–	–	–	–	–	–	–	–	29	24	67	21	16	44	12	7.6	21	7.9	4.8	13	5.1	4.8	13
150,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	32	24	67	18	12	32	12	6.5	19	8.0	7.6	20
200,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25	16	44	17	9.7	27	11	10	28
300,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	37	24	67	26	15	41	17	16	44
400,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35	20	55	23	22	60
600,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35	33	92

PRESSURE DROP IN POUNDS PER SQUARE INCH THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED

PROBLEM: Air is required at the rate of 8,000 cubic feet per hour. Inlet pressure is 60 PSI. Delivery pressure should be at least 45 PSI. Branch layout calls for one Magnatrol Valve, one globe check valve, 35 feet of pipe, plus fittings consisting of elbows, tees and unions, the fittings together having a resistance comparable to that of about 15 feet of pipe.

SOLUTION: The total pressure drop is 15 pounds, which is 25% of the inlet pressure. From this drop less than 1/3 will go to the valve, hence its drop will be less than 10%. Table (A) should be used, wherein; the calculations are based upon drop through the valve as being 10% of inlet pressure.

Reading to the right of 8,000, the 3/4 inch pipe size bears investigation. For the two valves the drop would be 5.5 pounds each. For the pipe and fittings with a total length corresponding to 50 feet, the drop would be 9.0 pounds; or a total drop of 20.0 pounds for the entire branch line. This brings the delivery pressure down to about 40 pounds, which is too low, and it will be necessary to go to the 1 inch size. Here the figures are 2.7 plus 2.7 plus 4.6 amounting to 10.0 pounds as the total drop; for an indicated delivery pressure of 50 pounds.

AIR - Flow Table

Table B - Based upon inlet pressure 5 times higher than drop through valve
(valve pressure drop is 20% of inlet pressure)

FLOW CUBIC FEET OF FREE AIR PER HOUR	3/8" V	3/8" PIPE 25'	3/8" PIPE 50'	1/2" V	1/2" PIPE 25'	1/2" PIPE 50'	3/4" V	3/4" PIPE 25'	3/4" PIPE 50'	1" V	1" PIPE 25'	1" PIPE 50'	1-1/4" V	1-1/4" PIPE 50'	1-1/4" PIPE 100'	1-1/2" V	1-1/2" PIPE 50'	1-1/2" PIPE 100'	2" V	2" PIPE 50'	2" PIPE 100'	2-1/2" V	2-1/2" PIPE 50'	2-1/2" PIPE 100'	3" V	3" PIPE 100'	3" PIPE 200'
400	.55	.71	1.7	.24	.28	.60																					
600	1.1	1.2	3.1	.50	.50	1.2																					
800	1.7	1.7	4.4	.83	.75	1.8	.23	.24	.59																		
1,000	2.3	2.2	5.7	1.2	.99	2.5	.34	.33	.75																		
1,500	3.9	3.5	9.5	2.1	1.7	4.3	.70	.60	1.4	.25	.25	.55															
2,000	5.7	4.8	13	3.2	2.3	6.1	1.1	.88	2.3	.42	.38	.90	.20	.25	.53												
3,000	9.2	7.4	21	5.3	3.6	10	2.0	1.5	3.8	.85	.69	1.7	.42	.50	1.1	.25	.25	.53									
4,000	13	10	28	7.5	5.0	14	3.1	2.1	5.5	1.5	.99	2.6	.70	.75	1.8	.41	.42	.89	.15	.12	.24						
6,000	20	15	42	12	7.7	22	5.1	3.3	9.0	2.4	1.7	4.3	1.3	1.4	3.2	.84	.75	1.8	.32	.25	.54	.16	.11	.22			
8,000	27	21	58	17	11	29	7.2	4.5	12	3.5	2.3	6.0	2.0	2.0	5.2	1.3	1.2	2.7	.52	.42	.89	.28	.19	.38	.13	.12	.25
10,000	34	27	73	21	13	36	10	5.8	16	4.5	3.0	8.0	2.8	2.7	6.8	2.2	1.6	3.9	.77	.60	1.3	.41	.27	.57	.20	.19	.39
15,000	53	41	113	33	41	56	15	8.9	25	7.6	4.7	13	4.6	4.3	11	3.2	2.7	6.8	1.5	1.1	2.5	.85	.50	1.2	.43	.40	.85
20,000	72	58	150	44	27	77	20	12	34	11	6.3	18	6.6	6.0	16	4.7	3.6	9.7	2.2	1.6	3.9	1.3	.82	1.9	.70	.66	1.4
30,000	–	–	–	68	42	116	31	18	49	17	9.8	27	11	9.5	25	7.5	6.0	16	3.8	2.7	6.8	2.4	1.5	3.5	1.3	1.3	2.9
40,000	–	–	–	–	–	–	43	25	69	23	13	37	15	13	35	11	8.0	22	5.5	3.6	9.8	3.5	2.1	5.3	2.1	2.0	4.6
60,000	–	–	–	–	–	–	65	38	106	35	20	56	23	20	54	17	13	35	8.6	6.0	16	5.8	4.0	8.6	3.3	3.3	8.4
80,000	–	–	–	–	–	–	–	–	–	48	28	76	31	27	74	23	18	47	13	8.5	22	8.2	4.9	13	5.1	4.9	13
100,000	–	–	–	–	–	–	–	–	–	60	35	96	39	34	93	29	22	60	16	11	29	11	6.3	17	6.7	6.5	17
150,000	–	–	–	–	–	–	–	–	–	–	–	–	60	52	142	44	34	93	25	16	44	17	9.7	27	11	10	27
200,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	60	46	125	33	22	60	25	14	36	15	14	39
300,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	51	34	93	35	21	57	23	22	60
400,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	69	46	125	48	28	77	32	30	83
600,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	72	42	117	48	46	128
800,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	66	63	173

PRESSURE DROP — IN POUNDS PER SQUARE INCH THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED

PROBLEM: Air to be discharged from tank to atmosphere. Rate of flow is 20,000 feet per hour. Tank pressure is 40 PSI. Discharge line to have one Magnatrol Valve, fittings with resistance equal to 20 feet of pipe, pipe 80 feet long, an equivalent of 100 feet of pipe.

SOLUTION: Total pressure drop is 100% of inlet pressure. Checking with the flow table at the 20,000 line and the medium size valves which appear to be in line for this job, roughly 1/3 of the drop, or 33%, goes to the valve, therefore table (B) which is based upon a 20% drop through the valve, should be used.

Reading on the 20,000 line from left to right, the first choice is 1 inch. Valve drop is given as 11 pounds. Pipe drop is given for lengths of 25 and 50 feet, and it will be noted that the drop for 50 feet is more than 2-1/2 times greater than for 25 feet. Multiplying the figure 18 by 2-1/2 gives 45 pounds as approximately the drop for 100 feet of 1 inch pipe; or a total drop of 56 pounds, which is too high. Repeating with the 1-1/4 inch size, the valve drop is 6.6 pounds, the pipe, here shown for 100 feet, is 16 pounds; a total indicated pressure drop of 22.6 pounds, therefore the 1-1/4 inch size will serve.

The solution given for steam flow is also pertinent to the air flow problems.

STEAM - Flow Table

Table A - Based upon inlet pressure 10 times higher than drop through valve
(valve pressure drop is 10% of inlet pressure)

PRESSURE DROP

IN POUNDS PER SQUARE INCH THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED

FLOW IN POUNDS OF STEAM PER HOUR	3/8" V	PIPE 12.5'	25'	1/2" V	PIPE 12.5'	25'	3/4" V	PIPE 12.5'	25'	1" V	PIPE 25'	50'	1-1/4" V	PIPE 25'	50'	1-1/2" V	PIPE 25'	50'	2" V	PIPE 50'	100'	2-1/2" V	PIPE 50'	100'	3" V	PIPE 50'	100'
12	.19	.44	1.1																								
18	.39	.68	1.7	.17	.29	.75																					
25	.64	.96	2.6	.29	.44	1.1																					
35	1.1	1.4	3.8	.54	.65	1.7	.15	.26	.61																		
50	1.7	2.0	5.7	.92	.96	2.6	.29	.41	.97																		
75	2.9	3.1	8.7	1.6	1.5	4.1	.56	.61	1.6	.21	.45	1.2															
100	4.0	4.2	12	2.3	2.0	5.7	.87	.85	2.3	.35	.67	1.7	.18	.27	.64												
150	5.7	6.1	18	3.8	3.1	8.7	1.5	1.3	3.6	.67	1.1	2.8	.35	.46	1.2	.21	.26	.60									
200	8.8	9.0	24	5.3	4.2	12	2.3	2.2	5.0	1.0	1.5	4.0	.56	.67	1.7	.35	.37	.93	.13	.29	.70						
300	14	14	37	8.3	6.5	18	3.7	2.8	7.6	1.7	2.4	6.4	1.0	1.1	2.8	.67	.64	1.6	.27	.53	1.2	.14	.22	.46			
400	19	18	50	11	8.8	24	5.1	3.8	10	2.6	3.2	8.9	1.5	1.5	4.0	1.0	.91	2.3	.44	.74	2.0	.24	.34	.77	.12	.13	.27
600	29	39	97	18	14	37	8.0	5.7	16	4.2	5.0	14	2.6	2.4	6.4	1.7	1.5	3.6	.81	1.3	3.4	.48	.59	1.4	.25	.25	.55
800	–	–	–	24	18	50	11	7.8	21	5.8	6.7	20	3.6	3.2	8.8	2.6	2.0	5.4	1.2	1.9	4.9	.74	.88	2.2	.40	.39	.89
1,000	–	–	–	–	–	–	14	9.8	27	7.4	8.5	24	4.7	4.1	11	3.4	2.6	6.9	1.6	2.5	6.4	1.0	1.2	3.0	.57	.54	1.3
1,500	–	–	–	–	–	–	22	15	41	12	13	36	7.4	6.3	17	5.4	4.0	11	3.0	3.9	10	1.7	1.9	5.0	1.0	.91	2.3
2,000	–	–	–	–	–	–	–	–	–	16	18	48	10	8.5	23	7.4	5.5	15	4.0	5.3	18	2.6	2.7	7.6	1.5	1.3	3.4
3,000	–	–	–	–	–	–	–	–	–	24	27	74	16	13	36	12	8.0	23	6.3	8.2	23	4.2	4.3	11	2.2	2.1	5.7
4,000	–	–	–	–	–	–	–	–	–	–	–	–	22	18	48	16	11	32	8.4	11	30	5.8	5.8	16	3.7	3.0	8.0
6,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24	18	47	13	17	47	9.1	9.2	25	5.9	4.7	13
8,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18	23	63	12	12	33	8.0	6.5	18
10,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23	29	87	16	15	42	11	8.2	23
15,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24	23	64	16	13	35
20,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22	17	47

PROBLEM: Steam is required at the rate of 700 pounds per hour. Boiler pressure is 15 PSI. Drop should not exceed 3 PSI. Branch layout to heat exchanger calls for one Magnatrol Valve, 25 feet of pipe, various fittings with a combined resistance equal to 10 feet of pipe.

SOLUTION: Pressure drop represents 20% of the inlet pressure. Less than half of this drop goes to valve; therefore table (A) should be used. The rate of 700 pounds is not shown, but will be taken as half-way between 600 and 800 pounds. The equivalent length of 35 feet of pipe and fittings together also is not shown, but can be taken as half-way between 25 and 50. Reading along the 600 and 800 pound lines, the 1-1/2 inch valve shows 1.7 plus 2.6 divided by 2 equals 2.2 pounds drop for the 700 pound flow rate; for the pipe the figures 1.5, 3.6, 2.0 and 5.4 are added and divided by 4, equaling 3.1 as the mid-point drop. 2.2 plus 3.1 equals 5.3 as the drop in PSI, which is too high. Repeating with the 2 inch size, the valve comes to 1.0 pounds drop, the piping for 50 feet would come to 1.6 pounds, or less than 1.0 pounds for 35 feet; a total indicated pressure drop of slightly less than 2 PSI.

The solutions given for the air flow are also applicable to steam flow tables.

STEAM - Flow Table

MAGNATROL VALVE CORPORATION info@magnatrol.com • Phone: 973-427-4341 • Fax: 973-427-7611

Table B - Based upon inlet pressure 5 times higher than drop through valve
(valve pressure drop is 20% of inlet pressure)

PRESSURE DROP

IN POUNDS PER SQUARE INCH THRU { V - FULL PORT MAGNATROL OR GLOBE VALVE / PIPE - PER LENGTH AS INDICATED

FLOW IN POUNDS OF STEAM PER HOUR	3/8" V	3/8" PIPE 12.5'	3/8" PIPE 25'	1/2" V	1/2" PIPE 12.5'	1/2" PIPE 25'	3/4" V	3/4" PIPE 12.5'	3/4" PIPE 25'	1" V	1" PIPE 25'	1" PIPE 50'	1-1/4" V	1-1/4" PIPE 25'	1-1/4" PIPE 50'	1-1/2" V	1-1/2" PIPE 25'	1-1/2" PIPE 50'	2" V	2" PIPE 50'	2" PIPE 100'	2-1/2" V	2-1/2" PIPE 50'	2-1/2" PIPE 100'	3" V	3" PIPE 50'	3" PIPE 100'
12	.20	.54	1.1																								
18	.41	.83	2.3	.18	.37	.91																					
25	.96	1.3	3.4	.33	.56	1.5																					
35	1.3	1.9	5.1	.58	.85	2.2	.16	.31	.73																		
50	2.2	2.8	7.6	1.1	1.3	3.4	.27	.49	1.2																		
75	3.4	4.7	12	2.0	2.0	5.6	.62	.81	2.1	.22	.58	1.4															
100	5.1	5.8	16	3.0	2.8	7.6	1.0	1.1	3.0	.38	.86	2.1	.18	.32	.73												
150	8.6	8.9	25	5.0	4.6	12	2.1	1.8	4.8	.76	1.4	3.7	.38	.58	1.4	.22	.30	.70									
200	12	12	35	7.0	5.8	16	2.8	2.5	6.7	1.2	2.0	5.3	.62	.85	2.1	.38	.46	1.1	.12	.35	.71						
300	19	19	51	11	8.9	25	4.7	3.8	10	2.2	3.2	8.5	1.2	1.4	3.7	.76	.78	2.0	.29	.62	1.3	.15	.23	.49			
400	25	25	70	15	12	35	6.7	5.2	14	3.3	4.4	12	1.9	2.0	5.3	1.2	1.2	3.0	.47	1.0	2.3	.25	.38	.84	.12	.13	.28
600	39	39	97	23	19	51	11	7.9	22	5.1	6.8	19	3.3	3.2	8.5	2.2	1.8	4.6	.94	1.7	4.3	.52	.72	1.7	.26	.28	.59
800	50	52	143	33	25	70	15	11	30	7.7	9.8	26	4.1	4.4	12	3.3	2.7	7.2	1.5	2.4	6.3	.85	1.1	2.7	.42	.45	1.0
1,000	–	–	–	42	32	88	19	14	38	10	12	32	6.0	5.7	15	4.6	3.4	9.3	2.1	3.2	8.4	1.2	1.5	3.7	.68	.64	1.5
1,500	–	–	–	–	–	–	29	21	58	16	18	50	10	8.6	24	7.1	5.5	15	3.6	5.2	14	2.2	2.5	6.5	1.2	1.2	2.8
2,000	–	–	–	–	–	–	40	28	77	22	24	70	14	12	32	10	7.5	20	5.1	9.0	19	3.3	3.8	9.3	1.9	1.7	4.3
3,000	–	–	–	–	–	–	–	–	–	33	37	103	22	18	50	16	11	31	8.3	11	31	5.1	5.7	15	3.3	2.8	7.3
4,000	–	–	–	–	–	–	–	–	–	45	50	140	29	24	70	22	15	43	12	15	40	7.7	7.9	21	4.8	4.0	11
6,000	–	–	–	–	–	–	–	–	–	–	–	–	45	37	103	33	23	65	18	23	64	12	12	33	7.8	6.4	17
8,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	45	31	88	25	32	88	17	17	46	11	8.8	24
10,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	31	44	114	22	21	58	14	11	31
15,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	48	61	170	33	32	89	22	17	48
20,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	45	43	121	30	23	64
30,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	46	36	99

PROBLEM: Steam is required at the rate of 700 pounds per hour. Boiler pressure is 15 PSI. Drop should not exceed 3 PSI. Branch layout to heat exchanger calls for one Magnatrol Valve, 25 feet of pipe, various fittings with a combined resistance equal to 10 feet of pipe.

SOLUTION: Pressure drop represents 20% of the inlet pressure. Less than half of this drop goes to valve; therefore table (A) should be used. The rate of 700 pounds is not shown, but will be taken as half-way between 600 and 800 pounds. The equivalent length of 35 feet of pipe and fittings together also is not shown, but can be taken as half-way between 25 and 50. Reading along the 600 and 800 pound lines, the 1-1/2 inch valve shows 1.7 plus 2.6 divided by 2 equals 2.2 pounds drop for the 700 pound flow rate; for the pipe the figures 1.5, 3.6, 2.0 and 5.4 are added and divided by 4, equaling 3.1 as the mid-point drop. 2.2 plus 3.1 equals 5.3 as the drop in PSI, which is too high. Repeating with the 2 inch size, the valve comes to 1.0 pounds drop, the piping for 50 feet would come to 1.6 pounds, or less than 1.0 pounds for 35 feet; a total indicated pressure drop of slightly less than 2 PSI.

The solutions given for the air flow are also applicable to steam flow tables.