



Resources

Rain Bird Online Resources and Contacts List

Programs and Marketing Resources

Contacts/Information

Design and Specification Resources	www.rainbird.com/documents/professionals
Distributor Portal Website	ww2.rainbird.com/turfdistributor
Public and Non-Profit Agencies Portal	www.rainbird.com/agency
Facebook	www.facebook.com/RainBirdCorp
Intelligent Use of Water™	www.rainbird.com/corporate/intelligent-use-water
LEED Library	www.rainbird.com/LEED
Rain Bird Logo	www.rainbird.com/corporate/rain-bird-logo
Product Catalog	www.rainbird.com/catalog
Product Literature and Tech Specs	www.rainbird.com/documents/professionals
Rain Bird Agency Rewards (non-profits and government agencies)	www.rainbird.com/agency • E-mail: rewards@rainbird.com
Rain Bird Rewards	www.rainbird.com/Rewards • E-mail: rewards@rainbird.com
Rain Bird Training Services	www.rainbirdsolutions.com
Rain Bird Replacement Parts	www.rainbird.com/parts
Twitter	www.twitter.com/rainbirdcorp
Water Efficiency Calculators	www.rainbird.com/professionals/calculators
Site Reports	www.rainbird.com/sitereports
YouTube	www.youtube.com/rainbirdcorp



Rain Bird Training Services

Dedicated to the Development of Irrigation Professionals

Rain Bird Online Technical Training

In-Depth Technical Training Anytime, Anywhere

- Technical irrigation training anytime and anywhere
- High-quality training in about an hour
- Many of the most requested questions answered



Rain Bird Academy

General Irrigation Skills Training

- Top quality training on many manufacturers' products
- Prepare for Irrigation Association (IA) exams
- The Rain Bird Academy Boot Camp delivers the basics of irrigation in one week
 - Boot Camp classes are part of the IA Select Program



Rain Bird Factory Trained

Comprehensive Training on Rain Bird Products

- Training is exclusive to Rain Bird Products
- Be an expert on installing, managing and maintaining Rain Bird irrigation systems
- Get the designation that proves to your customers that you are the best choice to do the job



Rain Bird Customized Training

Customized and Private Classes

- Training is customized based on your organization's unique needs
- We come to your facility with everything needed to hold training
- From basic irrigation troubleshooting to central control, your staff will get the skills they need



For pricing and course registration, please visit: www.rainbirdsolutions.com

Rain Bird Rewards

Supporting Your Business Success and Growth

You're working hard to build a successful business and Rain Bird Rewards is here to reward you. We have the benefits and tools you can use to attract new customers, train your employees and reduce costs. Reinvesting in your company and its future success has never been so easy.

Join today — and get the benefits you need to take your business to the next level.

Help Your Business Succeed

Tools to grow your business.

- Use Rain Bird marketing materials to align your business with the industry leader

Rewards you deserve.

- Points can be redeemed to reward your hard work and help you build a successful business

Training discounts.

- Receive 20% off professional-level training from Rain Bird Training Services

Enroll today at ww2.rainbird.com/rewards/enrollment.htm



Reward for Your Hard Work

Let Rain Bird reward your growing business now and in the future.

Customer Service

At Rain Bird, we believe that when you purchase our products, you should also receive the support you need to ensure that they perform as designed. Like our products, Rain Bird customer service is designed to exceed expectations. When you call with questions about orders or new products, you get the support you need from the top water management professionals in the industry, backed by our vast global network of distributor-partners.

Worry-Free Warranties

Our comprehensive product warranties make it even easier to choose Rain Bird and relax. Most Rain Bird Landscape Irrigation products are warranted to the trade for a period of either three or five years from the date of original purchase. A Rain Bird warranty is hassle-free support that enables maximum peak performance by irrigation system professionals. For you, it's the added peace of mind of knowing Rain Bird is there when you need it.

Rain Bird's Professional Customer Satisfaction Policy

Rain Bird will repair or replace at no charge any Rain Bird professional product that fails in normal use within the warranty period stated below. You must return it to the dealer or distributor where you bought it. Product failures due to acts of God including without limitation, lightning and flooding, are not covered by this warranty. This commitment to repair or replace is our sole and total warranty.

Implied Warranties of Merchantability and Fitness, if Applicable, are Limited to One Year from the Date of Sale.

We will not, under any circumstances be liable for incidental or consequential damages, no matter how they occur.

I. Landscape Irrigation and Drainage Products

1800 Series Pop-Up Spray Heads, U-Series Nozzles, PA-8S and PA-8S-PRS Shrub Adapters, 1300 and 1400 Bubblers, 5000 Series Rotors, 5500 Series Rotors, 8005 Series Rotors, Falcon® 6504 Series Rotors, PEB/PESB/PESB-R Plastic Valves, DV/DVF and ASVF Plastic Valves, VB Series Valve Boxes, Internet Connected Water Meters (ICWM), and XF Series Dripline* – 5 years

C2 Power Unit – 2 years

Pump Start Relays – 1 year for controls/electronics, 2 years for enclosure

All other Landscape Irrigation and Drainage products – 3 years

II. Golf Products, Agricultural Products, and Pump Stations

For complete information and details please visit:
<http://www.rainbird.com/corporate/CustomerSatisfactionPolicy.htm>

III. All Other Products - 1 year

*XF Series Dripline - 7 Years on Environmental Stress Cracking (ESCR)

For more information, see your Rain Bird Distributor. To find the nearest authorized distributor in your area, visit www.rainbird.com or call 1-800-RAINBIRD

How to Use This Catalog

Precipitation Rates

Rain Bird has calculated for you the precipitation rates for our comprehensive lines of impacts, sprays, and rotors. These rates are an indication of the approximate rate at which water is being applied. The equations used to calculate the precipitation rates are as follows:

Square Spacing

U.S.: $PR = 96.3 \times \frac{gpm}{S \times S}$
Metric: $PR = 1000 \times \frac{m^3/h}{S \times S}$

Triangular Spacing

U.S.: $PR = 96.3 \times \frac{gpm}{S \times L}$
Metric: $PR = 1000 \times \frac{m^3/h}{S \times L}$

96.3 = Constant (inches/square foot/hour)

1000 = Constant (millimeter/square meter/hour)

gpm = Gallons per minute (applied to area by sprinklers)

m³/h = Cubic meters per hour (applied to area by sprinklers)

S = Spacing between sprinklers

L = Spacing between rows (S x 0.866)

Specification Information

The information in this catalog was accurate at the time of printing and may be used for proper specification of each product. For the most up-to-date information, go to the Rain Bird web site at www.rainbird.com.

ASABE Test Certification Statement

Rain Bird Corporation certifies that pressure, flow rate, and radius data for its products were determined and listed in accordance with ASABE/ICC 802-2014 or ASAE S398.1, Procedure for Sprinkler Testing and Performance Reporting, and are representative of performance of production sprinklers at the time of publication. Actual product performance may differ from the published specifications due to normal manufacturing variations and sample selection. All other specifications are solely the recommendations of Rain Bird Corporation.

Reference Charts

Information contained in this catalog is based upon generally accepted formulas, computations, and trade practices. Rain Bird Corporation, and its subsidiaries and affiliates, shall not be responsible or liable therefore if any problems, difficulties, or injuries should arise from or in connection with the use or application of this information, or if there is any error herein, typographical or otherwise.

Technical Support

Rain Bird Technical Support has the answers to your specific product and water-management questions. Call our toll-free Technical Service number, or for maximum convenience, access the Rain Bird web site. You'll get expert advice and the right solutions.

Technical Service

1-800-RAINBIRD
 (1-800-724-6247)

Internet Address

www.rainbird.com

Pressure Loss Through Water Meters

Pressure Loss: psi
 Nominal Size

Flow gpm	5/8"	3/4"	1"	1 1/2"	2"	3"	4"
1	0.2	0.1					
2	0.3	0.2					
3	0.4	0.3					
4	0.6	0.5	0.1				
5	0.9	0.6	0.2				
6	1.3	0.7	0.3				
7	1.8	0.8	0.4				
8	2.3	1.0	0.5				
9	3.0	1.3	0.6				
10	3.7	1.6	0.7				
11	4.4	1.9	0.8				
12	5.1	2.2	0.9				
13	6.1	2.6	1.0				
14	7.2	3.1	1.1				
15	8.3	3.6	1.2				
16	9.4	4.1	1.4	0.4			
17	10.7	4.6	1.6	0.5			
18	12.0	5.2	1.8	0.6			
19	13.4	5.8	2.0	0.7			
20	15.0	6.5	2.2	0.8			
22		7.9	2.8	1.0			
24		9.5	3.4	1.2			
26		11.2	4.0	1.4			
28		13.0	4.6	1.6			
30		15.0	5.3	1.8			
32			6.0	2.1	0.8		
34			6.9	2.4	0.9		
36			7.8	2.7	1.0		
38			8.7	3.0	1.2		
40			9.6	3.3	1.3		
42			10.6	3.6	1.4		
44			11.7	3.9	1.5		
46			12.8	4.2	1.6		
48			13.9	4.5	1.7		
50			15.0	4.9	1.9	0.7	
52				5.3	2.1		
54				5.7	2.2		
56				6.2	2.3		
58				6.7	2.5		
60				7.2	2.7		
65				8.3	3.2	1.1	
70				9.8	3.7	1.3	
75				11.2	4.3	1.5	
80				12.8	4.9	1.6	0.7
90				16.1	6.2	2.0	0.8
100				20.0	7.8	2.5	0.9
110					9.5	2.9	1.0
120					11.3	3.4	1.2
130					13.0	3.9	1.4
140					15.1	4.5	1.6
150					17.3	5.1	1.8
160					20.0	5.8	2.1
170						6.5	2.4
180						7.2	2.7
190						8.0	3.0
200						9.0	3.2
220						11.0	3.9
240						13.0	4.7
260						15.0	5.5
280						17.3	6.3
300						20.0	7.2
350							10.0
400							13.0
450							16.2
500							20.0

PVC Class 160 IPS Plastic Pipe

(1120, 1220) SDR 26 C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1" through 6" Flow 1 through 600 gpm

Nominal Size	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"		
Pipe OD	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625		
Avg. ID	1.175	1.512	1.734	2.173	2.635	3.21	4.134	6.084		
Avg. Wall	0.070	0.074	0.083	0.101	0.120	0.145	0.183	0.271		
Tolerance	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.031		
Min. Wall	0.060	0.064	0.073	0.091	0.110	0.135	0.173	0.255		
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	0.30	0.02	0.18	0.01	0.14	0.00	0.09	0.00	0.06	0.00
2	0.59	0.07	0.36	0.02	0.27	0.01	0.17	0.00	0.12	0.00
3	0.89	0.15	0.54	0.04	0.41	0.02	0.26	0.01	0.18	0.00
4	1.18	0.25	0.71	0.07	0.54	0.04	0.35	0.01	0.24	0.00
5	1.48	0.38	0.89	0.11	0.68	0.06	0.43	0.02	0.29	0.01
6	1.77	0.54	1.07	0.16	0.81	0.08	0.52	0.03	0.35	0.01
7	2.07	0.71	1.25	0.21	0.95	0.11	0.60	0.04	0.41	0.01
8	2.36	0.91	1.43	0.27	1.09	0.14	0.69	0.05	0.47	0.02
9	2.66	1.14	1.61	0.33	1.22	0.17	0.78	0.06	0.53	0.02
10	2.96	1.38	1.78	0.40	1.36	0.21	0.86	0.07	0.59	0.03
11	3.25	1.65	1.96	0.48	1.49	0.25	0.95	0.08	0.65	0.03
12	3.55	1.94	2.14	0.57	1.63	0.29	1.04	0.10	0.71	0.04
14	4.14	2.58	2.50	0.76	1.90	0.39	1.21	0.13	0.82	0.05
16	4.73	3.30	2.86	0.97	2.17	0.50	1.38	0.17	0.94	0.06
18	5.32	4.10	3.21	1.20	2.44	0.62	1.56	0.21	1.06	0.08
20	5.91	4.99	3.57	1.46	2.71	0.75	1.73	0.25	1.18	0.10
22	6.50	5.95	3.93	1.74	2.99	0.90	1.90	0.30	1.29	0.12
24	7.09	6.99	4.28	2.05	3.26	1.05	2.07	0.35	1.41	0.14
26	7.68	8.11	4.64	2.38	3.53	1.22	2.25	0.41	1.53	0.16
28	8.27	9.30	5.00	2.73	3.80	1.40	2.42	0.47	1.65	0.18
30	8.87	10.57	5.35	3.10	4.07	1.59	2.59	0.53	1.76	0.21
35	10.34	14.06	6.25	4.12	4.75	2.12	3.02	0.71	2.06	0.28
40	11.82	18.00	7.14	5.28	5.43	2.71	3.46	0.90	2.35	0.35
45	13.30	22.39	8.03	6.56	6.11	3.37	3.89	1.12	2.64	0.44
50	14.78	27.21	8.92	7.98	6.78	4.10	4.32	1.37	2.94	0.53
55			9.82	9.52	7.46	4.89	4.75	1.63	3.23	0.64
60			10.71	11.18	8.14	5.74	5.18	1.91	3.53	0.75
65			11.60	12.97	8.82	6.66	5.62	2.22	3.82	0.87
70			12.49	14.88	9.50	7.64	6.05	2.55	4.11	1.00
75			13.38	16.90	10.18	8.68	6.48	2.89	4.41	1.13
80			14.28	19.05	10.86	9.78	6.91	3.26	4.70	1.28
85					11.53	10.94	7.34	3.65	4.99	1.43
90					12.21	12.16	7.78	4.06	5.29	1.59
95					12.89	13.45	8.21	4.48	5.58	1.76
100					13.57	14.79	8.64	4.93	5.88	1.93
110					14.93	17.64	9.50	5.88	6.46	2.30
120							10.37	6.91	7.05	2.71
130							11.23	8.02	7.64	3.14
140							12.10	9.20	8.23	3.60
150							12.96	10.45	8.81	4.09
160							13.82	11.77	9.40	4.61
170							14.69	13.17	9.99	5.16
180									10.58	5.73
190									11.16	6.34
200									11.75	6.97
225									13.22	8.67
250									14.69	10.53
275									10.89	4.81
300									11.88	5.65
325									12.87	6.55
350									13.86	7.52
375									14.85	8.54
400										9.55
425										10.15
450										10.74
475										11.34
500										11.94
550										13.13
600										14.32

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with cautionThe velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$ Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

PVC Class 200 IPS Plastic Pipe

(1120, 1220) SDR 21 C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 3/4" through 6" Flow 1 through 600 gpm

Nominal Size Pipe OD	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	
Avg. ID	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	
Avg. Wall	0.91	1.169	1.482	1.7	2.129	2.581	3.146	4.046	5.955	
Tolerance	0.070	0.073	0.089	0.100	0.123	0.147	0.177	0.227	0.335	
Min. Wall	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.026	0.038	
	0.060	0.063	0.079	0.090	0.113	0.137	0.167	0.214	0.316	
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	0.49	0.07	0.30	0.02	0.19	0.01	0.14	0.00	0.01	0.00
2	0.99	0.24	0.60	0.07	0.37	0.02	0.28	0.01	0.18	0.00
3	1.48	0.52	0.90	0.15	0.56	0.05	0.42	0.02	0.27	0.01
4	1.97	0.88	1.19	0.26	0.74	0.08	0.56	0.04	0.36	0.01
5	2.46	1.33	1.49	0.39	0.93	0.12	0.71	0.06	0.45	0.02
6	2.96	1.86	1.79	0.55	1.11	0.17	0.85	0.09	0.54	0.03
7	3.45	2.47	2.09	0.73	1.30	0.23	0.99	0.12	0.63	0.04
8	3.94	3.17	2.39	0.94	1.49	0.30	1.13	0.15	0.72	0.05
9	4.43	3.94	2.69	1.17	1.67	0.37	1.27	0.19	0.81	0.06
10	4.93	4.79	2.99	1.42	1.86	0.45	1.41	0.23	0.90	0.08
11	5.42	5.72	3.28	1.69	2.04	0.53	1.55	0.27	0.99	0.09
12	5.91	6.71	3.58	1.98	2.23	0.63	1.69	0.32	1.08	0.11
14	6.90	8.93	4.18	2.64	2.60	0.83	1.98	0.43	1.26	0.14
16	7.88	11.44	4.78	3.38	2.97	1.07	2.26	0.55	1.44	0.18
18	8.87	14.23	5.37	4.21	3.34	1.33	2.54	0.68	1.62	0.23
20	9.85	17.29	5.97	5.11	3.72	1.61	2.82	0.83	1.80	0.28
22	10.84	20.63	6.57	6.10	4.09	1.92	3.11	0.99	1.98	0.33
24	11.82	24.24	7.17	7.17	4.46	2.26	3.39	1.16	2.16	0.39
26	12.81	28.11	7.76	8.31	4.83	2.62	3.67	1.34	2.34	0.45
28	13.80	32.25	8.36	9.53	5.20	3.01	3.95	1.54	2.52	0.52
30	14.78	36.64	8.96	10.83	5.57	3.41	4.24	1.75	2.70	0.59
35			10.45	14.41	6.50	4.54	4.94	2.33	3.15	0.78
40			11.94	18.45	7.43	5.82	5.65	2.98	3.60	1.00
45			13.44	22.95	8.36	7.24	6.35	3.71	4.05	1.24
50			14.93	27.90	9.29	8.79	7.06	4.51	4.50	1.51
55					10.22	10.49	7.76	5.38	4.95	1.80
60					11.15	12.33	8.47	6.32	5.40	2.11
65					12.07	14.30	9.18	7.33	5.85	2.45
70					13.00	16.40	9.88	8.41	6.30	2.81
75					13.93	18.63	10.59	9.56	6.75	3.20
80					14.86	21.00	11.29	10.77	7.20	3.60
85							12.00	12.05	7.65	4.03
90							12.71	13.40	8.10	4.48
95							13.41	14.81	8.55	4.95
100							14.12	16.28	9.00	5.45
110									9.90	6.50
120									10.80	7.63
130									11.70	8.85
140									12.60	10.16
150									13.50	11.54
160									14.40	13.01
170									10.41	5.70
180									11.02	6.34
190									11.64	7.01
200									12.25	7.71
225									13.78	9.58
250									15.31	11.65
275										
300										
325										
350										
375										
400										
425										
450										
475										
500										
550										
600										

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with caution

The velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$

Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

PVC Class 315 IPS Plastic Pipe

(1120, 1220) SDR 13.5 C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 6" Flow 1 through 600 gpm

Nominal Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
Pipe OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625
Avg. ID	0.6960	0.8740	1.1010	1.3940	1.5980	2.0030	2.4230	2.9510	3.7940	5.5840
Avg. Wall	0.072	0.088	0.107	0.133	0.151	0.186	0.226	0.275	0.353	0.521
Tolerance	0.020	0.020	0.020	0.020	0.020	0.020	0.026	0.031	0.040	0.059
Min. Wall	0.062	0.078	0.097	0.123	0.141	0.176	0.213	0.259	0.333	0.491
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	0.84	0.25	0.53	0.08	0.34	0.03	0.21	0.01	0.16	0.00
2	1.68	0.90	1.07	0.30	0.67	0.10	0.42	0.03	0.32	0.02
3	2.53	1.90	1.60	0.63	1.01	0.20	0.63	0.06	0.48	0.03
4	3.37	3.24	2.14	1.07	1.35	0.35	0.84	0.11	0.64	0.06
5	4.21	4.89	2.67	1.61	1.68	0.53	1.05	0.17	0.80	0.09
6	5.05	6.86	3.20	2.26	2.02	0.74	1.26	0.23	0.96	0.12
7	5.90	9.12	3.74	3.01	2.36	0.98	1.47	0.31	1.12	0.16
8	6.74	11.68	4.27	3.86	2.69	1.25	1.68	0.40	1.28	0.20
9	7.58	14.53	4.81	4.80	3.03	1.56	1.89	0.49	1.44	0.25
10	8.42	17.66	5.34	5.83	3.37	1.90	2.10	0.60	1.60	0.31
11	9.26	21.07	5.88	6.96	3.70	2.26	2.31	0.72	1.76	0.37
12	10.11	24.75	6.41	8.17	4.04	2.66	2.52	0.84	1.92	0.43
14	11.79	32.93	7.48	10.87	4.71	3.53	2.94	1.12	2.24	0.58
16	13.48	42.16	8.55	13.92	5.39	4.53	3.36	1.44	2.56	0.74
18	15.16	52.44	9.61	17.32	6.06	5.63	3.78	1.79	2.88	0.92
20			10.68	21.05	6.73	6.84	4.20	2.17	3.20	1.12
22			11.75	25.11	7.40	8.16	4.62	2.59	3.52	1.33
24			12.82	29.50	8.08	9.59	5.04	3.04	3.83	1.57
26			13.89	34.21	8.75	11.12	5.46	3.53	4.15	1.82
28			14.96	39.25	9.42	12.76	5.88	4.05	4.47	2.08
30			16.02	44.60	10.10	14.50	6.30	4.60	4.79	2.37
35					11.78	19.29	7.35	6.12	5.59	3.15
40					13.46	24.70	8.40	7.84	6.39	4.03
45					15.15	30.72	9.45	9.75	7.19	5.01
50					16.83	37.34	10.50	11.85	7.99	6.09
55							11.55	14.13	8.79	7.27
60							12.60	16.60	9.59	8.54
65							13.65	19.26	10.39	9.91
70							14.70	22.09	11.18	11.37
75							15.75	25.10	11.98	12.91
80							16.80	28.29	12.78	14.55
85									13.58	16.28
90									14.38	18.10
95									15.18	20.01
100									15.98	22.00
110									11.19	8.74
120									12.20	10.27
130									13.22	11.92
140									14.24	13.67
150									15.25	15.53
160									16.27	17.50
170									11.81	7.76
180									12.51	8.62
190									13.20	9.53
200									13.90	10.48
225									15.64	13.03
250									17.37	15.84
275									12.88	7.24
300									14.06	8.51
325									15.23	9.87
350									16.40	11.32
375									17.57	12.86
400									11.34	4.27
425									12.05	4.77
450									12.75	5.31
475									13.46	5.87
500									14.17	6.45
550									15.59	7.70
600									17.01	9.04

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with cautionThe velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$ Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

PVC Schedule 40 IPS Plastic Pipe

(1120, 1220) C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 6" Flow 1 through 600 gpm

Nominal Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
Pipe OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625
Avg. ID	0.602	0.804	1.029	1.36	1.59	2.047	2.445	3.042	3.998	6.031
Avg. Wall	0.119	0.123	0.143	0.150	0.155	0.164	0.215	0.229	0.251	0.297
Tolerance	0.020	0.020	0.020	0.020	0.020	0.020	0.024	0.026	0.028	0.034
Min. Wall	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.237	0.280
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	1.13	0.50	0.63	0.12	0.39	0.04	0.22	0.01	0.16	0.00
2	2.25	1.82	1.26	0.44	0.77	0.13	0.44	0.03	0.32	0.02
3	3.38	3.85	1.89	0.94	1.16	0.28	0.66	0.07	0.48	0.03
4	4.50	6.55	2.52	1.60	1.54	0.48	0.88	0.12	0.65	0.06
5	5.63	9.91	3.16	2.42	1.93	0.73	1.10	0.19	0.81	0.09
6	6.75	13.89	3.79	3.40	2.31	1.02	1.32	0.26	0.97	0.12
7	7.88	18.48	4.42	4.52	2.70	1.36	1.54	0.35	1.13	0.16
8	9.01	23.66	5.05	5.79	3.08	1.74	1.76	0.45	1.29	0.21
9	10.13	29.43	5.68	7.20	3.47	2.17	1.99	0.56	1.45	0.26
10	11.26	35.77	6.31	8.75	3.85	2.63	2.21	0.68	1.61	0.32
11	12.38	42.68	6.94	10.44	4.24	3.14	2.43	0.81	1.78	0.38
12	13.51	50.14	7.57	12.27	4.62	3.69	2.65	0.95	1.94	0.44
14	15.76	66.71	8.84	16.32	5.39	4.91	3.09	1.26	2.26	0.59
16	18.01	85.42	10.10	20.90	6.17	6.29	3.53	1.62	2.58	0.76
18	20.26	106.24	11.36	25.99	6.94	7.82	3.97	2.01	2.90	0.94
20			12.62	31.59	7.71	9.51	4.41	2.45	3.23	1.14
22			13.89	37.69	8.48	11.35	4.85	2.92	3.55	1.37
24			15.15	44.28	9.25	13.33	5.29	3.43	3.87	1.60
26			16.41	51.36	10.02	15.46	5.74	3.98	4.20	1.86
28			17.67	58.91	10.79	17.73	6.18	4.56	4.52	2.13
30			18.94	66.94	11.56	20.15	6.62	5.19	4.84	2.42
35					13.49	26.81	7.72	6.90	5.65	3.23
40					15.41	34.33	8.82	8.84	6.46	4.13
45					17.34	42.70	9.93	10.99	7.26	5.14
50					19.27	51.90	11.03	13.36	8.07	6.25
55							12.13	15.94	8.88	7.45
60							13.24	18.72	9.68	8.75
65							14.34	21.72	10.49	10.15
70							15.44	24.91	11.30	11.65
75							16.54	28.31	12.10	13.23
80							17.65	31.90	12.91	14.91
85							18.75	35.69	13.72	16.69
90							19.85	39.67	14.52	18.55
95									15.33	20.50
100									16.14	22.55
110									17.75	26.90
120									19.37	31.60
130									12.66	10.72
140									13.63	12.30
150									14.61	13.97
160									15.58	15.75
170									16.55	17.62
180									17.53	19.58
190									18.50	21.65
200									19.47	23.80
225									15.36	12.47
250									17.06	15.16
275									18.77	18.09
300									13.23	7.34
325									14.33	8.51
350									15.43	9.76
375									16.53	11.09
400									17.64	12.50
425									18.74	13.99
450									19.84	15.55
475										
500										
550										
600										

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with caution

The velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$

Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

PVC Schedule 80 IPS Plastic Pipe

(1120, 1220) C=150

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 6" Flow 1 through 600 gpm

Nominal Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
Pipe OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625
Avg. ID	0.526	0.722	0.935	1.254	1.476	1.913	2.289	2.864	3.786	5.709
Avg. Wall	0.157	0.164	0.190	0.203	0.212	0.231	0.293	0.318	0.357	0.458
Tolerance	0.020	0.020	0.022	0.024	0.024	0.026	0.034	0.036	0.040	0.052
Min. Wall	0.147	0.154	0.179	0.191	0.200	0.218	0.276	0.300	0.337	0.432
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	1.47	0.97	0.78	0.21	0.47	0.06	0.26	0.01	0.19	0.01
2	2.95	3.50	1.57	0.75	0.93	0.21	0.52	0.05	0.37	0.02
3	4.42	7.42	2.35	1.59	1.40	0.45	0.78	0.11	0.56	0.05
4	5.90	12.64	3.13	2.71	1.87	0.77	1.04	0.18	0.75	0.08
5	7.37	19.11	3.91	4.09	2.33	1.16	1.30	0.28	0.94	0.13
6	8.85	26.78	4.70	5.74	2.80	1.63	1.56	0.39	1.12	0.18
7	10.32	35.63	5.48	7.63	3.27	2.17	1.82	0.52	1.31	0.24
8	11.80	45.63	6.26	9.77	3.73	2.78	2.08	0.67	1.50	0.30
9	13.27	56.75	7.04	12.15	4.20	3.45	2.34	0.83	1.69	0.37
10	14.75	68.98	7.83	14.77	4.67	4.20	2.59	1.01	1.87	0.46
11			8.61	17.62	5.13	5.01	2.85	1.20	2.06	0.54
12			9.39	20.70	5.60	5.88	3.11	1.41	2.25	0.64
14			10.96	27.55	6.53	7.83	3.63	1.88	2.62	0.85
16			12.52	35.27	7.47	10.03	4.15	2.40	3.00	1.09
18			14.09	43.87	8.40	12.47	4.67	2.99	3.37	1.35
20			15.65	53.32	9.33	15.16	5.19	3.63	3.75	1.64
22					10.27	18.08	5.71	4.33	4.12	1.96
24					11.20	21.24	6.23	5.09	4.49	2.30
26					12.13	24.64	6.75	5.91	4.87	2.67
28					13.07	28.26	7.26	6.77	5.24	3.06
30					14.00	32.12	7.78	7.70	5.62	3.48
35					16.33	42.73	9.08	10.24	6.55	4.63
40							10.38	13.11	7.49	5.93
45							11.68	16.31	8.43	7.38
50							12.97	19.83	9.36	8.97
55							14.27	23.65	10.30	10.70
60							15.57	27.79	11.24	12.57
65									12.17	14.58
70									13.11	16.73
75									14.05	19.01
80									14.98	21.42
85									15.92	23.96
90									10.03	7.54
95									10.59	8.34
100									11.15	9.17
110									12.26	10.94
120									13.38	12.85
130									14.49	14.90
140									15.61	17.09
150									10.90	7.14
160									11.68	8.11
170									12.46	9.14
180									13.24	10.23
190									14.02	11.37
200									14.80	12.57
225									15.57	13.82
250									11.19	5.78
275									12.44	7.02
300									13.68	8.38
325									14.92	9.84
350									16.17	11.41
375									9.25	2.94
400									9.96	3.37
425									10.67	3.83
450									11.39	4.31
475									12.10	4.82
500									12.81	5.36
550									13.52	5.93
600									14.23	6.52

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with cautionThe velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$ Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

Polyethylene (PE) SDR Pressure Rated Tube

(2306, 3206, 3306) SDR 7, 9, 11.5, 15 C=140

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 4" Flow 1 through 600 gpm

Nominal Size Avg. I.D.	1/2" 0.622		3/4" 0.824		1" 1.049		1 1/4" 1.380		1 1/2" 1.610		2" 2.067		2 1/2" 2.469		3" 3.068		4" 4.026	
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	1.05	0.49	0.60	0.12	0.37	0.04	0.21	0.01	0.16	0.00	0.10	0.00	0.07	0.00	0.04	0.00	0.03	0.00
2	2.11	1.76	1.20	0.45	0.74	0.14	0.43	0.04	0.31	0.02	0.19	0.01	0.13	0.00	0.09	0.00	0.05	0.00
3	3.16	3.73	1.80	0.95	1.11	0.29	0.64	0.08	0.47	0.04	0.29	0.01	0.20	0.00	0.13	0.00	0.08	0.00
4	4.22	6.35	2.40	1.62	1.48	0.50	0.86	0.13	0.63	0.06	0.38	0.02	0.27	0.01	0.17	0.00	0.10	0.00
5	5.27	9.60	3.00	2.44	1.85	0.76	1.07	0.20	0.79	0.09	0.48	0.03	0.33	0.01	0.22	0.00	0.13	0.00
6	6.33	13.46	3.61	3.43	2.22	1.06	1.29	0.28	0.94	0.13	0.57	0.04	0.40	0.02	0.26	0.01	0.15	0.00
7	7.38	17.91	4.21	4.56	2.60	1.41	1.50	0.37	1.10	0.18	0.67	0.05	0.47	0.02	0.30	0.01	0.18	0.00
8	8.44	22.93	4.81	5.84	2.97	1.80	1.71	0.47	1.26	0.22	0.76	0.07	0.54	0.03	0.35	0.01	0.20	0.00
9	9.49	28.52	5.41	7.26	3.34	2.24	1.93	0.59	1.42	0.28	0.86	0.08	0.60	0.03	0.39	0.01	0.23	0.00
10	10.55	34.67	6.01	8.82	3.71	2.73	2.14	0.72	1.57	0.34	0.95	0.10	0.67	0.04	0.43	0.01	0.25	0.00
11			6.61	10.53	4.08	3.25	2.36	0.86	1.73	0.40	1.05	0.12	0.74	0.05	0.48	0.02	0.28	0.00
12			7.21	12.37	4.45	3.82	2.57	1.01	1.89	0.48	1.15	0.14	0.80	0.06	0.52	0.02	0.30	0.01
14			8.41	16.45	5.19	5.08	3.00	1.34	2.20	0.63	1.34	0.19	0.94	0.08	0.61	0.03	0.35	0.01
16			9.61	21.07	5.93	6.51	3.43	1.71	2.52	0.81	1.53	0.24	1.07	0.10	0.69	0.04	0.40	0.01
18			10.82	26.21	6.67	8.10	3.86	2.13	2.83	1.01	1.72	0.30	1.20	0.13	0.78	0.04	0.45	0.01
20			12.02	31.85	7.42	9.84	4.28	2.59	3.15	1.22	1.91	0.36	1.34	0.15	0.87	0.05	0.50	0.01
22					8.16	11.74	4.71	3.09	3.46	1.46	2.10	0.43	1.47	0.18	0.95	0.06	0.55	0.02
24					8.90	13.79	5.14	3.63	3.78	1.72	2.29	0.51	1.61	0.21	1.04	0.07	0.60	0.02
26					9.64	16.00	5.57	4.21	4.09	1.99	2.48	0.59	1.74	0.25	1.13	0.09	0.65	0.02
28					10.38	18.35	6.00	4.83	4.41	2.28	2.67	0.68	1.87	0.28	1.21	0.10	0.70	0.03
30					11.12	20.85	6.43	5.49	4.72	2.59	2.86	0.77	2.01	0.32	1.30	0.11	0.76	0.03
35					12.98	27.74	7.50	7.30	5.51	3.45	3.34	1.02	2.34	0.43	1.52	0.15	0.88	0.04
40							8.57	9.35	6.30	4.42	3.82	1.31	2.68	0.55	1.73	0.19	1.01	0.05
45							9.64	11.63	7.08	5.49	4.30	1.63	3.01	0.69	1.95	0.24	1.13	0.06
50							10.71	14.14	7.87	6.68	4.77	1.98	3.35	0.83	2.17	0.29	1.26	0.08
55							11.78	16.87	8.66	7.97	5.25	2.36	3.68	0.99	2.38	0.35	1.38	0.09
60							12.85	19.82	9.44	9.36	5.73	2.77	4.02	1.17	2.60	0.41	1.51	0.11
65									10.23	10.86	6.21	3.22	4.35	1.36	2.82	0.47	1.64	0.13
70									11.02	12.45	6.68	3.69	4.69	1.55	3.03	0.54	1.76	0.14
75									11.81	14.15	7.16	4.19	5.02	1.77	3.25	0.61	1.89	0.16
80									12.59	15.95	7.64	4.73	5.35	1.99	3.47	0.69	2.01	0.18
85									13.38	17.84	8.12	5.29	5.69	2.23	3.68	0.77	2.14	0.21
90											8.59	5.88	6.02	2.48	3.90	0.86	2.27	0.23
95											9.07	6.50	6.36	2.74	4.12	0.95	2.39	0.25
100											9.55	7.15	6.69	3.01	4.33	1.05	2.52	0.28
110											10.50	8.53	7.36	3.59	4.77	1.25	2.77	0.33
120											11.46	10.02	8.03	4.22	5.20	1.47	3.02	0.39
130											12.41	11.62	8.70	4.89	5.63	1.70	3.27	0.45
140											13.37	13.33	9.37	5.61	6.07	1.95	3.52	0.52
150													10.04	6.38	6.50	2.22	3.78	0.59
160													10.71	7.19	6.94	2.50	4.03	0.67
170													11.38	8.04	7.37	2.79	4.28	0.74
180													12.05	8.94	7.80	3.11	4.53	0.83
190													12.72	9.88	8.24	3.43	4.78	0.92
200													13.39	10.87	8.67	3.78	5.03	1.01
225															9.75	4.70	5.66	1.25
250															10.84	5.71	6.29	1.52
275															11.92	6.81	6.92	1.81
300															13.00	8.00	7.55	2.13
325															14.09	9.28	8.18	2.47
350																	8.81	2.84
375																	9.44	3.22
400																	10.07	3.63
425																	10.70	4.06
450																	11.33	4.52
475																	11.96	4.99
500																	12.59	5.49
550																	13.84	6.55
600																	15.10	7.70

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with caution

The velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$

Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

Schedule 40 Standard Steel Pipe

C=100

psi Loss per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 6" Flow 1 through 600 gpm

Nominal Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"
Pipe OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625
Avg. ID	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065
Avg. Wall	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.237	0.280
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	1.05	0.91	0.60	0.23	0.37	0.07	0.21	0.02	0.16	0.01
2	2.11	3.28	1.20	0.84	0.74	0.26	0.43	0.07	0.31	0.03
3	3.16	6.95	1.80	1.77	1.11	0.55	0.64	0.14	0.47	0.07
4	4.22	11.85	2.40	3.02	1.48	0.93	0.86	0.25	0.63	0.12
5	5.27	17.91	3.00	4.56	1.85	1.41	1.07	0.37	0.79	0.18
6	6.33	25.10	3.61	6.39	2.22	1.97	1.29	0.52	0.94	0.25
7	7.38	33.40	4.21	8.50	2.60	2.63	1.50	0.69	1.10	0.33
8	8.44	42.77	4.81	10.88	2.97	3.36	1.71	0.89	1.26	0.42
9	9.49	53.19	5.41	13.54	3.34	4.18	1.93	1.10	1.42	0.52
10	10.55	64.65	6.01	16.45	3.71	5.08	2.14	1.34	1.57	0.63
11	11.60	77.14	6.61	19.63	4.08	6.06	2.36	1.60	1.73	0.75
12	12.65	90.62	7.21	23.06	4.45	7.12	2.57	1.88	1.89	0.89
14			8.41	30.68	5.19	9.48	3.00	2.50	2.20	1.18
16			9.61	39.29	5.93	12.14	3.43	3.20	2.52	1.51
18			10.82	48.87	6.67	15.10	3.86	3.97	2.83	1.88
20			12.02	59.40	7.42	18.35	4.28	4.83	3.15	2.28
22			13.22	70.87	8.16	21.89	4.71	5.76	3.46	2.72
24					8.90	25.72	5.14	6.77	3.78	3.20
26					9.64	29.83	5.57	7.85	4.09	3.71
28					10.38	34.22	6.00	9.01	4.41	4.25
30					11.12	38.88	6.43	10.24	4.72	4.83
35					12.98	51.72	7.50	13.62	5.51	6.43
40							8.57	17.44	6.30	8.24
45							9.64	21.69	7.08	10.25
50							10.71	26.36	7.87	12.45
55							11.78	31.45	8.66	14.86
60							12.85	36.95	9.44	17.45
65							13.93	42.86	10.23	20.24
70									11.02	23.22
75									11.81	26.39
80									12.59	29.74
85									13.38	33.27
90									8.59	10.96
95									9.07	12.12
100									9.55	13.33
110									10.50	15.90
120									11.46	18.68
130									12.41	21.66
140									13.37	24.85
150									10.04	11.89
160									10.71	13.40
170									11.38	15.00
180									12.05	16.67
190									12.72	18.43
200									13.39	20.26
225									9.75	8.76
250									10.84	10.64
275									11.92	12.70
300									13.00	14.92
325									8.18	4.61
350									8.81	5.29
375									9.44	6.01
400									10.07	6.77
425									10.70	7.58
450									11.33	8.43
475									11.96	9.31
500									12.59	10.24
550										6.10
600										6.66

Note: Dark shaded area of chart indicates velocities over 7" per second. Use with caution

The velocity values were derived using the following equation $V = \frac{0.408 \times Q_{gpm}}{d^2}$ Table are based upon the following Hazen-Williams equation: $H_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.852} \times \frac{Q^{1.852}}{D^{4.8655}}$ for change in psi per foot of elevation. Pressure loss for uphill elevation and pressure gain for downhill elevation changes.

Type K Copper Water Tube

C=140

psi Loss per 100 Feet of Tube (psi/100 ft.)

Sizes 1/2" through 3" Flow 1 through 600 gpm

Nominal Size	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg. ID	0.5270		0.652		0.745		0.995		1.245		1.481		1.959		2.435		2.907	
Avg. Wall	0.049		0.049		0.065		0.065		0.065		0.072		0.083		0.095		0.109	
Flow (gpm)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)	Velocity (ft/s)	Loss (psi)
1	1.47	1.09	0.96	0.39	0.74	0.20	0.41	0.05	0.26	0.02	0.19	0.01	0.11	0.00	0.07	0.00	0.05	0.00
2	2.94	3.94	1.92	1.40	1.47	0.73	0.82	0.18	0.53	0.06	0.37	0.03	0.21	0.01	0.14	0.00	0.10	0.00
3	4.41	8.35	2.88	2.97	2.21	1.55	1.24	0.38	0.79	0.13	0.56	0.05	0.32	0.01	0.21	0.00	0.14	0.00
4	5.88	14.23	3.84	5.05	2.94	2.64	1.65	0.65	1.05	0.22	0.74	0.09	0.43	0.02	0.28	0.01	0.19	0.00
5	7.35	21.51	4.80	7.64	3.68	3.99	2.06	0.98	1.32	0.33	0.93	0.14	0.53	0.04	0.34	0.01	0.24	0.01
6	8.81	30.15	5.76	10.70	4.41	5.59	2.47	1.37	1.58	0.46	1.12	0.20	0.64	0.05	0.41	0.02	0.29	0.01
7	10.28	40.12	6.72	14.24	5.15	7.44	2.88	1.82	1.84	0.61	1.30	0.26	0.74	0.07	0.48	0.02	0.34	0.01
8	11.75	51.37	7.68	18.24	5.88	9.53	3.30	2.33	2.11	0.78	1.49	0.34	0.85	0.09	0.55	0.03	0.39	0.01
9	13.22	63.90	8.64	22.68	6.62	11.85	3.71	2.90	2.37	0.97	1.67	0.42	0.96	0.11	0.62	0.04	0.43	0.02
10	14.69	77.66	9.60	27.57	7.35	14.41	4.12	3.52	2.63	1.18	1.86	0.51	1.06	0.13	0.69	0.05	0.48	0.02
11			10.56	32.89	8.09	17.19	4.53	4.21	2.90	1.41	2.05	0.61	1.17	0.16	0.76	0.05	0.53	0.02
12			11.52	38.64	8.82	20.20	4.95	4.94	3.16	1.66	2.23	0.71	1.28	0.18	0.83	0.06	0.58	0.03
14			13.44	51.41	10.29	26.87	5.77	6.57	3.69	2.21	2.60	0.95	1.49	0.24	0.96	0.08	0.68	0.04
16			15.36	65.83	11.76	34.41	6.59	8.42	4.21	2.83	2.98	1.22	1.70	0.31	1.10	0.11	0.77	0.05
18			17.28	81.88	13.23	42.80	7.42	10.47	4.74	3.52	3.35	1.51	1.91	0.39	1.24	0.13	0.87	0.06
20					14.70	52.02	8.24	12.72	5.26	4.28	3.72	1.84	2.13	0.47	1.38	0.16	0.97	0.07
22					16.17	62.06	9.07	15.18	5.79	5.10	4.09	2.19	2.34	0.56	1.51	0.19	1.06	0.08
24					17.64	72.91	9.89	17.84	6.32	5.99	4.46	2.58	2.55	0.66	1.65	0.23	1.16	0.10
26							10.71	20.69	6.84	6.95	4.84	2.99	2.76	0.77	1.79	0.27	1.26	0.11
28							11.54	23.73	7.37	7.97	5.21	3.43	2.98	0.88	1.93	0.30	1.35	0.13
30							12.36	26.96	7.90	9.06	5.58	3.89	3.19	1.00	2.06	0.35	1.45	0.15
35							14.42	35.87	9.21	12.05	6.51	5.18	3.72	1.33	2.41	0.46	1.69	0.19
40							16.48	45.94	10.53	15.43	7.44	6.63	4.25	1.70	2.75	0.59	1.93	0.25
45									11.84	19.20	8.37	8.25	4.78	2.11	3.10	0.73	2.17	0.31
50									13.16	23.33	9.30	10.03	5.32	2.57	3.44	0.89	2.41	0.38
55									14.48	27.84	10.23	11.96	5.85	3.07	3.78	1.06	2.66	0.45
60									15.79	32.70	11.16	14.05	6.38	3.60	4.13	1.25	2.90	0.53
65									17.11	37.93	12.09	16.30	6.91	4.18	4.47	1.45	3.14	0.61
70									18.43	43.51	13.02	18.70	7.44	4.79	4.82	1.66	3.38	0.70
75											13.95	21.24	7.97	5.45	5.16	1.89	3.62	0.80
80											14.88	23.94	8.51	6.14	5.50	2.13	3.86	0.90
85											15.81	26.79	9.04	6.87	5.85	2.38	4.10	1.01
90											16.74	29.78	9.57	7.63	6.19	2.65	4.35	1.12
95											17.67	32.91	10.10	8.44	6.54	2.93	4.59	1.24
100											18.60	36.19	10.63	9.28	6.88	3.22	4.83	1.36
110													11.69	11.07	7.57	3.84	5.31	1.62
120													12.76	13.01	8.26	4.51	5.79	1.91
130													13.82	15.08	8.95	5.23	6.28	2.21
140													14.88	17.30	9.63	6.00	6.76	2.54
150													15.95	19.66	10.32	6.82	7.24	2.88
160													17.01	22.16	11.01	7.69	7.72	3.25
170													18.07	24.79	11.70	8.60	8.21	3.63
180															12.39	9.56	8.69	4.04
190															13.07	10.57	9.17	4.46
200															13.76	11.62	9.66	4.91
225															15.48	14.46	10.86	6.10
250															17.20	17.57	12.07	7.42
275															18.92	20.96	13.28	8.85
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