

CGA STANDARD PRACTICE SERIES

APPENDIX B

TABLES AND EXAMPLES

TABLE I Properties of Wrought Steel Pipe

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TABLE II Friction Loss

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TABLE I-A
PROPERTIES OF WROUGHT STEEL PIPE

Sch 40

Size	Diameter Internal	Diameter External	Area of Cross Section	Weight per foot	Weight/Ft of water in pipe	Length of pipe to contain 1 gal	Volume of Flow at 1 Ft/Min Velocity	Allowable working pressure at 100° F	Water Hammer Factor	Size
inches	inches	inches	square inches	pounds	pounds	feet	gallons	lbs/sq inch		inches
1	1.049	1.315	0.494	1.68	0.374	22.27	0.046	2100	22.3	1
1 1/4	1.38	1.66	0.669	2.27	0.648	12.87	0.078	1800	12.9	1 1/4
1 1/2	1.61	1.9	0.799	2.72	0.882	9.456	0.106	1700	9.46	1 1/2
2	2.067	2.375	1.075	3.65	1.454	5.737	0.174	1500	5.74	2
2 1/2	2.323	2.875	1.704	5.79	2.074	4.021	0.248	1900	4.02	2 1/2
3	3.068	3.5	2.228	7.58	3.202	2.604	0.383	1600	2.6	3
4	4.026	4.5	3.174	10.79	5.515	1.512	0.66	1400	1.51	4
6	6.065	6.625	5.581	18.97	12.52	0.663	1.5	1210	0.66	6

Selected from ANSI B36.10 - 1985

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TABLE II
PROPERTIES OF WROUGHT STEEL PIPE

Sch 80

Size	Diameter Internal	Diameter External	Area of Cross Section	Weight per foot	Weight/Ft of water in pipe	Length of pipe to contain 1 gal	Volume of Flow at 1 Ft/Min Velocity	Allowable working pressure at 100° F	Water Hammer Factor	Size
inches	inches	inches	square inches	pounds	pounds	feet	gallons	lbs/sq inch		inches
1	0.957	1.315	0.639	2.17	0.312	26.76	0.037	3500	26.8	1
1 1/4	1.278	1.66	0.881	3	0.556	15.01	0.067	3000	15	1 1/4
1 1/2	1.5	1.9	1.068	3.63	0.766	10.89	0.092	2800	10.9	1 1/2
2	1.939	2.375	1.477	5.02	1.279	6.519	0.154	2500	6.52	2
2 1/2	2.323	2.875	2.254	7.66	1.836	4.542	0.22	2800	4.54	2 1/2
3	2.9	3.5	3.016	10.25	2.861	2.914	0.344	2600	2.92	3
4	3.826	4.5	4.407	14.98	4.98	1.674	0.597	2300	1.67	4
6	5.761	6.625	8.405	28.57	11.29	0.738	1.355	2070	0.738	6

Selected from ANSI B36.10 - 1985

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TABLE II-A
FRICITION LOSS - SCH 40 STEEL PIPE
 Feet of Head per 100 Feet of Pipe

GPM	GPH	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
		1.049" ID	1.380" ID	1.610" ID	2.067" ID	2.469" ID	3.068" ID	4.026" ID
5	300	1.9						
6	360	2.7						
7	420	3.6						
8	480	4.5						
9	540	5.7						
10	600	6.9	1.8					
12	720	9.6	2.5	1.2				
14	840	12.8	3.3	1.5				
16	960	16.5	4.2	2.0				
20	1200	25.1	6.3	2.9				
25	1500	38.7	9.6	4.5	1.3			
30	1800	54.6	13.6	6.3	1.8			
35	2100	73.3	18.2	8.4	2.4			
40	2400	95.0	23.5	10.8	3.1	1.3		
45	2700		29.4	13.5	3.9	1.6		
50	3000		36.0	16.4	4.7	1.9		
60	3600		51.0	23.2	6.6	2.7		
70	4200		68.8	31.3	8.9	3.6	1.2	
80	4800		89.2	40.5	11.4	4.6	1.6	
90	5400			51.0	14.2	5.8	2.0	
100	6000			62.2	17.4	7.1	2.4	
120	7200				24.7	10.1	3.4	
140	8400				33.2	13.5	4.5	1.2
160	9600				43.0	17.5	5.8	1.5
200	12,000				66.3	27.0	8.9	2.3
260	15,600					45.0	14.8	3.7
300	18,000					59.6	19.5	4.9

Figures given are for new pipe; add 15-20% for old pipe

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TABLE II-B
FRICITION LOSS - SCH 80 STEEL PIPE
 Feet of Head per 100 Feet of Pipe

GPM	GPH	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
		.957" ID	1.278" ID	1.500" ID	1.939" ID	2.323" ID	2.900" ID	3.826" ID
5	300	3.0						
6	360	4.2	1.0					
8	480	7.1	1.7					
10	600	10.8	2.55					
12	720	15.2	3.6	1.6				
14	840	20.4	4.75	2.1				
16	960	26.3	6.1	2.7				
20	1200	40.3	9.3	4.15				
25	1500	55.3	14.2	6.3	1.7			
30	1800	88.2	20.1	8.9	2.5			
35	2100	119.0	27.0	11.9	3.3			
40	2400		34.9	15.4	4.2	1.7		
45	2700		41.6	19.3	5.3	2.1		
50	3000		53.7	23.6	6.4	2.6		
60	3600		76.5	33.6	9.1	3.65	1.2	
70	4200		103.0	45.3	12.2	4.9	1.6	
80	4800		134.0	58.7	15.8	6.3	2.1	
90	5400			73.8	19.8	7.9	2.6	
100	6000			90.7	24.3	9.7	3.15	
120	7200			129.6	34.5	13.7	4.45	
140	8400				46.6	18.5	6.0	1.5
160	9600				60.5	23.9	7.7	1.9
200	12,000				93.6	36.9	11.9	2.9
260	15,600					61.6	19.7	4.8
300	18,000					81.6	26.0	6.3

Figures given are for new pipe; add 15-20% for used pipe

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TABLE II-C
FRICITION LOSS - PLASTIC PIPE
 Feet of Head per 100 Feet of Pipe

GPM	GPH	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
		1.049" ID	1.380" ID	1.610" ID	2.067" ID	2.469" ID	3.068" ID	4.026" ID
5	300	1.8						
6	360	2.5						
7	420	3.3						
8	480	4.2						
9	540	5.2						
10	600	6.3	1.7					
12	720	8.9	2.3	1.1				
14	840	11.8	3.1	1.4				
16	960	15.1	4.0	1.9				
20	1200	22.8	6.0	2.8				
25	1500	38.7	9.1	4.3	1.3			
30	1800		12.7	6.0	1.8			
35	2100		16.9	8.0	2.4			
40	2400		21.6	10.2	3.0	1.1		
45	2700		28.0	12.5	3.8	1.4		
50	3000			15.4	4.6	1.7		
60	3600			21.6	6.4	2.3		
70	4200			28.7	8.5	3.0	1.2	
80	4800			36.8	10.9	3.8	1.4	
90	5400			45.7	13.6	4.8	1.8	
100	6000			56.6	16.5	5.7	2.2	
120	7200				23.1	8.0	3.0	
140	8400				30.6	10.5	4.0	1.1
160	9600				39.3	13.4	5.0	1.4
200	12,000					20.1	7.6	2.1
260	15,600					32.4	12.2	3.4
300	18,000					42.1	15.8	4.4

Figures given are for new pipe; add 15-20% for old pipe

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TABLE III-A
CHLORINE COMPOUND - DOSAGE
 To provide a disinfectant solution of 100mg/l (ppm)

5.25% Sodium Hypochlorite	25 fluid oz. / 100 gallons water
70% Calcium Hypochlorite	2 oz. (by weight) / 100 gallons water

PER 100 FEET OF WATER - FILLED CASING

Diameter of Casing (inches)	Gallons per 100 Feet (approximate)	Chlorine Compounds	
		(70%) Calcium Hypochlorite ¹	(5.25%) Sodium Hypochlorite ²
2	16.33	1/3 oz.	4 oz
4	65.25	1 1/3 oz.	16 oz.
6	150	3 oz.	38 oz.
8	260	5 1/4 oz.	2 qts
10	410	8 1/4 oz.	3 1/8 qts
12	590	3/4 lbs.	1 1/8 gal
16	1045	1 1/3 lbs.	2 gal
20	1630	2 lbs.	3 1/8 gal
24	2350	3 lbs.	4 2/3 gal
36	5285	7 lbs.	10 1/3 gal

1/ Calcium Hypochlorite with 70% available chlorine; dry weight measure

Note: 1 oz = 28.35 grams

2/ Sodium Hypochlorite (household bleach) with 5.25% available chlorine; liquid measure

Note: 1 gal = 128 fl oz = 3.785 litres

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TABLE V
DISCHARGE RATE IN GALLONS PER MINUTE
USING HORIZONTAL OPEN DISCHARGE METHOD

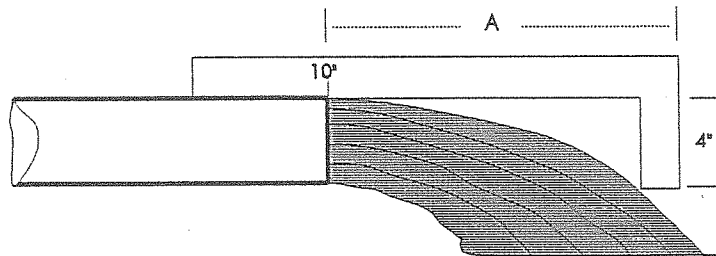
Horiz. Distance A (Inches)	NOMINAL PIPE SIZE											
	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
4	5.7	9.8	13.3	22.0	31	48	83					
5	7.1	12.2	16.6	27.5	39	61	104	163				
6	8.5	14.7	20.0	33.0	47	73	125	195	285			
7	10.0	17.1	23.2	38.5	55	85	146	228	334	380		
8	11.3	19.6	26.5	44.0	62	97	166	260	380	665	1060	
9	12.8	22.0	29.8	49.5	70	110	187	293	430	750	1190	1660
10	14.2	24.5	33.2	55.5	78	122	208	326	476	830	1330	1850
11	15.6	27.0	36.5	60.5	86	134	229	360	525	915	1460	2100
12	17.0	29.0	40.0	66.0	94	146	250	390	570	1000	1600	2220
13	18.5	31.5	43.0	71.5	102	158	270	425	620	1080	1730	2400
14	20.0	34.0	46.5	77.0	109	170	292	456	670	1160	1860	2590
15	21.3	36.3	50.0	82.5	117	183	312	490	710	1250	2000	2780
16	22.7	39.0	53.0	88.0	125	196	334	520	760	1330	2120	2960
17		41.5	56.5	93.0	133	207	355	550	810	1410	2260	3140
18			60.0	99.0	144	220	375	590	860	1500	2390	3330
19				110.0	148	232	395	620	919	1580	2520	3700
20					156	244	415	650	950	1660	2660	
21						256	435	685	1000	1750	2800	
22							460	720	1050	1830	2920	
23									1100	1910	3060	
24									1140	2000	3200	

The most reliable method of measuring flow is through a meter. When a meter is not available, however, it is possible to estimate discharge capacity using this chart in conjunction with an "L" shaped measuring stick. This measuring stick and the calculation method is described in examples in this appendix.

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EXAMPLE 1 Calculating Discharge Rate by Using The Horizontal Open Discharge Method

An L-shaped measuring square can be used to estimate flow capacity using the information in Table V. As shown in the illustration, position the "L" so that the end of the short 4" side just touches the stream of water. Note the Horizontal distance from this point to the open end of the discharge pipe. The horizontal discharge distance shown as "A" is in the first column of Table V. Read across the table to the pipe diameter to find the discharge rate in gallons per minute.



Example:

The nominal size of the pipe in the illustration is 4" and the horizontal distance "A" is 10"
From Table V the discharge rate is shown to be approximately 208 gpm