

VELOCITY CHART (IN FEET PER SECOND)

PP-ER-007 | Part of the Penn Pump Engineering Reference Series

U.S. Gals. per min.	½" Pipe		¾" Pipe		1" Pipe		1¼" Pipe		1½" Pipe		2" Pipe		2½" Pipe		3" Pipe		4" Pipe		5" Pipe		6" Pipe	
	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet
2	2.11	7.50	1.20	1.91																		
4	4.22	27.0	2.41	6.87	1.48	2.12	.86	.56														
6	6.34	57.2	3.61	14.6	2.23	4.49	1.29	1.18	.95	.56												
8	8.45	97.5	4.81	24.8	2.97	7.65	1.72	2.01	1.26	.95												
10	10.6	147.3	6.02	37.4	3.71	11.6	2.15	3.04	1.58	1.43	.96	.42										
12			7.22	52.5	4.45	16.2	2.57	4.26	1.89	2.01	1.15	.60	.80	.25								
15			9.02	79.3	5.57	24.5	3.22	6.43	2.36	3.04	1.43	.90	1.01	.38								
18			10.8	111.1	6.68	34.3	3.86	9.01	2.84	4.25	1.72	1.26	1.21	.53								
20			12.0	135.0	7.42	41.6	4.29	11.0	3.15	5.17	1.91	1.53	1.34	.64	.87	.22						
25					9.28	62.9	5.36	16.6	3.94	7.81	2.39	2.31	1.68	.97	1.08	.34						
30					11.1	88.2	6.44	23.2	4.73	10.9	2.87	3.24	2.01	1.36	1.30	.47						
35					13.0	117.3	7.51	30.8	5.52	14.6	3.35	4.31	2.35	1.81	1.52	.63	.88	.17				
40					14.8	150.1	8.58	39.5	6.30	18.6	3.82	5.52	2.68	2.32	1.74	.81	1.01	.21				
45							9.65	49.1	7.09	23.2	4.30	6.86	3.02	2.89	1.95	1.00	1.13	.27				
50							10.7	59.7	7.88	28.2	4.78	8.34	3.35	3.51	2.17	1.22	1.26	.32	.80	.11		
55							11.8	71.2	8.67	33.6	5.26	9.95	3.69	4.19	2.39	1.45	1.39	.39	.88	.13		
60							12.9	83.6	9.46	39.5	5.74	11.7	4.02	4.92	2.60	1.71	1.51	.45	.96	.15		
65							13.9	96.9	10.2	45.8	6.21	13.6	4.36	5.70	2.82	1.98	1.64	.53	1.04	.18		
70							15.0	111.2	11.0	52.5	6.69	15.5	4.69	6.54	3.04	2.27	1.76	.60	1.12	.20		
75							16.1	126.3	11.8	59.6	7.17	17.7	5.03	7.43	3.25	2.58	1.89	.69	1.20	.23	.83	.09
80							17.2	142.4	12.6	67.2	7.65	19.9	5.36	8.38	3.47	2.91	2.02	.77	1.28	.26	.89	.11
85							18.2	159.3	13.4	75.2	8.13	22.3	5.70	9.37	3.69	3.25	2.14	.87	1.36	.29	.94	.12
90									14.2	83.6	8.61	24.7	6.03	10.4	3.91	3.62	2.27	.96	1.44	.32	1.00	.13
95									15.0	92.3	9.08	27.3	6.37	11.5	4.12	4.00	2.39	1.06	1.52	.35	1.06	.14
100									15.8	101.5	9.56	30.1	6.70	12.7	4.34	4.39	2.52	1.17	1.60	.39	1.11	.16
110									17.3	121.1	10.5	35.9	7.37	15.1	4.77	5.24	2.77	1.40	1.76	.46	1.22	.19
120									18.9	142.3	11.5	42.1	8.04	17.7	5.21	6.16	3.02	1.64	1.92	.55	1.33	.22
130											12.4	48.9	8.71	20.6	5.64	7.14	3.28	1.90	2.08	.63	1.44	.26
140											13.4	56.0	9.38	23.6	6.08	8.19	3.53	2.18	2.25	.73	1.55	.30
150											14.3	63.7	10.1	26.8	6.51	9.30	3.78	2.48	2.41	.82	1.67	.34
160											15.3	71.7	10.7	30.2	6.94	10.5	4.03	2.79	2.57	.93	1.78	.38
170											16.3	80.3	11.4	33.8	7.38	11.7	4.28	3.12	2.73	1.04	1.89	.42
180											17.2	89.2	12.1	37.5	7.81	13.0	4.54	3.47	2.89	1.15	2.00	.47
190											18.2	98.6	12.7	41.5	8.25	14.4	4.79	3.84	3.05	1.28	2.11	.52
200											19.1	108.4	13.4	45.6	8.68	15.8	5.04	4.22	3.21	1.40	2.22	.57
220											21.0	129.3	14.7	54.4	9.55	18.9	5.54	5.03	3.53	1.67	2.44	.68
240											22.9	151.9	16.1	63.9	10.4	22.2	6.05	5.91	3.85	1.97	2.67	.80
260													17.4	74.1	11.3	25.7	6.55	6.85	4.17	2.28	2.89	.93
280													18.8	85.0	12.2	29.5	7.06	7.86	4.49	2.61	3.11	1.07
300													20.1	96.6	13.0	33.5	7.56	8.93	4.81	2.97	3.33	1.21
320													21.4	108.8	13.9	37.8	8.06	10.1	5.13	3.35	3.55	1.37
340													22.8	121.8	14.8	42.3	8.57	11.3	5.45	3.74	3.78	1.53
360													24.1	135.3	15.6	47.0	9.07	12.5	5.77	4.16	4.00	1.70
380													25.5	149.6	16.5	51.9	9.58	13.8	6.09	4.60	4.22	1.88
400															17.4	57.1	10.1	15.2	6.41	5.06	4.44	2.07
450															19.5	71.0	11.3	18.9	7.22	6.29	5.00	2.57
500															21.7	86.3	12.6	23.0	8.02	7.64	5.55	3.12
550															23.9	102.9	13.9	27.4	8.82	9.12	6.11	3.73
600															26.0	120.9	15.1	32.2	9.62	10.7	6.66	4.38
650															28.2	140.2	16.4	37.3	10.4	12.4	7.22	5.07
700																	17.6	42.8	11.2	14.2	7.77	5.82
750																	18.9	48.6	12.0	16.2	8.33	6.61
800																	20.2	54.8	12.8	18.2	8.88	7.45
850																	21.4	61.3	13.6	20.4	9.44	8.34
900																	22.7	68.2	14.4	22.7	9.99	9.26
950																	23.9	75.3	15.2	25.1	10.6	10.2
1000																	25.2	82.8	16.0	27.5	11.1	11.3
1100																	27.7	98.8	17.6	32.9	12.2	13.4
1200																	30.2	116.0	19.2	38.6	13.3	15.8
1300																	32.8	134.6	20.8	44.8	14.4	18.3
1400																	35.3	154.3	22.5	51.3	15.5	21.0
1500																			24.1	58.3	16.7	23.8
1600																			25.7	65.7	17.8	26.9
1800																			28.9	81.7	20.0	33.4
2000																			32.1	99.3	22.2	40.6
2200																			35.3	118.5	24.4	48.4
2400																			38.5	139.2	26.7	56.9
2600																					28.9	65.9
2800																					31.1	75.6
3000																					33.3	85.9
3200																					35.5	96.8
3500																					38.9	114.3
3800																					42.2	133.1

Friction loss of water in feet per 100 feet length of pipe; based on the Williams & Hazen formula using constant 100 sizes of standard pipe in inches. For new smooth pipe, use 71% of these values.

VELOCITY CHART (IN FEET PER SECOND)

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U.S. Gals. per min.	8" Pipe		10" Pipe		12" Pipe		14" Pipe		16" Pipe		20" Pipe		24" Pipe		30" Pipe	
	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet	Vel. ft. per Sec.	Loss in Feet
130	.83	.07														
140	.90	.08														
150	.96	.09														
160	1.03	.10														
170	1.09	.11														
180	1.15	.12														
190	1.22	.14														
200	1.28	.15	.81	.05												
220	1.41	.18	.90	.06												
240	1.54	.21	.98	.07												
260	1.67	.24	1.06	.08												
280	1.80	.28	1.14	.09	.80	.04										
300	1.92	.32	1.22	.11	.86	.04										
320	2.05	.36	1.30	.12	.92	.05										
340	2.18	.40	1.38	.13	.97	.06	.81	.04								
360	2.31	.45	1.46	.15	1.03	.06	.85	.04								
380	2.44	.49	1.55	.16	1.09	.07	.90	.04								
400	2.57	.54	1.63	.18	1.15	.08	.95	.05								
450	2.89	.67	1.83	.22	1.29	.09	1.07	.06	.82	.03						
500	3.21	.82	2.03	.27	1.43	.12	1.19	.07	.91	.04						
550	3.53	.98	2.24	.32	1.58	.14	1.30	.09	1.00	.05						
600	3.85	1.15	2.44	.38	1.72	.16	1.42	.10	1.09	.05						
650	4.17	1.33	2.64	.44	1.86	.19	1.54	.12	1.18	.06						
700	4.49	1.53	2.85	.50	2.01	.22	1.66	.14	1.27	.07	.81	.02				
750	4.81	1.74	3.05	.57	2.15	.24	1.78	.15	1.36	.08	.87	.03				
800	5.13	1.96	3.25	.65	2.29	.28	1.90	.17	1.45	.09	.92	.03				
850	5.45	2.19	3.46	.72	2.44	.31	2.02	.19	1.54	.10	.98	.03				
900	5.77	2.43	3.66	.80	2.58	.34	2.13	.22	1.63	.11	1.04	.04				
950	6.09	2.69	3.87	.89	2.72	.38	2.25	.24	1.72	.12	1.10	.04				
1000	6.41	2.96	4.07	.98	2.87	.42	2.37	.26	1.82	.14	1.15	.05				
1100	7.05	3.53	4.48	1.16	3.15	.50	2.61	.31	2.00	.16	1.27	.05	.88	.02		
1200	7.70	4.14	4.88	1.37	3.44	.58	2.85	.37	2.18	.19	1.39	.06	.96	.03		
1300	8.34	4.80	5.29	1.59	3.73	.68	3.08	.43	2.36	.22	1.50	.07	1.04	.03		
1400	8.98	5.51	5.70	1.82	4.01	.78	3.32	.49	2.54	.26	1.62	.08	1.12	.03		
1500	9.62	6.26	6.10	2.07	4.30	.88	3.56	.56	2.72	.29	1.73	.10	1.20	.04		
1600	10.3	7.05	6.51	2.33	4.59	.99	3.79	.63	2.90	.33	1.85	.11	1.28	.04	.80	.01
1800	11.5	8.77	7.32	2.90	5.16	1.23	4.27	.78	3.27	.41	2.08	.13	1.44	.05	.91	.02
2000	12.8	10.7	8.14	3.52	5.73	1.50	4.74	.95	3.63	.49	2.31	.16	1.60	.07	1.01	.02
2200	14.1	12.7	8.95	4.20	6.31	1.79	5.22	1.13	3.99	.59	2.54	.20	1.76	.08	1.11	.03
2400	15.4	14.9	9.76	4.93	6.88	2.10	5.69	1.33	4.36	.69	2.77	.23	1.92	.09	1.21	.03
2600	16.7	17.3	10.6	5.72	7.45	2.44	6.17	1.54	4.72	.80	3.00	.27	2.08	.11	1.31	.04
2800	18.0	19.9	11.4	6.56	8.03	2.80	6.64	1.76	5.08	.92	3.23	.31	2.23	.12	1.41	.04
3000	19.2	22.6	12.2	7.45	8.60	3.18	7.12	2.00	5.45	1.04	3.46	.35	2.39	.14	1.51	.05
3200	20.5	25.4	13.0	8.40	9.17	3.58	7.59	2.26	5.81	1.18	3.69	.39	2.55	.16	1.61	.05
3500	22.4	30.0	14.2	9.91	10.0	4.22	8.30	2.66	6.35	1.39	4.04	.46	2.79	.19	1.76	.06
3800	24.4	35.0	15.5	11.5	10.9	4.92	9.01	3.10	6.90	1.62	4.39	.54	3.03	.22	1.91	.07
4200	26.9	42.1	17.1	13.9	12.0	5.92	9.96	3.73	7.63	1.95	4.85	.65	3.35	.26	2.11	.09
4500	28.9	47.8	18.3	15.8	12.9	6.72	10.7	4.24	8.17	2.21	5.19	.73	3.59	.30	2.26	.10
5000	32.1	58.1	20.3	19.2	14.3	8.17	11.9	5.15	9.08	2.69	5.77	.89	3.99	.36	2.51	.12
5500	35.3	69.3	22.4	22.9	15.8	9.75	13.0	6.15	9.99	3.21	6.35	1.06	4.39	.43	2.77	.14
6000	38.5	81.4	24.4	26.9	17.2	11.4	14.2	7.22	10.9	3.77	6.93	1.25	4.79	.51	3.02	.17
6500	41.7	94.3	26.4	31.2	18.6	13.3	15.4	8.37	11.8	4.37	7.50	1.45	5.19	.59	3.27	.19
7000	44.9	108.2	28.5	35.7	20.1	15.2	16.6	9.60	12.7	5.01	8.08	1.66	5.59	.68	3.52	.22
8000	51.3	138.5	32.5	45.7	22.9	19.5	19.0	12.3	14.5	6.41	9.23	2.13	6.38	.87	4.02	.28
9000			36.6	56.9	25.8	24.2	21.3	15.3	16.3	7.97	10.4	2.65	7.18	1.08	4.53	.35
10000			40.7	69.1	28.7	29.5	23.7	18.6	18.2	9.69	11.5	3.22	7.98	1.31	5.03	.43
12000			48.8	96.9	34.4	41.3	28.5	26.0	21.8	13.6	13.9	4.51	9.58	1.83	6.04	.60
14000			57.0	128.8	40.1	54.9	33.2	34.6	25.4	18.1	16.2	5.99	11.2	2.44	7.04	.79
16000					45.9	70.3	37.9	44.3	29.0	23.1	18.5	7.67	12.8	3.12	8.05	1.01
18000					51.6	87.4	42.7	55.1	32.7	28.7	20.8	9.54	14.4	3.88	9.05	1.26
20000					57.3	106.2	47.4	67.0	36.3	34.9	23.1	11.6	16.0	4.72	10.1	1.53

Friction loss of water in feet per 100 feet length of pipe; based on the Williams & Hazen formula using constant 100 sizes of standard pipe in inches. For new smooth pipe, use 71% of these values.