



Formula for Calculating Velocity at End of Last Dialysis Station

1. Determine the number of dialysis machines that will be used.
2. Determine the amount of water each machine will be using in cc/min.
3. Multiply number of dialysis machines by amount of water each machine will be using.
4. Divide result by 3785 (the number of cc per gallon). The result is the total GPM all the machines will have used at end of the last station.
5. Subtract the total GPM from the GPM the RO machine will produce. The result is the GPM through pipe at the end of last dialysis station.
6. Determine the velocity in feet per second by looking at Table 29 "Carrying Capacity and Friction Loss" of the Harrington Plastics Engineering Handbook. The table shows that at 2 GPM, the velocity will be 1.57 feet per second in a 3/4 inch SCH 80 PVC pipe. Therefore, any pipe carrying 2 GPM or higher at the end of the last dialysis station will have a velocity of 1.57 feet per second or greater.

Example:

Number of Dialysis Machine = 21

Amount of Water Each Machine will use = 800 cc/min

$21 \times 800 \text{ cc/min} = 16800 \text{ cc/min}$

$16800 \text{ cc/min} \text{ divided by } 3785 \text{ cc/min} = 4.44 \text{ GPM}$ (total gallons per minute used by machines)

RO machine is designed to produce 8 GPM

$8 \text{ GPM} - 4.44 \text{ GPM} = 3.56 \text{ GPM}$ (total gallons running through pipe at end of last station)

The flow requirement through a 3/4 inch Sch 80 PVC pipe to achieve 1.57 feet per second is 2 gallons per minute. Since the flow through the pipe past the last dialysis machine is 4.44 GPM, the velocity is 2.84 feet per second. Minimum velocity required is 1.57 feet per second.

(Independent variables: Gallons per minute and nominal pipe size O.D.)

Dependent variables: Velocity, friction head and pressure drop per 100 feet of pipe, interior smooth .)

GALLONS PER MINUTE	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET	VELOCITY FEET PER SECOND	FRICTION LOSS POUNDS PER SQUARE INCH	FRICTION HEAD FEET
	1/2 IN.			3/4 IN.			1 IN.			1-1/4 IN.			1-1/2 IN.			2 IN.			2-1/2 IN.			3 IN.		
1	1.48	4.02	1.74	0.74	0.86	0.37																		
2	2.95	8.03	3.48	1.57	1.72	0.74	0.94	0.88	0.38	0.52	0.21	0.09	0.38	0.10	0.041									
5	7.39	45.23	19.59	3.92	9.67	4.19	2.34	2.75	1.19	1.30	0.66	0.29	0.94	0.30	0.126	0.56	0.10	0.040	0.39	0.05	0.022	0.25	0.02	0.009
7	10.34	83.07	35.97	5.49	17.76	7.69	3.28	5.04	2.19	1.82	1.21	0.53	1.32	0.55	0.24	0.78	0.15	0.065	0.54	0.07	0.032	0.35	0.028	0.012
10				7.84	33.84	14.65	4.68	9.61	4.16	2.60	2.30	1.00	1.88	1.04	0.45	1.12	0.29	0.13	0.78	0.12	0.052	0.50	0.04	0.017
15		4 IN.		11.76	71.70	31.05	7.01	20.36	8.82	3.90	4.87	2.11	2.81	2.20	0.95	1.68	0.62	0.27	1.17	0.26	0.11	0.75	0.09	0.039
20	0.57	0.04	0.017				9.35	34.68	15.02	5.20	8.30	3.59	3.75	3.75	1.62	2.23	1.06	0.46	1.56	0.44	0.19	1.00	0.15	0.065
25	0.72	0.06	0.026		5 IN.		11.69	52.43	22.70	6.50	12.55	5.43	4.69	5.67	2.46	2.79	1.60	0.69	1.95	0.67	0.29	1.25	0.22	0.095
30	0.86	0.08	0.035	0.54	0.03	0.013	14.03	73.48	31.82	7.80	17.59	7.62	5.63	7.95	3.44	3.35	2.25	0.97	2.34	0.94	0.41	1.49	0.31	0.13
35	1.00	0.11	0.048	0.63	0.04	0.017				9.10	23.40	10.13	6.57	10.58	4.58	3.91	2.99	1.29	2.73	1.25	0.54	1.74	0.42	0.18
40	1.15	0.14	0.061	0.72	0.04	0.017		6 IN.		10.40	29.97	12.98	7.50	13.55	5.87	4.47	3.83	1.66	3.12	1.60	0.69	1.99	0.54	0.23
45	1.29	0.17	0.074	0.81	0.06	0.026				11.70	37.27	16.14	8.44	16.85	7.30	5.03	4.76	2.07	3.51	1.99	0.86	2.24	0.67	0.29
50	1.43	0.21	0.091	0.90	0.07	0.030	0.63	0.03	0.013	13.00	45.30	19.61	9.38	20.48	8.87	5.58	5.79	2.51	3.90	2.42	1.05	2.49	0.81	0.35
60	1.72	0.30	0.13	1.08	0.10	0.043	0.75	0.04	0.017				11.26	28.70	12.43	6.70	8.12	3.52	4.68	3.39	1.47	2.99	1.14	0.49
70	2.01	0.39	0.17	1.26	0.13	0.056	0.88	0.05	0.022							7.82	10.80	4.68	5.46	4.51	1.95	3.49	1.51	0.65
75	2.15	0.45	0.19	1.35	0.14	0.061	0.94	0.06	0.026							8.38	12.27	5.31	5.85	5.12	2.22	3.74	1.72	0.74
80	2.29	0.50	0.22	1.44	0.16	0.069	1.00	0.07	0.030							8.93	13.83	5.99	6.24	5.77	2.50	3.99	1.94	0.84
90	2.58	0.63	0.27	1.62	0.20	0.087	1.13	0.08	0.035							10.05	17.20	7.45	7.02	7.18	3.11	4.48	2.41	1.04
100	2.87	0.76	0.33	1.80	0.24	0.10	1.25	0.10	0.043							11.17	20.90	9.05	7.80	8.72	3.78	4.98	2.93	1.27
125	3.59	1.16	0.50	2.25	0.37	0.16	1.57	0.16	0.068	0.90	0.045	0.019							9.75	13.21	5.72	6.23	4.43	1.92
150	4.30	1.61	0.70	2.70	0.52	0.23	1.88	0.22	0.095	1.07	0.05	0.022		10 IN.					11.70	18.48	8.00	7.47	6.20	2.68
175	5.02	2.15	0.93	3.15	0.69	0.30	2.20	0.29	0.12	1.25	0.075	0.033			0.90	0.036	0.015					8.72	8.26	3.58
200	5.73	2.75	1.19	3.60	0.88	0.38	2.51	0.37	0.16	1.43	0.09	0.039	0.90	0.036	0.015							9.97	10.57	4.58
250	7.16	4.16	1.81	4.50	1.34	0.58	3.14	0.56	0.24	1.79	0.14	0.61	1.14	0.045	0.02		12 IN.					12.46	16.00	6.93
300	8.60	5.83	2.52	5.40	1.87	0.81	3.76	0.78	0.34	2.14	0.20	0.087	1.36	0.07	0.03									
350	10.03	7.76	3.36	6.30	2.49	1.08	4.39	1.04	0.45	2.50	0.27	0.12	1.59	0.085	0.037	1.12	0.037	0.016						
400	11.47	9.93	4.30	7.19	3.19	1.38	5.02	1.33	0.58	2.86	0.34	0.15	1.81	0.11	0.048	1.28	0.05	0.022						
450				8.09	3.97	1.72	5.64	1.65	0.71	3.21	0.42	0.18	2.04	0.14	0.061	1.44	0.06	0.026						
500				8.99	4.82	2.09	6.27	2.00	0.87	3.57	0.51	0.22	2.27	0.17	0.074	1.60	0.07	0.030						
750							9.40	4.25	1.84	5.36	1.08	0.47	3.40	0.36	0.16	2.40	0.15	0.065						
1000							12.54	7.23	3.13	7.14	1.84	0.80	4.54	0.61	0.26	3.20	0.26	0.11						
1250										8.93	2.78	1.20	5.67	0.92	0.40	4.01	0.40	0.17						
1500										10.71	3.89	1.68	6.80	1.29	0.56	4.81	0.55	0.24						
2000													9.07	2.19	0.95	6.41	0.94	0.41						
2500													11.34	3.33	1.44	8.01	1.42	0.62						
3000																9.61	1.99	0.86						
3500																11.21	2.65	1.15						
4000																12.82	3.41	1.48						

CARRYING CAPACITY & FRICTION LOSS

TABLE 29

FOR SERVICE, PLEASE CALL 1-800-877-HIPCO

