

FRICTION HEAD LOSS SCHEDULE 40 IRON OR STEEL PIPE

FRICTION HEAD LOSS IN FEET OF WATER PER 100 FT. OF PIPE

SIZE	1/2" PIPE		3/4" PIPE		1" PIPE		1 1/4" PIPE		1 1/2" PIPE		2" PIPE		2 1/2" PIPE		3" PIPE		SIZE
	0.622" INSIDE DIA.		0.824" INSIDE DIA.		1.049" INSIDE DIA.		1.380" INSIDE DIA.		1.610" INSIDE DIA.		2.067" INSIDE DIA.		2.469" INSIDE DIA.		3.068" INSIDE DIA.		
GALLONS PER MINUTE	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	VELOCITY FEET PER SECOND	HEAD LOSS FEET	GALLONS PER MINUTE
1	1.056	2.100	0.602	0.534	0.371	0.165											1
2	2.112	7.580	1.203	1.929	0.743	0.596	0.429	0.157									2
3	3.168	16.062	1.805	4.087	1.114	1.263	0.644	0.333	0.473	0.157							3
4	4.224	27.365	2.407	6.962	1.485	2.151	0.858	0.566	0.630	0.268							4
5	5.279	41.369	3.008	10.525	1.856	3.252	1.073	0.856	0.788	0.405							5
6	6.335	57.985	3.610	14.753	2.227	4.558	1.287	1.200	0.946	0.567	0.574	0.168					6
8	8.447	98.787	4.813	25.134	2.970	7.765	1.716	2.045	1.261	0.966	0.765	0.286	0.536	0.121			8
10	10.559	149.341	6.016	37.996	3.712	11.738	2.145	3.091	1.576	1.460	0.956	0.433	0.670	0.182			10
15	4" PIPE																
20	4.026" INSIDE DIA.				7.425	42.374	4.290	11.159	3.152	5.271	1.912	1.563	1.340	0.658	0.868	0.229	20
25	VELOCITY FEET PER SECOND	HEAD LOSS FEET			9.281	64.059	5.363	16.869	3.940	7.968	2.390	2.363	1.675	0.995	1.085	0.346	25
30					11.137	89.789	6.435	23.645	4.728	11.169	2.868	3.312	2.010	1.395	1.302	0.485	30
35	0.882	0.172					7.508	31.457	5.516	14.859	3.346	4.406	2.345	1.856	1.519	0.645	35
40	1.008	0.220					8.580	40.283	6.304	19.028	3.825	5.642	2.681	2.376	1.736	0.826	40
45	1.134	0.274					9.653	50.102	7.092	23.666	4.303	7.017	3.016	2.956	1.953	1.027	45
50	1.260	0.333					10.725	60.898	7.880	28.765	4.781	8.529	3.351	3.592	2.170	1.249	50
60	1.512	0.467	6" PIPE						9.456	40.319	5.737	11.955	4.021	5.035	2.604	1.750	60
70	1.764	0.621	6.065" INSIDE DIA.						11.032	53.641	6.693	15.905	4.691	6.699	3.038	2.328	70
80	2.016	0.795	VELOCITY FEET PER SECOND	HEAD LOSS FEET							7.649	20.367	5.361	8.578	3.472	2.981	80
90	2.268	0.988									8.605	25.331	6.031	10.669	3.906	3.708	90
100	2.520	1.201	1.111	0.164							9.561	30.789	6.701	12.968	4.340	4.507	100
125	3.150	1.816	1.388	0.247							11.952	46.546	8.376	19.605	5.425	6.814	125
150	3.780	2.546	1.666	0.347									10.052	27.479	6.510	9.550	150
175	4.410	3.387	1.943	0.461											7.595	12.706	175
200	5.041	4.337	2.221	0.591											8.680	16.271	200
225	5.671	5.394	2.499	0.735											9.765	20.237	225
250	6.301	6.556	2.776	0.893											10.850	24.597	250
275	6.931	7.822	3.054	1.065													275
300	7.561	9.190	3.332	1.252													300
325	8.191	10.658	3.609	1.452													325
350	8.821	12.226	3.887	1.665													350
375	9.451	13.893	4.165	1.892													375
400	10.081	15.656	4.442	2.132													400
425			4.720	2.386													425
450			4.997	2.652													450
475			5.275	2.931													475
500			5.553	3.223													500
550			6.108	3.846													550
600			6.663	4.518													600
650			7.218	5.240													650
700			7.774	6.011													700
750			8.329	6.830													750
800			8.884	7.698													800

RECOMMENDED OPERATING CONDITIONS SHOWN ABOVE HEAVY LINES IN CHART

WATER HAMMER (shock waves) in pipe systems can result from sudden changes in flow, such as pumps starting and stopping, automatic control valves opening and closing, exhausting air from the system, or other flow restricting action. When a sudden change in flow occurs, the velocity energy of the flowing water is suddenly changed to pressure at that location. This excess pressure is called SURGE PRESSURE and is greater with larger changes in velocity. To help minimize SURGE PRESSURES, the maximum velocity of the water in the pipe line should be limited.

USE CAUTION IF VELOCITIES EXCEED 5 FEET PER SECOND, ESPECIALLY SUCTION VELOCITIES.

VELOCITIES SHOULD NOT EXCEED 8 FEET PER SECOND IN COLD WATER SYSTEMS.

Velocity calculated using the formula...

$$V = \frac{0.4085 \times Q}{D^2}$$

V = flow velocity in feet per second
Q = flow rate in gallons per minute
D = inside diameter of pipe in inches

Head loss calculated using Hazen-Williams formula with C=100...

$$F = \frac{0.2083 (100/C)^{1.852} \times Q^{1.852}}{D^{4.8655}}$$

F = friction head loss in feet of water per 100 feet of pipe
C = coefficient for roughness of the interior pipe surface
Q = flow rate in gallons per minute
D = inside diameter of pipe in inches

LANCASTER PUMP A Division of C-B Tool Company

1340 Manheim Pike Lancaster, PA 17601

Phone 717-397-3521 Fax 717-392-0266 www.lancasterpump.com