

Copper Water Tube

The mechanics of making both the solder joint and the brazing joint are comparatively similar. Complete instructions on proper techniques of both of these joining methods are outlined in this catalog on pages 85-97.

A very important consideration in Copper Piping is the selection of the proper bonding medium. As a general rule, the working temperature of the installation is a more important consideration than the working pressures. If the working temperature is not over 250°F (121°C), either 50-50%* or 95-5% solder can be used successfully. However, if the temperature exceeds 250°F (121°C), a low temperature brazing alloy should be used, with a melting temperature somewhat in excess of 1000°F (538°C).

According to BMS report No. 58, joints made with tin or tin-alloy solders should not be subject continuously to temperatures above 250°F (121°C). A number of brazing alloys are available and a careful study should be made in every case to determine the proper alloy for the particular application.

*The Safe Drinking Water Act Amendment of 1986 prohibits the use in potable water systems of any solder having a lead content in excess of 0.2%.

DIMENSIONAL DATA – SOLDER JOINT FITTING ENDS

Nominal Water Tube Size (In Inches)	Solder Joint Fittings – Tolerances						Solder Joint Fittings Copper Alloy – Pressure ^{1,2}		Solder Joint Fittings Copper Alloy – Drainage ^{3,4}							
	Male End (Fitting Connector) Diameter		Female End (Solder Cup) Diameter				Fitting End Length		Solder Cup Length		Fitting End Length		Solder Cup Length			
	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)	Min. Inch	Max. (mm)		
1/8	0.248	(6.30)	0.251	(6.38)	0.252	(6.40)	0.256	(6.50)	0.31	(7.9)	0.25	(6.4)	N/A	N/A	N/A	N/A
1/4	0.373	(9.47)	0.376	(9.55)	0.377	(9.58)	0.381	(9.68)	0.38	(9.7)	0.31	(7.9)	N/A	N/A	N/A	N/A
3/8	0.497	(12.62)	0.501	(12.73)	0.502	(12.75)	0.506	(12.85)	0.44	(11.2)	0.38	(9.7)	N/A	N/A	N/A	N/A
1/2	0.622	(15.80)	0.626	(15.90)	0.627	(15.93)	0.631	(16.03)	0.56	(14.2)	0.50	(12.7)	N/A	N/A	N/A	N/A
5/8	0.747	(18.97)	0.751	(19.08)	0.752	(19.10)	0.756	(19.20)	0.69	(17.5)	0.62	(15.7)	N/A	N/A	N/A	N/A
3/4	0.872	(22.15)	0.876	(22.25)	0.877	(22.28)	0.881	(22.38)	0.81	(20.6)	0.75	(19.1)	N/A	N/A	N/A	N/A
1	1.122	(28.50)	1.127	(28.63)	1.128	(28.65)	1.132	(28.75)	0.97	(24.6)	0.91	(23.1)	N/A	N/A	N/A	N/A
1 1/4	1.372	(34.85)	1.377	(34.98)	1.378	(35.00)	1.382	(35.10)	1.03	(26.2)	0.97	(24.6)	0.56	(14.2)	0.50	(12.7)
1 1/2	1.621	(41.17)	1.627	(41.33)	1.628	(41.35)	1.633	(41.48)	1.16	(29.5)	1.09	(27.7)	0.62	(15.7)	0.56	(14.2)
2	2.121	(53.87)	2.127	(54.03)	2.128	(54.05)	2.133	(54.18)	1.41	(35.8)	1.34	(34.0)	0.69	(17.5)	0.62	(15.7)
2 1/2	2.621	(66.57)	2.627	(66.73)	2.628	(66.75)	2.633	(66.88)	1.53	(38.9)	1.47	(37.3)	N/A	N/A	N/A	N/A
3	3.121	(79.27)	3.127	(79.43)	3.128	(79.45)	3.133	(79.58)	1.72	(43.7)	1.66	(42.2)	0.81	(20.6)	0.75	(19.1)
3 1/2	3.621	(91.97)	3.627	(92.13)	3.628	(92.15)	3.633	(92.28)	1.97	(50.0)	1.91	(48.5)	N/A	N/A	N/A	N/A
4	4.121	(104.67)	4.127	(104.83)	4.128	(104.85)	4.133	(104.98)	2.22	(56.4)	2.16	(54.9)	1.06	(26.9)	1.00	(25.4)
5	5.121	(130.07)	5.127	(130.23)	5.128	(130.25)	5.133	(130.38)	2.72	(69.1)	2.66	(67.6)	1.31	(33.3)	1.25	(31.8)
6	6.121	(155.47)	6.127	(155.63)	6.128	(155.65)	6.133	(79.58)	3.22	(81.8)	3.09	(78.5)	1.62	(41.1)	1.50	(38.1)
8	8.119	(206.22)	8.127	(206.43)	8.128	(206.45)	8.133	(206.58)	4.09	(103.9)	3.97	(100.8)	2.12	(53.8)	2.00	(50.8)
10	10.119	(257.02)	10.127	(257.23)	10.128	(257.25)	10.133	(257.38)	4.12	(104.6)	4.00	(101.6)	N/A	N/A	N/A	N/A
12	12.119	(307.82)	12.127	(308.03)	12.128	(308.05)	12.133	(308.18)	4.62	(117.3)	4.50	(114.3)	N/A	N/A	N/A	N/A

¹ As shown Standard ASME B16.18

² As shown Standard ASME B16.22

³ As shown Standard ASME B16.23

⁴ As shown Standard ASME B16.29

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DIMENSIONAL DATA – BRAZING FITTING ENDS

Nominal Water Tube Size (In Inches)	Male End (Fitting Connector) Diameter				Female End (Brazing Cup) Diameter				Fitting End Length Min.		Solder Cup Length Min.	
	Min.		Max.		Min.		Max.		Inch	(mm)	Inch	(mm)
	Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)				
1/4	0.373	(9.47)	0.376	(9.55)	0.377	(9.58)	0.381	(9.68)	0.23	(5.8)	0.17	(4.3)
3/8	0.497	(12.62)	0.501	(12.73)	0.502	(12.75)	0.506	(12.85)	0.26	(6.6)	0.20	(5.1)
1/2	0.622	(15.80)	0.626	(15.90)	0.627	(15.93)	0.631	(16.03)	0.28	(7.1)	0.22	(5.6)
5/8	0.747	(18.97)	0.751	(19.08)	0.752	(19.10)	0.756	(19.20)	N/A	N/A	N/A	N/A
3/4	0.872	(22.15)	0.876	(22.25)	0.877	(22.28)	0.881	(22.38)	0.31	(7.9)	0.25	(6.4)
1	1.122	(28.50)	1.127	(28.63)	1.128	(28.65)	1.132	(28.75)	0.34	(8.6)	0.28	(7.1)
1 1/4	1.372	(34.85)	1.377	(34.98)	1.378	(35.00)	1.382	(35.10)	0.37	(9.4)	0.31	(7.9)
1 1/2	1.621	(41.17)	1.627	(41.33)	1.628	(41.35)	1.633	(41.48)	0.40	(10.2)	0.34	(8.6)
2	2.121	(53.87)	2.127	(54.03)	2.128	(54.05)	2.133	(54.18)	0.47	(11.9)	0.40	(10.2)
2 1/2	2.621	(66.57)	2.627	(66.73)	2.628	(66.75)	2.633	(66.88)	0.53	(13.5)	0.47	(11.9)
3	3.121	(79.27)	3.127	(79.43)	3.128	(79.45)	3.133	(79.58)	0.59	(15.0)	0.53	(13.5)
3 1/2	3.621	(91.97)	3.627	(92.13)	3.628	(92.15)	3.633	(92.28)	0.65	(16.5)	0.59	(15.0)
4	4.121	(104.67)	4.127	(104.83)	4.128	(104.85)	4.133	(104.98)	0.72	(18.3)	0.64	(16.3)
5	5.121	(130.07)	5.127	(130.23)	5.128	(130.25)	5.133	(130.38)	0.81	(20.6)	0.73	(18.5)
6	6.121	(155.47)	6.127	(155.63)	6.128	(155.65)	6.133	(155.78)	0.94	(23.9)	0.83	(21.1)
8	8.119	(206.22)	8.127	(206.43)	8.128	(206.45)	8.133	(206.58)	1.28	(32.5)	1.17	(29.7)
10	10.119	(257.02)	10.127	(257.23)	10.128	(257.25)	10.133	(257.38)	N/A	N/A	N/A	N/A
12	12.119	(307.82)	12.127	(308.03)	12.128	(308.05)	12.133	(308.18)	N/A	N/A	N/A	N/A

¹ In accordance with MS SP-73

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Copper Water Tube continued

DIMENSIONAL DATA – COPPER WATER TUBE – TYPE “K”

Nominal Water Tube Size (In Inches)	Outside Diameter Inch (mm)		Tolerances (Hard Drawn Only) Tubing OD Min. Inch (mm) Max. Inch (mm)				Nominal Wall Thickness Inch (mm)		Weight Per Foot Lb (kg)		TYPE “K”							
											Hard Drawn				Soft Annealed			
											Bursting Pressure ^A psi (bars)		Safe Working Pressure ^B psi (bars)		Bursting Pressure ^A psi (bars)		Safe Working Pressure ^C psi (bars)	
1/4	0.375	(9.53)	0.373	(9.47)	0.376	(9.55)	0.035	(0.89)	0.145	(0.07)	N/A	N/A	1612	(111)	N/A	N/A	913	(63)
3/8	0.500	(12.70)	0.497	(12.62)	0.501	(12.73)	0.049	(1.24)	0.269	(0.12)	N/A	N/A	1675	(115)	N/A	N/A	960	(66)
1/2	0.625	(15.88)	0.622	(15.80)	0.626	(15.90)	0.049	(1.24)	0.344	(0.16)	9840	(678)	1337	(92)	4535	(313)	758	(52)
5/8	0.750	(19.05)	0.747	(18.97)	0.751	(19.08)	0.049	(1.24)	0.418	(0.19)	N/A	N/A	1104	(76)	N/A	N/A	626	(43)
3/4	0.875	(22.23)	0.872	(22.15)	0.876	(22.25)	0.065	(1.65)	0.641	(0.29)	9300	(641)	1278	(88)	4200	(290)	724	(50)
1	1.125	(28.58)	1.122	(28.50)	1.127	(28.63)	0.065	(1.65)	0.839	(0.38)	7200	(496)	982	(68)	3415	(235)	557	(38)
1 1/4	1.375	(34.93)	1.372	(34.85)	1.377	(34.98)	0.065	(1.65)	1.040	(0.47)	5525	(381)	797	(55)	2800	(193)	452	(31)
1 1/2	1.625	(41.28)	1.621	(41.17)	1.627	(41.33)	0.072	(1.83)	1.360	(0.62)	5000	(345)	742	(51)	2600	(179)	420	(29)
2	2.125	(53.98)	2.121	(53.87)	2.127	(54.03)	0.083	(2.11)	2.060	(0.93)	3915	(270)	652	(45)	2235	(154)	370	(26)
2 1/2	2.625	(66.68)	2.621	(66.57)	2.627	(66.73)	0.095	(2.41)	2.930	(1.33)	3575	(246)	597	(41)	N/A	N/A	338	(23)
3	3.125	(79.38)	3.121	(79.27)	3.127	(79.43)	0.109	(2.77)	4.000	(1.81)	3450	(238)	578	(40)	N/A	N/A	328	(23)
3 1/2	3.625	(92.08)	3.621	(91.97)	3.627	(92.13)	0.120	(3.05)	5.120	(2.32)	N/A	N/A	549	(38)	N/A	N/A	311	(21)
4	4.125	(104.78)	4.121	(104.67)	4.127	(104.83)	0.134	(3.40)	6.510	(2.95)	3415	(235)	540	(37)	N/A	N/A	306	(21)
5	5.125	(130.18)	5.121	(130.07)	5.127	(130.23)	0.160	(4.06)	9.670	(4.39)	3585	(247)	517	(36)	N/A	N/A	293	(20)
6	6.125	(155.58)	6.121	(155.47)	6.127	(155.63)	0.192	(4.88)	13.900	(6.30)	3425	(236)	520	(36)	N/A	N/A	295	(20)
8	8.125	(206.38)	8.119	(206.22)	8.127	(206.43)	0.271	(6.88)	25.900	(11.75)	3635	(251)	553	(38)	N/A	N/A	314	(22)
10	10.125	(257.18)	10.119	(257.02)	10.127	(257.23)	0.338	(8.59)	40.300	(18.28)	N/A	N/A	553	(38)	N/A	N/A	314	(22)
12	12.125	(307.98)	12.119	(307.82)	12.127	(308.03)	0.405	(10.29)	57.800	(26.22)	N/A	N/A	555	(38)	N/A	N/A	314	(22)

Note: Information and data contained in these charts, as taken from ASTM Specifications B 88.
Rated internal pressure for copper water tube based on the strength of the tube alone and applicable to systems using suitable mechanical joints.

^ABased on actual laboratory test data provided by Copper Development Association, Inc.

^BBased upon 150°F (65.6°C) with an allowable stress of 9500 psi (668 kPa).

^CBased upon 150°F (65.6°C) with an allowable stress of 5100 psi (359 kPa).

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DIMENSIONAL DATA – COPPER WATER TUBE – TYPE “L”

Nominal Water Tube Size (In Inches)	Outside Diameter Inch (mm)		Tolerances (Hard Drawn Only) Tubing OD Min. Inch (mm) Max. Inch (mm)				TYPE “L”		Usage: For general purpose plumbing and heating conditions.									
							Hard Drawn:		Soft Annealed:		Hard Drawn				Soft Annealed			
							20-ft. (6.1m) Straight Lengths		20-ft. (6.1m) Straight Lengths, or 40-ft. (12.2m) and 60-ft. (18.3m) Length Coils (to and including size 1 1/2)		Nominal Wall Thickness		Weight Per Foot		Bursting Pressure ^A		Safe Working Pressure ^B	
Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)	Lb	(kg)	psi	(bars)	psi	(bars)	psi	(bars)	psi	(bars)	
1/4	0.375	(9.53)	0.373	(9.47)	0.376	(9.55)	0.030	(0.76)	0.126	(0.06)	N/A	N/A	1367	(94)	N/A	N/A	775	(53)
3/8	0.500	(12.70)	0.497	(12.62)	0.501	(12.73)	0.035	(0.89)	0.198	(0.09)	N/A	N/A	1168	(81)	N/A	N/A	662	(46)
1/2	0.625	(15.88)	0.622	(15.80)	0.626	(15.90)	0.040	(1.02)	0.285	(0.13)	7765	(535)	1082	(75)	3885	(268)	613	(42)
5/8	0.750	(19.05)	0.747	(18.97)	0.751	(19.08)	0.042	(1.07)	0.362	(0.16)	N/A	N/A	947	(65)	N/A	N/A	537	(37)
3/4	0.875	(22.23)	0.872	(22.15)	0.876	(22.25)	0.045	(1.14)	0.455	(0.21)	5900	(407)	873	(60)	2935	(202)	495	(34)
1	1.125	(28.58)	1.122	(28.50)	1.127	(28.63)	0.050	(1.27)	0.655	(0.30)	5115	(353)	741	(51)	2650	(183)	420	(29)
1 1/4	1.375	(34.93)	1.372	(34.85)	1.377	(34.98)	0.055	(1.40)	0.884	(0.40)	4550	(314)	658	(45)	2400	(165)	373	(26)
1 1/2	1.625	(41.28)	1.621	(41.17)	1.627	(41.33)	0.060	(1.52)	1.140	(0.52)	4100	(283)	613	(42)	2200	(152)	347	(24)
2	2.125	(53.98)	2.121	(53.87)	2.127	(54.03)	0.070	(1.78)	1.750	(0.79)	3365	(232)	545	(38)	1910	(132)	309	(21)
2 1/2	2.625	(66.68)	2.621	(66.57)	2.627	(66.73)	0.080	(2.03)	2.480	(1.12)	3215	(222)	504	(35)	N/A	N/A	285	(20)
3	3.125	(79.38)	3.121	(79.27)	3.127	(79.43)	0.090	(2.29)	3.330	(1.51)	2865	(198)	476	(33)	N/A	N/A	270	(19)
3 1/2	3.625	(92.08)	3.621	(91.97)	3.627	(92.13)	0.100	(2.54)	4.290	(1.95)	N/A	N/A	455	(31)	N/A	N/A	258	(18)
4	4.125	(104.78)	4.121	(104.67)	4.127	(104.83)	0.110	(2.79)	5.380	(2.44)	2865	(198)	440	(30)	N/A	N/A	249	(17)
5	5.125	(130.18)	5.121	(130.07)	5.127	(130.23)	0.125	(3.18)	7.610	(3.45)	2985	(206)	404	(28)	N/A	N/A	229	(16)
6	6.125	(155.58)	6.121	(155.47)	6.127	(155.63)	0.140	(3.56)	10.200	(4.63)	2690	(185)	376	(26)	N/A	N/A	213	(15)
8	8.125	(206.38)	8.119	(206.22)	8.127	(206.43)	0.200	(5.08)	19.290	(8.75)	2650	(183)	406	(28)	N/A	N/A	230	(16)
10	10.125	(257.18)	10.119	(257.02)	10.127	(257.23)	0.250	(6.35)	30.100	(13.65)	N/A	N/A	407	(28)	N/A	N/A	231	(16)
12	12.125	(307.98)	12.119	(307.82)	12.127	(308.03)	0.280	(7.11)	40.400	(18.33)	N/A	N/A	380	(26)	N/A	N/A	215	(15)

Note: Information and data contained in these charts, as taken from ASTM Specifications B 88. Rated internal pressure for copper water tube based on the strength of the tube alone and applicable to systems using suitable mechanical joints.

^ABased on actual laboratory test data provided by Copper Development Association, Inc.

^BBased upon 150°F (65.6°C) with an allowable stress of 9500 psi (668 kPa).

^CBased upon 150°F (65.6°C) with an allowable stress of 5100 psi (359 kPa).

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Copper Water Tube continued

DIMENSIONAL DATA – COPPER WATER TUBE – TYPE “M”

Nominal Water Tube Size (In Inches)	Outside Diameter		Tolerances (Hard Drawn Only) Tubing OD				TYPE “M”							
							Hard Drawn Only: 20-ft. (6.1m) Straight Lengths							
							Usage: For general purpose plumbing, heating and drainage installations.							
						Nominal Wall Thickness		Weight Per Foot		Hard Drawn				
Inch	(mm)	Min. Inch	(mm)	Max. Inch	(mm)	Inch	(mm)	Lb	(kg)	Bursting Pressure ^A		Safe Working Pressure ^B		
										psi	(bars)	psi	(bars)	
1/4	0.375	(9.53)	0.373	(9.47)	0.376	(9.55)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/8	0.500	(12.70)	0.497	(12.62)	0.501	(12.73)	0.025	(0.64)	0.145	(0.07)	N/A	N/A	855	(59)
1/2	0.625	(15.88)	0.622	(15.80)	0.626	(15.90)	0.028	(0.71)	0.204	(0.09)	6135	(423)	741	(51)
5/8	0.750	(19.05)	0.747	(18.97)	0.751	(19.08)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	0.875	(22.23)	0.872	(22.15)	0.876	(22.25)	0.032	(0.81)	0.328	(0.15)	4717	(325)	611	(42)
1	1.125	(28.58)	1.122	(28.50)	1.127	(28.63)	0.035	(0.89)	0.465	(0.21)	3865	(266)	506	(35)
1 1/4	1.375	(34.93)	1.372	(34.85)	1.377	(34.98)	0.042	(1.07)	0.682	(0.31)	3875	(267)	507	(35)
1 1/2	1.625	(41.28)	1.621	(41.17)	1.627	(41.33)	0.049	(1.24)	0.940	(0.43)	3550	(245)	497	(34)
2	2.125	(53.98)	2.121	(53.87)	2.127	(54.03)	0.058	(1.47)	1.460	(0.66)	2935	(202)	448	(31)
2 1/2	2.625	(66.68)	2.621	(66.57)	2.627	(66.73)	0.065	(1.65)	2.030	(0.92)	2800	(193)	411	(28)
3	3.125	(79.38)	3.121	(79.27)	3.127	(79.43)	0.072	(1.83)	2.680	(1.22)	2665	(184)	380	(26)
3 1/2	3.625	(92.08)	3.621	(91.97)	3.627	(92.13)	0.083	(2.11)	3.580	(1.62)	N/A	N/A	378	(26)
4	4.125	(104.78)	4.121	(104.67)	4.127	(104.83)	0.095	(2.41)	4.660	(2.11)	2215	(153)	377	(26)
5	5.125	(130.18)	5.121	(130.07)	5.127	(130.23)	0.109	(2.77)	6.660	(3.02)	2490	(172)	349	(24)
6	6.125	(155.58)	6.121	(155.47)	6.127	(155.63)	0.122	(3.10)	8.920	(4.05)	2000	(138)	328	(23)
8	8.125	(206.38)	8.119	(206.22)	8.127	(206.43)	0.170	(4.32)	16.500	(7.48)	2285	(158)	344	(24)
10	10.125	(257.18)	10.119	(257.02)	10.127	(257.23)	0.212	(5.38)	25.600	(11.61)	N/A	N/A	344	(24)
12	12.125	(307.98)	12.119	(307.82)	12.127	(308.03)	0.254	(6.45)	36.700	(16.65)	N/A	N/A	345	(24)

Note: Information and data contained in these charts, as taken from ASTM Specifications B 88.
Rated internal pressure for copper water tube based on the strength of the tube alone and applicable to systems using suitable mechanical joints.

^ABased on actual laboratory test data provided by Copper Development Association, Inc.

^BBased upon 150°F (65.6°C) with an allowable stress of 9500 psi (668 kPa).

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DIMENSIONAL DATA – COPPER WATER TUBE – TYPE “DWV”

Nominal Water Tube Size (In Inches)	Outside Diameter Inch (mm)		Tolerances (Hard Drawn Only) Tubing OD Min. Inch (mm) Max. Inch (mm)		TYPE “DWV” Hard Drawn Only: 20-ft. (6.1m) Straight Lengths Usage: For drain, waste, vent and other non-pressure applications.							
					Nominal Wall Thickness		Weight Per Foot		Hard Drawn Bursting Pressure ^A			
					Inch	(mm)	Lb	(kg)	psi	(bars)		
1/4	0.375	(9.53)	0.373	(9.47)	0.376	(9.55)	N/A	N/A	N/A	N/A	N/A	N/A
3/8	0.500	(12.70)	0.497	(12.62)	0.501	(12.73)	N/A	N/A	N/A	N/A	N/A	N/A
1/2	0.625	(15.88)	0.622	(15.80)	0.626	(15.90)	N/A	N/A	N/A	N/A	N/A	N/A
5/8	0.750	(19.05)	0.747	(18.97)	0.751	(19.08)	N/A	N/A	N/A	N/A	N/A	N/A
3/4	0.875	(22.23)	0.872	(22.15)	0.876	(22.25)	N/A	N/A	N/A	N/A	N/A	N/A
1	1.125	(28.58)	1.122	(28.50)	1.127	(28.63)	N/A	N/A	N/A	N/A	N/A	N/A
1 1/4	1.375	(34.93)	1.372	(34.85)	1.377	(34.98)	0.040	(1.02)	0.650	(0.29)	N/A	N/A
1 1/2	1.625	(41.28)	1.621	(41.17)	1.627	(41.33)	0.042	(1.07)	0.809	(0.37)	440	(30)
2	2.125	(53.98)	2.121	(53.87)	2.127	(54.03)	0.042	(1.07)	1.070	(0.49)	326	(22)
2 1/2	2.625	(66.68)	2.621	(66.57)	2.627	(66.73)	N/A	N/A	N/A	N/A	N/A	N/A
3	3.125	(79.38)	3.121	(79.27)	3.127	(79.43)	0.045	(1.14)	1.690	(0.77)	239	(16)
3 1/2	3.625	(92.08)	3.621	(91.97)	3.627	(92.13)	N/A	N/A	N/A	N/A	N/A	N/A
4	4.125	(104.78)	4.121	(104.67)	4.127	(104.83)	0.058	(1.47)	2.870	(1.30)	225	(16)
5	5.125	(130.18)	5.121	(130.07)	5.127	(130.23)	0.072	(1.83)	4.430	(2.01)	227	(16)
6	6.125	(155.58)	6.121	(155.47)	6.127	(155.63)	0.083	(2.11)	6.100	(2.77)	223	(15)
8	8.125	(206.38)	8.119	(206.22)	8.127	(206.43)	0.109	N/A	10.600	(4.81)	219	(15)
10	10.125	(257.18)	10.119	(257.02)	10.127	(257.23)	N/A	N/A	N/A	N/A	N/A	N/A
12	12.125	(307.98)	12.119	(307.82)	12.127	(308.03)	N/A	N/A	N/A	N/A	N/A	N/A

DWV Tube is for sanitary drainage applications. The tubing wall is thinner than Type “M” – making it both lighter and less expensive. Research indicates that DWV tube has a service life of approximately 100 years – considerably longer than any building in which it might be installed.

The advantages of copper systems are augmented in DWV installations. Its light weight makes handling and transportation easier – only 0.34 lb. (0.15 kg) for a 20 ft. (6.1 m) length of size 3. Its thinner wall allows faster soldering.

These advantages offer an economical option without sacrificing stability or longevity for both contractor and the home owner. Further information will be furnished on request from NIBCO’s Technical Services Department, at 1-888-446-4226

Note: Information and data contained in these charts, as taken from ASTM Specifications B 88. Rated internal pressure for copper water tube based on the strength of the tube alone and applicable to systems using suitable mechanical joints.

^ABased on actual laboratory test data provided by Copper Development Association, Inc.
^BBased upon 150°F (65.6°C) with an allowable stress of 9500 psi (668 kPa).
^CBased upon 150°F (65.6°C) with an allowable stress of 5100 psi (359 kPa).

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Copper Water Tube continued

Under normal conditions, the physical properties of copper tubes, when produced by responsible manufacturers are perfectly adapted for the conveyance of hot and cold water, steam, oil, gas, and air. Copper tubes will stand up under ordinary conditions, but the user is specifically cautioned against laying underground tube in cinderfill, especially if the ground is apt to be wet. Due to the sulphur compounds in the cinders, a condition of this kind may corrode the outside of the tubes. This may be overcome either by wrapping the tube with canvas and asphaltum or by surrounding the tube with a bed of clean sand mixed with lime, or with limestone or broken plaster. When conditions are doubtful, it is advisable to consult the Copper Development Association, or the tube manufacturer.

Annealed copper tubes are generally recommended for underground use. 1/2" annealed copper tubes have been frozen as many as six times before finally bursting, eight times for 1" size, and eleven times for 2" size. Hard drawn copper tubes, however, burst during the first freezing the same as iron pipe. (Condensed from Copper Tube Handbook.)

COMPARATIVE DATA – COPPER WATER TUBE AND IRON PIPES

Nominal Water Tube Size (In Inches)	"A" New Pipe	"B" Inside Diameter (mm)		"C" Outside Diameter (mm)		"D" Weight (Kg)		"E" Volume (L/3.05m)		BTUs to Raise 100°F/38°C				"I" Flow (GPM, LPM)			
										"F" Water		"G" Pipe				"H" Heat Loss	
										BTU	kJ	BTU	kJ	BTU	kJ		
3/8	Coper	.430	(10.92)	0.500	(12.70)	0.198	(0.090)	0.0754	(0.2854)	62.89	(66.4)	18.61	(19.6)	No Data	No Data	1.873	(7.089)
	Iron	.493	(12.52)	0.675	(17.15)	0.567	(0.257)	0.0992	(0.3755)	82.66	(87.2)	62.37	(65.8)	No Data	No Data	2.464	(9.326)
1/2	Coper	.545	(13.84)	0.625	(15.88)	0.285	(0.129)	0.1212	(0.4587)	101.20	(106.8)	26.70	(28.2)	0.34	(0.36)	3.565	(13.494)
	Iron	.622	(15.80)	0.840	(21.34)	0.850	(0.386)	0.1578	(0.5973)	131.60	(138.8)	93.50	(98.6)	5.94	(6.27)	4.585	(17.354)
3/4	Coper	.785	(19.94)	0.875	(22.23)	0.455	(0.207)	0.2514	(0.9515)	209.60	(221.1)	42.67	(45.0)	0.41	(0.44)	9.599	(36.332)
	Iron	.824	(20.93)	1.050	(26.67)	1.130	(0.513)	0.2770	(1.0484)	230.10	(242.8)	124.30	(131.1)	7.16	(7.55)	9.720	(36.790)
1	Coper	1.025	(26.04)	1.125	(28.58)	0.655	(0.297)	0.4287	(1.6226)	357.30	(377.0)	61.38	(64.8)	0.50	(0.53)	19.80	(74.94)
	Iron	1.049	(26.64)	1.315	(33.40)	1.678	(0.762)	0.4490	(1.6995)	374.30	(394.9)	184.58	(194.7)	8.62	(9.09)	18.53	(70.14)
1 1/4	Coper	1.265	(32.13)	1.375	(34.93)	0.884	(0.401)	0.6529	(2.4712)	544.30	(574.3)	82.91	(87.5)	0.62	(0.65)	35.05	(132.66)
	Iron	1.380	(35.05)	1.660	(42.16)	2.270	(1.031)	0.7770	(2.9409)	647.70	(683.4)	249.70	(263.4)	10.65	(11.24)	38.56	(145.95)
1 1/2	Coper	1.505	(38.23)	1.625	(41.28)	1.140	(0.518)	0.9241	(3.4977)	770.40	(812.8)	107.16	(113.1)	0.69	(0.73)	56.16	(212.57)
	Iron	1.610	(40.89)	1.900	(48.26)	2.720	(1.235)	1.0580	(4.0045)	881.60	(930.1)	298.10	(314.5)	11.97	(12.63)	58.20	(220.29)
2	Coper	1.985	(50.42)	2.125	(53.98)	1.750	(0.795)	1.6080	(6.0863)	1340.00	(1413.8)	164.50	(173.6)	0.84	(0.89)	119.10	(450.79)
	Iron	2.067	(52.50)	2.375	(60.33)	3.650	(1.657)	1.7430	(6.5973)	1453.00	(1533.0)	401.50	(423.6)	14.61	(15.41)	113.50	(429.60)
2 1/2	Coper	2.465	(62.61)	2.625	(66.68)	2.480	(1.126)	2.4790	(9.3830)	2066.00	(2179.7)	233.00	(245.8)	1.01	(1.07)	214.30	(811.13)
	Iron	2.469	(62.71)	2.875	(73.03)	5.790	(2.629)	2.4870	(9.4133)	2073.00	(2187.1)	636.90	(672.0)	17.42	(18.38)	182.50	(690.76)
3	Coper	2.945	(74.80)	3.125	(79.38)	3.330	(1.512)	3.5390	(13.3951)	2945.00	(3107.1)	313.20	(330.4)	1.13	(1.19)	347.40	(1314.91)
	Iron	3.068	(77.93)	3.5	(88.90)	7.58	(3.441)	3.8400	(14.5344)	3201.00	(3377.2)	832.70	(878.5)	20.63	(21.77)	326.00	(1233.91)
4	Coper	3.905	(99.19)	4.125	(104.78)	5.380	(2.443)	6.2220	(23.5503)	5186.00	(5471.5)	505.72	(533.6)	1.50	(1.58)	747.10	(2827.77)
	Iron	4.026	(102.26)	4.5	(114.30)	10.79	(4.899)	6.6130	(25.0302)	5513.00	(5816.5)	1186.90	(1252.2)	26.00	(27.43)	673.80	(2550.33)

COLUMN A: The copper tube is Type L Standard, meeting the requirements of ASTM Specification B 88. The iron pipe is standard weight, schedule 40, bare pipe, except as to Column I where new galvanized pipe is referred to.

COLUMN B: From manufacturers' specifications. Slight variations can be noted between specifications of different manufacturers, but these figures are representative.

COLUMN C: From manufacturers' specifications with the same considerations as noted for Column B.

COLUMN D: From manufacturers' specifications.

COLUMN E: Cubic contents of 10 linear feet/3.05 linear metres of tube and have been calculated from dimeters given in Column B, by the formula for the contents of a cylinder.

COLUMN F: This column has been calculated from Column E and shows the number of BTUs (kilojoules) required to heat the water content only of 10 feet (3.05 metres) of the given tube and pipe 100°F (38°C). It requires 833.6 BTUs (879.5 kJ) to heat 1 gallon (3.875 litres) of water 100°F (38°C).

COLUMN G: These figures are calculated from Column D and show the number of BTUs (kJ) required to raise the temperature of 10 feet (3.05 metres) of empty tube and pipe 100°F (38°C). Due to difference in the specific heat of the materials, it requires 9.4 BTUs (9.9 kJ) to raise 1 pound (0.454 kilograms) of copper 100°F (38°C) and 11.0 BTUs (11.6 kJ) to raise 1 pound (0.454 kilograms) of iron 100°F (38°C).

COLUMN H: This column shows the heat emission from 10 feet (3.05 metres) of the given tube and pipe placed horizontally. The column in terms of BTUs lost per hour (kilojoules lost per hour) for each degree of difference in temperature between the pipe and the surrounding air. The figures for iron are taken from experimental data obtained at the Mellon Institute. Figures for copper have been calculated with reference to those for iron on the basis of the known ratio of heat emission between the two materials.

COLUMN I: This column shows the number of gallons (litres) of water which will flow through 100 feet (30.48 metres) of the given tube and pipe with a pressure loss of 10 pounds per square inch (70 kilopascals). Flow is based on diameters in Column B according to Professor Dawson's formulae for NEW galvanized iron pipe and NEW copper tube. Due to the corrosion of iron and its tendency to accumulate sediments and other foreign matter, Prof. Dawson suggests that 15% be deducted from the figures for iron pipe in order to arrive at a reasonable performance expectancy for such pipe in service. Because copper resists rust and is inherently more smooth, Professor Dawson suggests a deduction of only 5% from the figures given for copper tube.

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EXPANSION AND CONTRACTION

In the majority of low-pressure heating systems employing copper tube and installed in small houses or private dwellings, provision for expansion and contraction is relatively simple. Mains, risers, and branches to radiators should be free or floating at one end of the line. Holes should be large enough to permit free movement of the tube, and care should be exercised so that pipe hangers and supports permit unrestricted movement and do not anchor the tube. Wrought copper tube hangers that are both practicable and neat in appearance are available.

Unusually long runs of copper tubing should be provided with an expansion bend or loop. By bending soft temper copper tube, a simple form of expansion loop can be made. With the addition of combination flared-tube to solder joint fittings, as illustrated in Figure 1, these types of loops can be used when space or other limitations exist. The correct proportions of such expansion loop to meet various conditions are shown in the accompanying table.

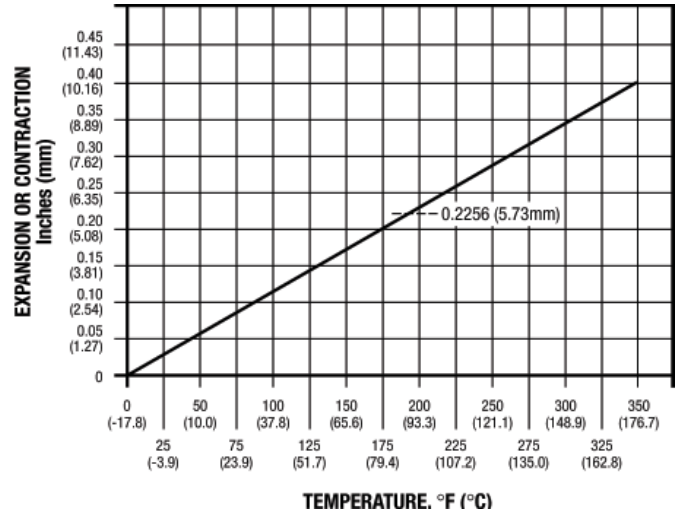
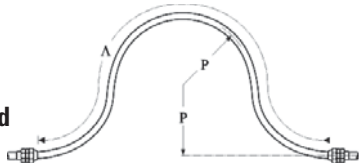
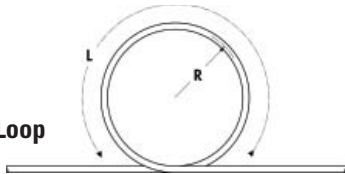


FIGURE 1

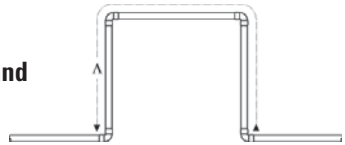
a. U-Bend



b. Coiled Loop



c. Offset and Return



The above chart is calculated using 10ft (3.05m) of copper tubing as the reference point. You may use it as follows: 100ft (30.5m) of copper tube, with a 200°F (93.3°C) temperature change. Reference point .2256 inches for 10ft, (5.73mm for 3.05m), multiply by 10 for 100ft (30.5m), resulting in an answer of 2.256 inches (57.3mm) of expansion or contraction.

NOTE: Calculations for expansion and contraction should be based on the average coefficient of expansion of copper which is 0.0000094 per °F (0.00001692 per °C) between 77°F and 212°F (25°C and 100°C). For example, the expansion for each 10ft (3.05m) of any size of tube heated from room temperature of 70°F (21.1°C) to 170°F (76.7°C), that is, 100°F (55.6°C) rise, is:

$$\begin{matrix} \text{Rise} & & & & \text{Coefficient} \\ 100^{\circ}\text{F} & \times & 10\text{ft} & \times & 12 \text{ inches} & \times & 0.000094 & = & 0.1128 \text{ in.} \\ (55.6^{\circ}\text{C}) & & (3.05\text{m}) & & (1000\text{mm}) & & (0.00001692) & & (2.87\text{mm}) \end{matrix}$$

RADI OF COILED EXPANSION LOOPS AND DEVELOPED LENGTHS OF EXPANSION OFFSETS

Nominal Tube Size	Expected Expansion															
	1/2		1		1 1/2		2		2 1/2		3		3 1/2		4	
	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)	R (mm)	L (mm)
1/4	6 (152.4)	38 (965.2)	9 (228.6)	54 (1371.6)	11 (279.4)	66 (1676.4)	12 (304.8)	77 (1955.8)	14 (355.6)	86 (2184.4)	15 (381.0)	94 (2387.6)	16 (406.4)	102 (2590.8)	17 (431.8)	109 (2768.6)
3/8	7 (177.8)	44 (1117.6)	10 (254.0)	63 (1600.2)	12 (304.8)	77 (1955.8)	14 (355.6)	89 (2260.6)	16 (406.4)	99 (2514.6)	17 (431.8)	109 (2768.6)	19 (482.6)	117 (2971.8)	20 (508.0)	126 (3200.4)
1/2	8 (203.2)	50 (1270.0)	11 (279.4)	70 (1778.0)	14 (355.6)	89 (2260.6)	16 (406.4)	99 (2514.6)	18 (457.2)	111 (2819.4)	19 (482.6)	122 (3098.8)	21 (533.4)	131 (3327.4)	22 (558.8)	140 (3556.0)
3/4	9 (228.6)	59 (1498.6)	13 (330.2)	83 (2108.2)	16 (406.4)	101 (2565.4)	19 (482.6)	117 (2971.8)	21 (533.4)	131 (3327.4)	23 (584.2)	143 (3632.2)	25 (635.0)	155 (3937.0)	26 (660.4)	166 (4216.4)
1	11 (279.4)	67 (1701.8)	15 (381.0)	94 (2387.6)	18 (457.2)	115 (2921.0)	21 (533.4)	133 (3378.2)	24 (609.6)	149 (3784.6)	26 (660.4)	163 (4140.2)	28 (711.2)	176 (4470.4)	30 (762.0)	188 (4775.2)
1 1/2	13 (330.2)	80 (2032.0)	18 (457.2)	113 (2870.2)	22 (558.8)	138 (3505.2)	25 (635.0)	160 (4064.0)	29 (736.6)	179 (4546.6)	31 (787.4)	196 (4978.4)	34 (863.6)	212 (5384.8)	36 (914.4)	226 (5740.4)
2	15 (381.0)	91 (2311.4)	21 (533.4)	129 (3276.6)	25 (635.0)	158 (4013.2)	29 (736.6)	183 (4648.2)	33 (838.2)	205 (5207.0)	36 (914.4)	224 (5689.6)	39 (990.6)	242 (6146.8)	41 (1041.4)	259 (6578.6)
2 1/2	16 (406.4)	102 (2590.8)	23 (584.2)	144 (3657.6)	28 (711.2)	176 (4470.4)	32 (812.8)	203 (5156.2)	36 (914.4)	227 (5765.8)	40 (1016.0)	249 (6324.6)	43 (1092.2)	269 (6832.6)	46 (1168.4)	288 (7315.2)
3	18 (457.2)	111 (2819.4)	25 (635.0)	157 (3987.8)	30 (762.0)	191 (4851.4)	35 (889.0)	222 (5638.8)	40 (1016.0)	248 (6239.2)	43 (1092.2)	272 (6908.8)	47 (1193.8)	293 (7442.2)	50 (1270.0)	314 (7975.6)
3 1/2	19 (482.6)	120 (3048.0)	27 (685.8)	169 (4292.6)	33 (838.2)	206 (5232.4)	38 (965.2)	239 (6070.6)	43 (1092.2)	267 (6781.8)	47 (1193.8)	293 (7442.2)	50 (1270.0)	316 (8026.4)	54 (1371.6)	338 (8585.2)
4	20 (508.0)	128 (3251.2)	29 (736.6)	180 (4572.0)	35 (889.0)	220 (5588.0)	41 (1041.4)	255 (6477.0)	45 (1143.0)	285 (7239.0)	50 (1270.0)	312 (7924.8)	54 (1371.6)	337 (8559.8)	57 (1447.8)	361 (9169.4)
5	23 (584.2)	142 (3606.8)	32 (812.8)	201 (5105.4)	39 (990.6)	245 (6223.0)	45 (1143.0)	284 (7213.6)	51 (1295.4)	318 (8077.2)	55 (1397.0)	348 (8839.2)	60 (1524.0)	376 (9550.4)	64 (1625.6)	402(10210.8)

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Copper Water Tube continued

SELECTION OF TUBE SIZES

The smooth interior of copper tube, and the design of both solder joint and flared-tube-type fittings, which have no shoulders projecting into the flow of water, decrease friction loss. With the use of copper tube, no allowance is necessary for the accumulation of rust deposits in supply and service lines. Consequently, copper tube lines are usually figured one size smaller than iron pipe for the same service. This rule does not apply to lines from a well to a pump where the nominal diameters specified by the pump manufacturer must be adhered to strictly.

Water passing through any pipe line encounters resistance by friction. The resistance is increased by bends and turns in the line, which should be taken into account in complex piping systems. For example, a one-inch 90° elbow will cause friction loss equivalent to that of one foot (0.305m) of straight one-inch tube. (See below for allowance to be made for fittings and valves in equivalent lengths of tube.) Friction loss in terms of head loss must be taken into consideration in calculating tube sizes to be used for various types of installations.

For most average-size-house installations with water pressures 40 PSI (275.8kPa) and higher, 3/4" copper tube will be ample for main supply lines, and 1/2" copper tube can be used for risers and branches to all fixtures. The smaller 3/8" tube is adequate to supply branches, but with pressures at 40 PSI (275.8kPa) and higher, water hammer becomes a concern when the flow is suddenly stopped.

APPROXIMATE FRICTION LOSS ALLOWANCES FOR FITTINGS AND VALVES IN FEET OF STRAIGHT TUBE

Nominal Tube Size (In Inches)	Wrought-Copper Fittings						Cast Copper Alloy Fittings and Valves						
	90° Elbow Feet (m)	45° Elbow Feet (m)	Tee Run Feet (m)	Tee Side Outlet Feet (m)	90° Bend Feet (m)	180° Bend Feet (m)	90° Elbow Feet (m)	45° Elbow Feet (m)	Tee Run Feet (m)	Tee Side Outlet Feet (m)	Comp. Stop Feet (m)	Globe Valve Feet (m)	Gate Valve Feet (m)
3/8	0.5 (0.15)	0.5 (0.15)	0.5 (0.15)	1 (0.31)	0.5 (0.15)	0.5 (0.15)	1 (0.31)	0.5 (0.15)	0.5 (0.15)	2 (0.61)	9 (2.75)	-	-
1/2	0.5 (0.15)	0.5 (0.15)	0.5 (0.15)	1 (0.31)	0.5 (0.15)	1 (0.31)	1 (0.31)	0.5 (0.15)	0.5 (0.15)	2 (0.61)	13 (3.97)	-	-
5/8	0.5 (0.15)	0.5 (0.15)	0.5 (0.15)	2 (0.61)	1 (0.31)	1 (0.31)	2 (0.61)	1 (0.31)	0.5 (0.15)	3 (0.92)	17 (5.19)	-	-
3/4	1 (0.31)	0.5 (0.15)	0.5 (0.15)	2 (0.61)	1 (0.31)	2 (0.61)	2 (0.61)	1 (0.31)	0.5 (0.15)	3 (0.92)	21 (6.41)	-	-
1	1 (0.31)	1 (0.31)	0.5 (0.15)	3 (0.92)	2 (0.61)	2 (0.61)	4 (1.22)	2 (0.61)	0.5 (0.15)	5 (1.53)	30 (9.15)	-	1 (0.31)
1 1/4	2 (0.61)	1 (0.31)	0.5 (0.15)	4 (1.22)	2 (0.61)	3 (0.92)	5 (1.53)	2 (0.61)	1 (0.31)	7 (2.14)	-	53 (16.17)	1 (0.31)
1 1/2	2 (0.61)	2 (0.61)	1 (0.31)	5 (1.53)	2 (0.61)	4 (1.22)	8 (2.44)	3 (0.92)	1 (0.31)	9 (2.75)	-	66 (20.13)	2 (0.61)
2	2 (0.61)	2 (0.61)	1 (0.31)	7 (2.14)	3 (0.92)	8 (2.44)	11 (3.36)	5 (1.53)	2 (0.61)	12 (3.66)	-	90 (27.45)	2 (0.61)
2 1/2	2 (0.61)	3 (0.92)	2 (0.61)	9 (2.75)	4 (1.22)	16 (4.88)	14 (4.27)	8 (2.44)	2 (0.61)	16 (4.88)	-	-	2 (0.61)
3	3 (0.92)	4 (1.22)	-	-	5 (1.53)	20 (6.10)	18 (5.49)	11 (3.36)	2 (0.61)	20 (6.10)	-	-	2 (0.61)
3 1/2	4 (1.22)	-	-	-	7 (2.14)	24 (7.32)	24 (7.32)	14 (4.27)	2 (0.61)	31 (9.46)	-	-	2 (0.61)
4	-	-	-	-	8 (2.44)	28 (8.54)	28 (8.54)	17 (5.19)	2 (0.61)	37 (11.29)	-	-	2 (0.61)
5	-	-	-	-	10 (3.05)	37 (11.29)	41 (12.51)	22 (6.71)	2 (0.61)	48 (14.64)	-	-	-
6	-	-	-	-	13 (3.97)	47 (14.34)	52 (15.86)	28 (8.54)	2 (0.61)	61 (18.61)	-	-	-

Notes: This table is based on tests conducted at Harvard University (1948).

If the type of fitting is not known – i.e., whether wrought copper or cast alloy – use cast copper alloy values for design.

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COPPER WATER TUBE – INTERNAL WORKING PRESSURES*

Nominal Tube Size (In Inches)	Service Temperature °F (°C)										Formulas
	100°F (37.8°C) S = 6000psi (414 bars)			200°F (93.3°C) S = 4800psi (331 bars)			300°F (148.9°C) S=4700 psi (324 bars)		400°F (204.4°C) S=3000 psi (207 bars)		
	Type K	Type L	Type M	Type K	Type L	Type M	Type K	Type L	Type K	Type L	
1/4	1210 (83.43)	1025 (70.67)	– –	850 (58.61)	700 (48.27)	– –	830 (57.23)	690 (47.58)	530 (36.54)	450 (31.03)	$tm = \frac{PD}{2S + 0.8P} + C$ <p style="text-align: center;">or</p> $P = \frac{2 S tm}{D - 0.8 tm} \text{ when } C \text{ is } 0$ <p>tm Minimum tube wall thickness P Maximum rated internal working pressure D Outside diameter of tube S Allowable stress in material due to internal pressure at operating temperature C Allowance for threading, mechanical strength and/or corrosion</p>
3/8	1275 (87.91)	890 (61.37)	625 (43.09)	930 (64.12)	630 (43.44)	460 (31.72)	910 (62.74)	610 (42.06)	590 (40.68)	400 (27.58)	
1/2	1005 (69.29)	810 (55.85)	560 (38.61)	730 (50.33)	580 (39.99)	415 (28.61)	720 (49.64)	570 (39.30)	460 (31.72)	370 (25.51)	
5/8	830 (57.23)	705 (48.61)	– –	600 (41.37)	500 (34.48)	– –	580 (39.99)	500 (34.48)	380 (26.20)	330 (22.75)	
3/4	950 (65.50)	645 (44.47)	450 (31.03)	700 (48.27)	470 (32.41)	325 (22.41)	690 (47.58)	460 (31.72)	440 (30.34)	300 (20.69)	
1	725 (49.99)	550 (37.92)	380 (26.20)	540 (37.23)	400 (27.58)	270 (18.62)	530 (36.54)	400 (27.58)	340 (23.44)	260 (17.93)	
1 1/4	590 (40.68)	495 (34.13)	375 (25.86)	440 (30.34)	370 (25.51)	270 (18.62)	430 (29.65)	360 (24.82)	280 (19.31)	230 (15.86)	
1 1/2	550 (37.92)	455 (31.37)	370 (25.51)	410 (28.27)	340 (23.44)	270 (18.62)	400 (27.58)	330 (22.75)	260 (17.93)	220 (15.17)	
2	485 (33.44)	405 (27.92)	335 (23.10)	350 (24.13)	310 (21.37)	240 (16.55)	345 (23.79)	305 (21.03)	230 (15.86)	190 (13.10)	
2 1/2	450 (31.03)	375 (25.86)	305 (21.03)	330 (22.75)	275 (18.96)	220 (15.17)	320 (22.06)	270 (18.62)	210 (14.48)	180 (12.41)	
3	430 (29.65)	355 (24.48)	280 (19.31)	320 (22.06)	260 (17.93)	205 (14.13)	315 (21.72)	255 (17.58)	210 (14.48)	170 (11.72)	
3 1/2	410 (28.27)	340 (23.44)	280 (19.31)	300 (20.69)	250 (17.24)	200 (13.79)	300 (20.69)	245 (16.89)	190 (13.10)	160 (11.03)	
4	400 (27.58)	325 (22.41)	280 (19.31)	295 (20.34)	240 (16.55)	200 (13.79)	290 (20.00)	235 (16.20)	190 (13.10)	150 (10.34)	
5	385 (26.55)	300 (20.69)	260 (17.93)	290 (20.00)	220 (15.17)	190 (13.10)	280 (19.31)	215 (14.82)	180 (12.41)	140 (9.65)	
6	385 (26.55)	280 (19.31)	240 (16.55)	280 (19.31)	205 (14.13)	180 (12.41)	280 (19.31)	200 (13.79)	190 (13.10)	130 (8.96)	
8	410 (28.27)	300 (20.69)	255 (17.58)	300 (20.69)	220 (15.17)	190 (13.10)	300 (20.69)	215 (14.82)	200 (13.79)	140 (9.65)	
10	410 (28.27)	300 (20.69)	255 (17.58)	310 (21.37)	225 (15.51)	190 (13.10)	305 (21.03)	220 (15.17)	200 (13.79)	150 (10.34)	
12	410 (28.27)	280 (19.31)	225 (15.51)	310 (21.37)	210 (14.48)	190 (13.10)	305 (21.03)	205 (14.13)	200 (13.79)	140 (9.65)	

*Rated internal pressures for Copper Water Tube based on the strength of the tube alone and applicable to systems using suitable mechanical joints.

The values are based on the formula in the American Standard Code, Power Piping ANSI/ASME B31.1 1992.

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1/4" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.3760 inches (9.550 mm) Nominal O.D. = 0.3750 inches (9.525 mm)
 Minimum O.D. = 0.3740 inches (9.499 mm) Nominal I.D. = 0.3050 inches (7.747 mm)
 Nominal Wall Thickness = 0.0350 inches (0.089 mm) Flow Area = 0.0731 sq. inches (47.14 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
0.50	3.77	8.81	2.20	32	0.85	8.81	0.67
1.00	13.62	31.77	4.39	63	3.08	31.77	1.34
1.50	28.86	67.27	6.59	95	6.53	67.27	2.01
2.00	49.17	114.54	8.78	126	11.12	114.54	2.68
2.50	74.33	173.08	10.98	158	16.81	173.08	3.35
3.00	104.18	242.51	13.17	189	23.57	242.51	4.02
3.50	138.60	322.54	15.37	221	31.35	322.54	4.68
4.00	177.49	412.92	17.57	252	40.15	412.92	5.35
4.50	220.75	513.46	19.76	284	49.94	513.46	6.02
5.00	268.32	623.96	21.96	315	60.70	623.96	6.69

1/4" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.3760 inches (9.550 mm) Nominal O.D. = 0.3750 inches (9.525 mm)
 Minimum O.D. = 0.3740 inches (9.499 mm) Nominal I.D. = 0.3150 inches (8.001 mm)
 Nominal Wall Thickness = 0.0300 inches (0.076 mm) Flow Area = 0.0779 sq. inches (50.28 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
0.50	3.22	7.53	2.06	32	0.73	7.53	0.63
1.00	11.64	27.16	4.12	63	2.63	27.16	1.25
1.50	24.67	57.50	6.18	95	5.58	57.50	1.88
2.00	42.02	97.90	8.23	126	9.51	97.90	2.51
2.50	63.53	147.94	10.29	158	14.37	147.94	3.14
3.00	89.05	207.28	12.35	189	20.14	207.28	3.76
3.50	118.47	275.69	14.41	221	26.80	275.69	4.39
4.00	151.71	352.94	16.47	252	34.32	352.94	5.02
4.50	188.68	438.87	18.53	284	42.68	438.87	5.65
5.00	229.34	533.32	20.58	315	51.88	533.32	6.27

3/8" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.5010 inches (12.725 mm) Nominal O.D. = 0.5000 inches (12.700 mm)
 Minimum O.D. = 0.4990 inches (12.674 mm) Nominal I.D. = 0.4020 inches (10.210 mm)
 Nominal Wall Thickness = 0.0490 inches (1.244 mm) Flow Area = 0.1269 sq. inches (81.89 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	3.55	8.29	2.53	63	0.80	8.29	0.77
1.50	7.53	17.55	3.79	95	1.70	17.55	1.16
2.00	12.83	29.89	5.06	126	2.90	29.89	1.54
2.50	19.39	45.16	6.32	158	4.39	45.16	1.93
3.00	27.18	63.28	7.58	189	6.15	63.28	2.31
3.50	36.16	84.16	8.85	221	8.18	84.16	2.70
4.00	46.31	107.74	10.11	252	10.48	107.74	3.08
4.50	57.60	133.97	11.37	284	13.03	133.97	3.47
5.00	70.01	162.80	12.64	315	15.84	162.80	3.85
5.50	83.52	194.19	13.90	347	18.89	194.19	4.24
6.00	98.13	228.11	15.17	379	22.20	228.11	4.62
6.50	113.81	264.51	16.43	410	25.74	264.51	5.01
7.00	130.55	303.38	17.69	442	29.53	303.38	5.39
7.50	148.34	344.68	18.96	473	33.56	344.68	5.78
8.00	167.18	388.40	20.22	505	37.82	388.40	6.16
8.50	187.04	434.49	21.49	536	42.31	434.49	6.55
9.00	207.93	482.96	22.75	568	47.03	482.96	6.93
9.50	229.83	533.76	24.01	599	51.99	533.76	7.32
10.00	252.73	586.89	25.28	631	57.17	586.89	7.70

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3/8" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Hazen Williams Formula							
		Maximum O.D.	= 0.5010 inches (12.725 mm)	Nominal O.D.	= 0.5000 inches (12.700 mm)		
		Minimum O.D.	= 0.4990 inches (12.675 mm)	Nominal I.D.	= 0.4500 inches (10.211 mm)		
		Nominal Wall Thickness	= 0.0350 inches (0.889 mm)	Flow Area	= 0.1590 sq. inches (102.61 sq. mm)		
		C Factor	= 150				
FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	2.56	5.97	2.21	63	0.58	5.97	0.67
1.50	5.43	12.65	3.31	95	1.23	12.65	1.01
2.00	9.24	21.54	4.42	126	2.09	21.54	1.35
2.50	13.98	32.54	5.52	158	3.16	32.54	1.68
3.00	19.59	45.60	6.63	189	4.43	45.60	2.02
3.50	26.06	60.65	7.73	221	5.90	60.65	2.36
4.00	33.37	77.64	8.84	252	7.55	77.64	2.69
4.50	41.51	96.54	9.94	284	9.39	96.54	3.03
5.00	50.45	117.32	11.05	315	11.41	117.32	3.37
5.50	60.19	139.94	12.15	347	13.62	139.94	3.70
6.00	70.72	164.38	13.26	379	16.00	164.38	4.04
6.50	82.01	190.62	14.36	410	18.55	190.62	4.38
7.00	94.08	218.63	15.46	442	21.28	218.63	4.71
7.50	106.90	248.40	16.57	473	24.18	248.40	5.05
8.00	120.48	279.90	17.67	505	27.25	279.90	5.39
8.50	134.79	313.12	18.78	536	30.49	313.12	5.72
9.00	149.84	348.04	19.88	568	33.90	348.04	6.06
9.50	165.62	384.65	20.99	599	37.47	384.65	6.40
10.00	182.13	422.94	22.09	631	41.20	422.94	6.73

3/8" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Hazen Williams Formula							
		Maximum O.D.	= 0.5010 inches (12.725 mm)	Nominal O.D.	= 0.5000 inches (12.700 mm)		
		Minimum O.D.	= 0.4990 inches (12.675 mm)	Nominal I.D.	= 0.4020 inches (10.211 mm)		
		Nominal Wall Thickness	= 0.0250 inches (0.635 mm)	Flow Area	= 0.1269 sq. inches (81.89 sq. mm)		
		C Factor	= 150				
FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	2.05	4.79	2.02	63	0.46	4.79	0.61
1.50	4.35	10.14	3.03	95	0.98	10.14	0.92
2.00	7.41	17.26	4.03	126	1.68	17.26	1.23
2.50	11.20	26.09	5.04	158	2.53	26.09	1.54
3.00	15.70	36.55	6.05	189	3.55	36.55	1.84
3.50	20.89	48.61	7.06	221	4.73	48.61	2.15
4.00	26.75	62.23	8.07	252	6.05	62.23	2.46
4.50	33.27	77.39	9.08	284	7.53	77.39	2.77
5.00	40.44	94.04	10.09	315	9.15	94.04	3.07
5.50	48.25	112.17	11.09	347	10.91	112.17	3.38
6.00	56.68	131.76	12.10	379	12.82	131.76	3.69
6.50	65.74	152.79	13.11	410	14.87	152.79	4.00
7.00	75.41	175.25	14.12	442	17.06	175.25	4.30
7.50	85.69	199.10	15.13	473	19.38	199.10	4.61
8.00	96.57	224.35	16.14	505	21.84	224.35	4.92
8.50	108.04	250.98	17.15	536	24.44	250.98	5.23
9.00	120.11	278.97	18.16	568	27.17	278.97	5.53
9.50	132.76	308.32	19.16	599	30.03	308.32	5.84
10.00	145.99	339.01	20.17	631	33.02	339.01	6.15

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1/2" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.626 inches (15.900 mm) Nominal O.D. = 0.6250 inches (15.875 mm)
 Minimum O.D. = 0.624 inches (15.850 mm) Nominal I.D. = 0.527 inches (13.3858 mm)
 Nominal Wall Thickness = 0.049 inches (1.245 mm) Flow Area = 0.2181 sq. inches (140.73 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	0.95	2.22	1.47	63	0.22	2.22	0.45
1.50	2.02	4.70	2.21	95	0.46	4.70	0.67
2.00	3.44	8.00	2.94	126	0.78	8.00	0.90
2.50	5.19	12.10	3.68	158	1.18	12.10	1.12
3.00	7.28	16.95	4.41	189	1.65	16.95	1.34
3.50	9.69	22.54	5.15	221	2.19	22.54	1.57
4.00	12.40	28.86	5.88	252	2.81	28.86	1.79
4.50	15.43	35.88	6.62	284	3.49	35.88	2.02
5.00	18.75	43.61	7.35	315	4.24	43.61	2.24
5.50	22.37	52.01	8.09	347	5.06	52.01	2.47
6.00	26.28	61.10	8.83	379	5.95	61.10	2.69
6.50	30.48	70.85	9.56	410	6.90	70.85	2.91
7.00	34.97	81.26	10.30	442	7.91	81.26	3.14
7.50	39.73	92.32	11.03	473	8.99	92.32	3.36
8.00	44.78	104.03	11.77	505	10.13	104.03	3.59
8.50	50.10	116.38	12.50	536	11.33	116.38	3.81
9.00	55.69	129.36	13.24	568	12.60	129.36	4.03
9.50	61.56	142.97	13.97	599	13.93	142.97	4.26
10.00	67.69	157.20	14.71	631	15.31	157.20	4.48
10.50	74.10	172.05	15.44	662	16.76	172.05	4.71
11.00	80.76	187.51	16.18	694	18.27	187.51	4.93
11.50	87.69	203.58	16.91	725	19.84	203.58	5.16
12.00	94.88	220.26	17.65	757	21.46	220.26	5.38
12.50	102.34	237.54	18.39	789	23.15	237.54	5.60
13.00	110.05	255.41	19.12	820	24.89	255.41	5.83
13.50	118.01	273.89	19.86	852	26.70	273.89	6.05
14.00	126.23	292.95	20.59	883	28.56	292.95	6.28

1/2" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.626 inches (15.900 mm) Nominal O.D. = 0.6250 inches (15.875 mm)
 Minimum O.D. = 0.624 inches (15.850 mm) Nominal I.D. = 0.5450 inches (13.843 mm)
 Nominal Wall Thickness = 0.049 inches (1.245 mm) Flow Area = 0.2333 sq. inches (150.50 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	0.81	1.89	1.38	63	0.18	1.89	0.42
1.50	1.71	3.99	2.06	95	0.39	3.99	0.63
2.00	2.92	6.80	2.75	126	0.66	6.80	0.84
2.50	4.41	10.27	3.44	158	1.00	10.27	1.05
3.00	6.18	14.39	4.13	189	1.40	14.39	1.26
3.50	8.23	19.14	4.81	221	1.86	19.14	1.47
4.00	10.53	24.51	5.50	252	2.38	24.51	1.68
4.50	13.10	30.47	6.19	284	2.96	30.47	1.89
5.00	15.92	37.03	6.88	315	3.60	37.03	2.10
5.50	19.00	44.17	7.56	347	4.30	44.17	2.31
6.00	22.32	51.89	8.25	379	5.05	51.89	2.52
6.50	25.89	60.17	8.94	410	5.86	60.17	2.72
7.00	29.70	69.01	9.63	442	6.72	69.01	2.93
7.50	33.74	78.41	10.31	473	7.63	78.41	3.14
8.00	38.03	88.35	11.00	505	8.60	88.35	3.35
8.50	42.55	98.83	11.69	536	9.62	98.83	3.56
9.00	47.30	109.86	12.38	568	10.70	109.86	3.77
9.50	52.28	121.41	13.07	599	11.83	121.41	3.98
10.00	57.49	133.50	13.75	631	13.00	133.50	4.19
10.50	62.92	146.11	14.44	662	14.23	146.11	4.40
11.00	68.59	159.24	15.13	694	15.51	159.24	4.61
11.50	74.47	172.89	15.82	725	16.85	172.89	4.82
12.00	80.58	187.05	16.50	757	18.23	187.05	5.03
12.50	86.91	201.73	17.19	789	19.66	201.73	5.24
13.00	93.46	216.91	17.88	820	21.14	216.91	5.45
13.50	100.22	232.60	18.57	852	22.67	232.60	5.66
14.00	107.20	248.78	19.25	883	24.25	248.78	5.87

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1/2" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Hazen Williams Formula

Maximum O.D.	= 0.626 inches (15.900 mm)	Nominal O.D.	= 0.6250 inches (15.875 mm)
Minimum O.D.	= 0.624 inches (15.850 mm)	Nominal I.D.	= 0.5690 inches (14.4526 mm)
Nominal Wall Thickness	= 0.028 inches (0.711 mm)	Flow Area	= 0.2543 sq. inches (164.05 sq. mm)
C Factor	= 150		

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	0.66	1.53	1.26	63	0.15	1.53	0.38
1.50	1.39	3.24	1.89	95	0.31	3.24	0.58
2.00	2.37	5.51	2.52	126	0.54	5.51	0.77
2.50	3.58	8.33	3.15	158	0.81	8.33	0.96
3.00	5.01	11.67	3.79	189	1.13	11.67	1.15
3.50	6.67	15.52	4.42	221	1.51	15.52	1.35
4.00	8.54	19.87	5.05	252	1.93	19.87	1.54
4.50	10.62	24.71	5.68	284	2.40	24.71	1.73
5.00	12.91	30.03	6.31	315	2.92	30.03	1.92
5.50	15.41	35.82	6.94	347	3.48	35.82	2.12
6.00	18.10	42.07	7.57	379	4.09	42.07	2.31
6.50	20.99	48.79	8.20	410	4.75	48.79	2.50
7.00	24.08	55.96	8.83	442	5.45	55.96	2.69
7.50	27.36	63.57	9.46	473	6.19	63.57	2.88
8.00	30.83	71.64	10.09	505	6.98	71.64	3.08
8.50	34.50	80.14	10.72	536	7.80	80.14	3.27
9.00	38.35	89.08	11.36	568	8.68	89.08	3.46
9.50	42.39	98.45	11.99	599	9.59	98.45	3.65
10.00	46.61	108.25	12.62	631	10.54	108.25	3.85
10.50	51.02	118.47	13.25	662	11.54	118.47	4.04
11.00	55.61	129.12	13.88	694	12.58	129.12	4.23
11.50	60.39	140.19	14.51	725	13.66	140.19	4.42
12.00	65.34	151.67	15.14	757	14.78	151.67	4.61
12.50	70.47	163.57	15.77	789	15.94	163.57	4.81
13.00	75.78	175.88	16.40	820	17.14	175.88	5.00
13.50	81.26	188.60	17.03	852	18.38	188.60	5.19
14.00	86.93	201.72	17.66	883	19.66	201.72	5.38

5/8" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Hazen Williams Formula

Maximum O.D.	= 0.751 inches (19.075 mm)	Nominal O.D.	= 0.7500 inches (19.050 mm)
Minimum O.D.	= 0.749 inches (19.025 mm)	Nominal I.D.	= 0.6520 inches (16.5608 mm)
Nominal Wall Thickness	= 0.049 inches (1.245 mm)	Flow Area	= 0.3339 sq. inches (215.40 sq. mm)
C Factor	= 150		

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	0.34	0.79	0.96	63	0.08	0.79	0.29
2.00	1.22	2.84	1.92	126	0.28	2.84	0.59
3.00	2.58	6.02	2.88	189	0.58	6.02	0.88
4.00	4.40	10.24	3.84	252	1.00	10.24	1.17
5.00	6.66	15.48	4.80	315	1.51	15.48	1.46
6.00	9.33	21.69	5.77	379	2.11	21.69	1.76
7.00	12.41	28.85	6.73	442	2.81	28.85	2.05
8.00	15.90	36.93	7.69	505	3.60	36.93	2.34
9.00	19.77	45.92	8.65	568	4.47	45.92	2.64
10.00	24.03	55.81	9.61	631	5.44	55.81	2.93
11.00	28.67	66.57	10.57	694	6.49	66.57	3.22
12.00	33.69	78.20	11.53	757	7.62	78.20	3.51
13.00	39.07	90.68	12.49	820	8.84	90.68	3.81
14.00	44.82	104.00	13.45	883	10.14	104.00	4.10
15.00	50.92	118.16	14.41	946	11.52	118.16	4.39
16.00	57.39	133.14	15.37	1009	12.98	133.14	4.69
17.00	64.21	148.95	16.34	1072	14.52	148.95	4.98
18.00	71.38	165.56	17.30	1136	16.15	165.56	5.27
19.00	78.89	182.98	18.26	1199	17.85	182.98	5.56
20.00	86.76	201.19	19.22	1262	19.63	201.19	5.86
21.00	94.96	220.19	20.18	1325	21.48	220.19	6.15
22.00	103.51	239.98	21.14	1388	23.41	239.98	6.44

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5/8" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.751 inches (19.075 mm) Nominal O.D. = 0.7500 inches (19.050 mm)
 Minimum O.D. = 0.749 inches (19.025 mm) Nominal I.D. = 0.6660 inches (16.9164 mm)
 Nominal Wall Thickness = 0.042 inches (1.067 mm) Flow Area = 0.3484 sq. inches (224.75 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1.00	0.30	0.71	0.92	63	0.07	0.71	0.28
2.00	1.10	2.56	1.84	126	0.25	2.56	0.56
3.00	2.33	5.43	2.76	189	0.53	5.43	0.84
4.00	3.97	9.24	3.68	252	0.90	9.24	1.12
5.00	6.00	13.96	4.60	315	1.36	13.96	1.40
6.00	8.41	19.56	5.53	379	1.90	19.56	1.68
7.00	11.20	26.02	6.45	442	2.53	26.02	1.96
8.00	14.34	33.31	7.37	505	3.24	33.31	2.25
9.00	17.83	41.41	8.29	568	4.03	41.41	2.53
10.00	21.67	50.33	9.21	631	4.90	50.33	2.81
11.00	25.86	60.03	10.13	694	5.85	60.03	3.09
12.00	30.38	70.52	11.05	757	6.87	70.52	3.37
13.00	35.23	81.77	11.97	820	7.97	81.77	3.65
14.00	40.41	93.79	12.89	883	9.14	93.79	3.93
15.00	45.92	106.56	13.81	946	10.39	106.56	4.21
16.00	51.75	120.07	14.74	1009	11.71	120.07	4.49
17.00	57.90	134.32	15.66	1072	13.10	134.32	4.77
18.00	64.37	149.30	16.58	1136	14.56	149.30	5.05
19.00	71.15	165.01	17.50	1199	16.09	165.01	5.33
20.00	78.24	181.43	18.42	1262	17.70	181.43	5.61
21.00	85.64	198.57	19.34	1325	19.37	198.57	5.89
22.00	93.34	216.42	20.26	1388	21.11	216.42	6.18

3/4" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.876 inches (22.250 mm) Nominal O.D. = 0.8750 inches (22.225 mm)
 Minimum O.D. = 0.874 inches (22.200 mm) Nominal I.D. = 0.7450 inches (18.923 mm)
 Nominal Wall Thickness = 0.065 inches (1.651 mm) Flow Area = 0.4359 sq. inches (281.24 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.00	0.64	1.49	1.47	126	0.14	1.49	0.45
4.00	2.30	5.35	2.94	252	0.52	5.35	0.90
6.00	4.88	11.34	4.42	379	1.10	11.34	1.35
8.00	8.31	19.30	5.89	505	1.88	19.30	1.79
10.00	12.56	29.17	7.36	631	2.84	29.17	2.24
12.00	17.61	40.87	8.83	757	3.98	40.87	2.69
14.00	23.42	54.36	10.30	883	5.30	54.36	3.14
16.00	30.00	69.59	11.78	1009	6.79	69.59	3.59
18.00	37.31	86.54	13.25	1136	8.44	86.54	4.04
20.00	45.35	105.16	14.72	1262	10.26	105.16	4.49
22.00	54.10	125.44	16.19	1388	12.24	125.44	4.94
24.00	63.56	147.34	17.66	1514	14.38	147.34	5.38
26.00	73.72	170.86	19.14	1640	16.68	170.86	5.83
28.00	84.56	195.97	20.61	1766	19.13	195.97	6.28
30.00	96.09	222.65	22.08	1893	21.74	222.65	6.73

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3/4" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.876 inches (22.250 mm) Nominal O.D. = 0.8750 inches (22.225 mm)
 Minimum O.D. = 0.874 inches (22.200 mm) Nominal I.D. = 0.7850 inches (19.939 mm)
 Nominal Wall Thickness = 0.045 inches (1.143 mm) Flow Area = 0.4840 sq. inches (312.25 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.00	0.4944	1.1517	1.3258	126.17	0.1118	1.1517	0.4041
4.00	1.7846	4.1519	2.6516	252.35	0.4037	4.1519	0.8082
6.00	3.7815	8.7905	3.9774	378.52	0.8554	8.7905	1.2123
8.00	6.4425	14.9675	5.3032	504.69	1.4573	14.9675	1.6164
10.00	9.7393	22.6169	6.6290	630.87	2.2031	22.6169	2.0205
12.00	13.6513	31.6896	7.9548	757.04	3.0880	31.6896	2.4246
14.00	18.1618	42.1472	9.2806	883.21	4.1083	42.1472	2.8287
16.00	23.2573	53.9578	10.6064	1009.39	5.2610	53.9578	3.2328
18.00	28.9264	67.0944	11.9322	1135.56	6.5434	67.0944	3.6369
20.00	35.1590	81.5338	13.2580	1261.73	7.9532	81.5338	4.0411
22.00	41.9465	97.2555	14.5838	1387.91	9.4886	97.2555	4.4452
24.00	49.2811	114.2412	15.9096	1514.08	11.1477	114.2412	4.8493
26.00	57.1557	132.4747	17.2354	1640.25	12.9290	132.4747	5.2534
28.00	65.5641	151.9408	18.5613	1766.43	14.8311	151.9408	5.6575
30.00	74.5002	172.6261	19.8871	1892.60	16.8525	172.6261	6.0616

3/4" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 0.876 inches (22.250 mm) Nominal O.D. = 0.8750 inches (22.225 mm)
 Minimum O.D. = 0.874 inches (22.200 mm) Nominal I.D. = 0.8110 inches (20.5994 mm)
 Nominal Wall Thickness = 0.032 inches (0.813 mm) Flow Area = 0.5156 sq. inches (333.27 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.00	0.42	0.98	1.24	126	0.10	0.98	0.38
4.00	1.52	3.54	2.48	252	0.34	3.54	0.76
6.00	3.23	7.50	3.73	379	0.73	7.50	1.14
8.00	5.50	12.77	4.97	505	1.24	12.77	1.51
10.00	8.31	19.30	6.21	631	1.88	19.30	1.89
12.00	11.65	27.04	7.45	757	2.64	27.04	2.27
14.00	15.50	35.97	8.70	883	3.51	35.97	2.65
16.00	19.85	46.05	9.94	1009	4.49	46.05	3.03
18.00	24.69	57.26	11.18	1136	5.58	57.26	3.41
20.00	30.00	69.58	12.42	1262	6.79	69.58	3.79
22.00	35.80	83.00	13.66	1388	8.10	83.00	4.16
24.00	42.06	97.49	14.91	1514	9.51	97.49	4.54
26.00	48.78	113.05	16.15	1640	11.03	113.05	4.92
28.00	55.95	129.66	17.39	1766	12.66	129.66	5.30
30.00	63.58	147.32	18.63	1893	14.38	147.32	5.68

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1" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.1265 inches (28.613 mm) Nominal O.D. = 1.1250 inches (28.575 mm)
 Minimum O.D. = 1.1235 inches (28.537 mm) Nominal I.D. = 0.9850 inches (25.273 mm)
 Nominal Wall Thickness = 0.0650 inches (1.651 mm) Flow Area = 0.7776 sq. inches (501.65 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.50	0.24	0.55	1.03	158	0.05	0.55	0.31
5.00	0.85	1.98	2.06	315	0.19	1.98	0.63
7.50	1.80	4.19	3.09	473	0.41	4.19	0.94
10.00	3.07	7.14	4.13	631	0.70	7.14	1.26
12.50	4.65	10.78	5.16	789	1.05	10.78	1.57
15.00	6.51	15.11	6.19	946	1.47	15.11	1.89
17.50	8.66	20.10	7.22	1104	1.96	20.10	2.20
20.00	11.09	25.73	8.25	1262	2.51	25.73	2.52
22.50	13.80	31.99	9.28	1419	3.12	31.99	2.83
25.00	16.77	38.88	10.32	1577	3.79	38.88	3.14
27.50	20.01	46.37	11.35	1735	4.53	46.37	3.46
30.00	23.51	54.47	12.38	1893	5.32	54.47	3.77
32.50	27.27	63.17	13.41	2050	6.17	63.17	4.09
35.00	31.28	72.45	14.44	2208	7.08	72.45	4.40
37.50	35.54	82.31	15.47	2366	8.04	82.31	4.72
40.00	40.05	92.75	16.50	2523	9.06	92.75	5.03
42.50	44.81	103.76	17.54	2681	10.14	103.76	5.34
45.00	49.81	115.33	18.57	2839	11.27	115.33	5.66
47.50	55.06	127.47	19.60	2997	12.46	127.47	5.97
50.00	60.55	140.15	20.63	3154	13.70	140.15	6.29
52.50	66.27	153.39	21.66	3312	14.99	153.39	6.60
55.00	72.24	167.18	22.69	3470	16.34	167.18	6.92

1" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.1265 inches (28.613 mm) Nominal O.D. = 1.1250 inches (28.575 mm)
 Minimum O.D. = 1.1235 inches (28.537 mm) Nominal I.D. = 1.0250 inches (26.035 mm)
 Nominal Wall Thickness = 0.0500 inches (1.270 mm) Flow Area = 0.8252 sq. inches (532.36 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.50	0.20	0.48	0.97	158	0.05	0.48	0.30
5.00	0.74	1.71	1.94	315	0.17	1.71	0.59
7.50	1.56	3.63	2.92	473	0.35	3.63	0.89
10.00	2.66	6.18	3.89	631	0.60	6.18	1.19
12.50	4.02	9.33	4.86	789	0.91	9.33	1.48
15.00	5.64	13.08	5.83	946	1.27	13.08	1.78
17.50	7.50	17.39	6.80	1104	1.70	17.39	2.07
20.00	9.60	22.27	7.78	1262	2.17	22.27	2.37
22.50	11.94	27.69	8.75	1419	2.70	27.69	2.67
25.00	14.52	33.65	9.72	1577	3.28	33.65	2.96
27.50	17.32	40.13	10.69	1735	3.92	40.13	3.26
30.00	20.35	47.14	11.66	1893	4.60	47.14	3.56
32.50	23.60	54.67	12.64	2050	5.34	54.67	3.85
35.00	27.07	62.70	13.61	2208	6.12	62.70	4.15
37.50	30.76	71.24	14.58	2366	6.96	71.24	4.44
40.00	34.66	80.27	15.55	2523	7.84	80.27	4.74
42.50	38.78	89.80	16.52	2681	8.77	89.80	5.04
45.00	43.11	99.81	17.50	2839	9.75	99.81	5.33
47.50	47.65	110.31	18.47	2997	10.78	110.31	5.63
50.00	52.40	121.29	19.44	3154	11.85	121.29	5.93
52.50	57.36	132.75	20.41	3312	12.97	132.75	6.22
55.00	62.52	144.68	21.38	3470	14.14	144.68	6.52

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

1" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.1265 inches (28.613 mm) Nominal O.D. = 1.1250 inches (28.575 mm)
 Minimum O.D. = 1.1235 inches (28.537 mm) Nominal I.D. = 1.0558 inches (26.797 mm)
 Nominal Wall Thickness = 0.0350 inches (0.889 mm) Flow Area = 0.8742 sq. inches (563.98 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
2.50	0.18	0.41	0.92	158	0.04	0.41	0.28
5.00	0.64	1.49	1.84	315	0.14	1.49	0.56
7.50	1.36	3.15	2.75	473	0.31	3.15	0.84
10.00	2.31	5.37	3.67	631	0.52	5.37	1.12
12.50	3.49	8.11	4.59	789	0.79	8.11	1.40
15.00	4.90	11.36	5.51	946	1.11	11.36	1.68
17.50	6.52	15.11	6.42	1104	1.47	15.11	1.96
20.00	8.34	19.35	7.34	1262	1.89	19.35	2.24
22.50	10.38	24.06	8.26	1419	2.35	24.06	2.52
25.00	12.61	29.24	9.18	1577	2.85	29.24	2.80
27.50	15.05	34.88	10.09	1735	3.40	34.88	3.08
30.00	17.68	40.97	11.01	1893	4.00	40.97	3.36
32.50	20.51	47.51	11.93	2050	4.64	47.51	3.64
35.00	23.52	54.49	12.85	2208	5.32	54.49	3.92
37.50	26.73	61.91	13.76	2366	6.05	61.91	4.19
40.00	30.12	69.76	14.68	2523	6.81	69.76	4.47
42.50	33.70	78.04	15.60	2681	7.62	78.04	4.75
45.00	37.47	86.74	16.52	2839	8.47	86.74	5.03
47.50	41.41	95.87	17.43	2997	9.37	95.87	5.31
50.00	45.54	105.41	18.35	3154	10.30	105.41	5.59
52.50	49.84	115.37	19.27	3312	11.28	115.37	5.87
55.00	54.33	125.74	20.19	3470	12.29	125.74	6.15

1 1/4" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.3765 inches (34.963 mm) Nominal O.D. = 1.3750 inches (34.925 mm)
 Minimum O.D. = 1.3735 inches (34.887 mm) Nominal I.D. = 1.2450 inches (31.623 mm)
 Nominal Wall Thickness = 0.0650 inches (1.651 mm) Flow Area = 1.2174 sq. inches (785.41 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.29	0.67	1.32	315	0.06	0.67	0.40
10.00	1.03	2.40	2.64	631	0.23	2.40	0.80
15.00	2.19	5.08	3.95	946	0.49	5.08	1.20
20.00	3.73	8.65	5.27	1262	0.84	8.65	1.61
25.00	5.64	13.06	6.59	1577	1.27	13.06	2.01
30.00	7.90	18.30	7.91	1893	1.79	18.30	2.41
35.00	10.51	24.34	9.22	2208	2.38	24.34	2.81
40.00	13.46	31.17	10.54	2523	3.04	31.17	3.21
45.00	16.74	38.75	11.86	2839	3.79	38.75	3.61
50.00	20.35	47.09	13.18	3154	4.60	47.09	4.02
55.00	24.27	56.18	14.49	3470	5.49	56.18	4.42
60.00	28.52	65.99	15.81	3785	6.45	65.99	4.82
65.00	33.07	76.52	17.13	4101	7.48	76.52	5.22
70.00	37.94	87.76	18.45	4416	8.58	87.76	5.62
75.00	43.11	99.71	19.77	4732	9.75	99.71	6.02
80.00	48.58	112.35	21.08	5047	10.99	112.35	6.43

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1 1/4" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D.	=	1.3765 inches (34.963 mm)	Nominal O.D.	=	1.375 inches (34.925 mm)
Minimum O.D.	=	1.3735 inches (34.887 mm)	Nominal I.D.	=	1.265 inches (32.131 mm)
Nominal Wall Thickness	=	0.0550 inches (1.397 mm)	Flow Area	=	1.2568 sq. inches (810.85 sq. mm)
C Factor	=	150			

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.26	0.62	1.28	315	0.06	0.62	0.39
10.00	0.96	2.22	2.55	631	0.22	2.22	0.78
15.00	2.02	4.70	3.83	946	0.46	4.70	1.17
20.00	3.45	8.00	5.11	1262	0.78	8.00	1.56
25.00	5.22	12.09	6.38	1577	1.18	12.09	1.95
30.00	7.31	16.94	7.66	1893	1.65	16.94	2.33
35.00	9.73	22.53	8.93	2208	2.20	22.53	2.72
40.00	12.45	28.84	10.21	2523	2.82	28.84	3.11
45.00	15.49	35.86	11.49	2839	3.50	35.86	3.50
50.00	18.83	43.58	12.76	3154	4.26	43.58	3.89
55.00	22.46	51.98	14.04	3470	5.08	51.98	4.28
60.00	26.39	61.06	15.32	3785	5.97	61.06	4.67
65.00	30.61	70.81	16.59	4101	6.92	70.81	5.06
70.00	35.11	81.21	17.87	4416	7.94	81.21	5.45
75.00	39.89	92.27	19.15	4732	9.02	92.27	5.84
80.00	44.96	103.97	20.42	5047	10.17	103.97	6.22

1 1/4" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D.	=	1.3765 inches (34.963 mm)	Nominal O.D.	=	1.3750 inches (34.925 mm)
Minimum O.D.	=	1.3735 inches (34.887 mm)	Nominal I.D.	=	1.2910 inches (32.7914 mm)
Nominal Wall Thickness	=	0.0420 inches (1.067 mm)	Flow Area	=	1.3090 sq. inches (844.52 sq. mm)
C Factor	=	150			

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.24	0.56	1.23	315	0.05	0.56	0.37
10.00	0.87	2.01	2.45	631	0.20	2.01	0.75
15.00	1.83	4.26	3.68	946	0.41	4.26	1.12
20.00	3.12	7.25	4.90	1262	0.71	7.25	1.49
25.00	4.72	10.95	6.13	1577	1.07	10.95	1.87
30.00	6.62	15.34	7.35	1893	1.50	15.34	2.24
35.00	8.81	20.40	8.58	2208	1.99	20.40	2.61
40.00	11.28	26.12	9.80	2523	2.55	26.12	2.99
45.00	14.03	32.48	11.03	2839	3.17	32.48	3.36
50.00	17.05	39.47	12.25	3154	3.86	39.47	3.74
55.00	20.34	47.08	13.48	3470	4.60	47.08	4.11
60.00	23.90	55.31	14.71	3785	5.41	55.31	4.48
65.00	27.72	64.14	15.93	4101	6.27	64.14	4.86
70.00	31.80	73.56	17.16	4416	7.19	73.56	5.23
75.00	36.13	83.57	18.38	4732	8.17	83.57	5.60
80.00	40.72	94.17	19.61	5047	9.21	94.17	5.98

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1 1/2" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.6270 inches (41.326 mm) Nominal O.D. = 1.6250 inches (41.275 mm)
 Minimum O.D. = 1.6230 inches (41.224 mm) Nominal I.D. = 1.4810 inches (38.227 mm)
 Nominal Wall Thickness = 0.0720 inches (1.829 mm) Flow Area = 1.7227 sq. inches (1111.39 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.12	0.29	0.93	315	0.03	0.29	0.28
10.00	0.44	1.03	1.86	631	0.10	1.03	0.57
15.00	0.94	2.18	2.79	946	0.21	2.18	0.85
20.00	1.60	3.72	3.72	1262	0.36	3.72	1.14
25.00	2.42	5.61	4.66	1577	0.55	5.61	1.42
30.00	3.39	7.87	5.59	1893	0.77	7.87	1.70
35.00	4.52	10.46	6.52	2208	1.02	10.46	1.99
40.00	5.78	13.39	7.45	2523	1.31	13.39	2.27
45.00	7.19	16.65	8.38	2839	1.63	16.65	2.55
50.00	8.74	20.24	9.31	3154	1.98	20.24	2.84
55.00	10.43	24.14	10.24	3470	2.36	24.14	3.12
60.00	12.26	28.36	11.17	3785	2.77	28.36	3.41
65.00	14.21	32.88	12.11	4101	3.22	32.88	3.69
70.00	16.30	37.72	13.04	4416	3.69	37.72	3.97
75.00	18.53	42.85	13.97	4732	4.19	42.85	4.26
80.00	20.88	48.28	14.90	5047	4.72	48.28	4.54
85.00	23.36	54.01	15.83	5362	5.28	54.01	4.83
90.00	25.97	60.04	16.76	5678	5.87	60.04	5.11
95.00	28.70	66.35	17.69	5993	6.49	66.35	5.39
100.00	31.56	72.96	18.62	6309	7.14	72.96	5.68
105.00	34.55	79.85	19.56	6624	7.82	79.85	5.96
110.00	37.66	87.03	20.49	6940	8.52	87.03	6.24
115.00	40.89	94.49	21.42	7255	9.25	94.49	6.53

1 1/2" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.6270 inches (41.326 mm) Nominal O.D. = 1.6250 inches (41.275 mm)
 Minimum O.D. = 1.6230 inches (41.224 mm) Nominal I.D. = 1.5050 inches (37.6174 mm)
 Nominal Wall Thickness = 0.0600 inches (1.524 mm) Flow Area = 1.7789 sq. inches (1147.71 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.11	0.26	0.90	315	0.03	0.26	0.27
10.00	0.41	0.95	1.80	631	0.09	0.95	0.55
15.00	0.87	2.02	2.71	946	0.20	2.02	0.82
20.00	1.48	3.44	3.61	1262	0.34	3.44	1.10
25.00	2.24	5.19	4.51	1577	0.51	5.19	1.37
30.00	3.14	7.27	5.41	1893	0.71	7.27	1.65
35.00	4.18	9.67	6.31	2208	0.94	9.67	1.92
40.00	5.35	12.39	7.21	2523	1.21	12.39	2.20
45.00	6.65	15.40	8.12	2839	1.50	15.40	2.47
50.00	8.09	18.72	9.02	3154	1.83	18.72	2.75
55.00	9.65	22.32	9.92	3470	2.18	22.32	3.02
60.00	11.33	26.22	10.82	3785	2.56	26.22	3.30
65.00	13.14	30.41	11.72	4101	2.97	30.41	3.57
70.00	15.08	34.88	12.62	4416	3.41	34.88	3.85
75.00	17.13	39.63	13.53	4732	3.88	39.63	4.12
80.00	19.31	44.65	14.43	5047	4.37	44.65	4.40
85.00	21.60	49.95	15.33	5362	4.89	49.95	4.67
90.00	24.01	55.52	16.23	5678	5.43	55.52	4.95
95.00	26.54	61.36	17.13	5993	6.00	61.36	5.22
100.00	29.19	67.47	18.03	6309	6.60	67.47	5.50
105.00	31.95	73.84	18.94	6624	7.23	73.84	5.77
110.00	34.82	80.48	19.84	6940	7.88	80.48	6.05
115.00	37.81	87.38	20.74	7255	8.55	87.38	6.32

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

1 1/2" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 1.6270 inches (41.326 mm) Nominal O.D. = 1.6250 inches (41.275 mm)
 Minimum O.D. = 1.6230 inches (41.224 mm) Nominal I.D. = 1.5270 inches (38.7858 mm)
 Nominal Wall Thickness = 0.0490 inches (1.2446 mm) Flow Area = 1.8313 sq. inches (1181.50 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
5.00	0.11	0.25	0.88	315	0.02	0.25	0.27
10.00	0.38	0.89	1.75	631	0.09	0.89	0.53
15.00	0.81	1.88	2.63	946	0.18	1.88	0.80
20.00	1.38	3.20	3.50	1262	0.31	3.20	1.07
25.00	2.09	4.84	4.38	1577	0.47	4.84	1.33
30.00	2.93	6.78	5.26	1893	0.66	6.78	1.60
35.00	3.89	9.02	6.13	2208	0.88	9.02	1.87
40.00	4.98	11.54	7.01	2523	1.13	11.54	2.14
45.00	6.20	14.35	7.88	2839	1.40	14.35	2.40
50.00	7.53	17.44	8.76	3154	1.70	17.44	2.67
55.00	8.99	20.80	9.64	3470	2.03	20.80	2.94
60.00	10.56	24.44	10.51	3785	2.39	24.44	3.20
65.00	12.25	28.34	11.39	4101	2.77	28.34	3.47
70.00	14.05	32.50	12.26	4416	3.18	32.50	3.74
75.00	15.96	36.92	13.14	4732	3.61	36.92	4.00
80.00	17.99	41.61	14.02	5047	4.07	41.61	4.27
85.00	20.13	46.55	14.89	5362	4.55	46.55	4.54
90.00	22.38	51.74	15.77	5678	5.06	51.74	4.81
95.00	24.73	57.18	16.64	5993	5.59	57.18	5.07
100.00	27.20	62.87	17.52	6309	6.15	62.87	5.34
105.00	29.77	68.81	18.40	6624	6.73	68.81	5.61
110.00	32.45	74.99	19.27	6940	7.34	74.99	5.87
115.00	35.23	81.42	20.15	7255	7.97	81.42	6.14

2" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.1270 inches (54.026 mm) Nominal O.D. = 2.1250 inches (53.975 mm)
 Minimum O.D. = 2.1230 inches (53.924 mm) Nominal I.D. = 1.9590 inches (49.7586 mm)
 Nominal Wall Thickness = 0.0830 inches (2.1082 mm) Flow Area = 3.0141 sq. inches (1944.58 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
10	0.11	0.26	1.06	631	0.03	0.26	0.32
20	0.41	0.95	2.13	1262	0.09	0.95	0.65
30	0.87	2.02	3.19	1893	0.20	2.02	0.97
40	1.48	3.43	4.26	2523	0.34	3.43	1.30
50	2.24	5.19	5.32	3154	0.51	5.19	1.62
60	3.14	7.27	6.39	3785	0.71	7.27	1.95
70	4.18	9.67	7.45	4416	0.95	9.67	2.27
80	5.35	12.38	8.52	5047	1.21	12.38	2.60
90	6.66	15.39	9.58	5678	1.51	15.39	2.92
100	8.09	18.71	10.64	6309	1.83	18.71	3.24
110	9.66	22.32	11.71	6940	2.18	22.32	3.57
120	11.34	26.21	12.77	7570	2.57	26.21	3.89
130	13.16	30.40	13.84	8201	2.98	30.40	4.22
140	15.09	34.86	14.90	8832	3.41	34.86	4.54
150	17.15	39.61	15.97	9463	3.88	39.61	4.87
160	19.33	44.63	17.03	10094	4.37	44.63	5.19
170	21.62	49.93	18.10	10725	4.89	49.93	5.52
180	24.04	55.50	19.16	11356	5.44	55.50	5.84
190	26.57	61.34	20.22	11986	6.01	61.34	6.16
200	29.22	67.44	21.29	12617	6.61	67.44	6.49

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2" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.1270 inches (54.026 mm)
 Minimum O.D. = 2.1230 inches (53.924 mm)
 Nominal Wall Thickness = 0.0700 inches (1.778 mm)
 C Factor = 150

Nominal O.D. = 2.1250 inches (53.975 mm)
 Nominal I.D. = 1.9850 inches (50.419 mm)
 Flow Area = 3.0946 sq. inches (1996.54 sq. mm)

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
10	0.11	0.25	1.04	631	0.02	0.25	0.32
20	0.39	0.89	2.07	1262	0.09	0.89	0.63
30	0.82	1.89	3.11	1893	0.18	1.89	0.95
40	1.39	3.22	4.15	2523	0.31	3.22	1.26
50	2.10	4.87	5.18	3154	0.48	4.87	1.58
60	2.95	6.82	6.22	3785	0.67	6.82	1.90
70	3.92	9.07	7.26	4416	0.89	9.07	2.21
80	5.02	11.61	8.29	5047	1.14	11.61	2.53
90	6.24	14.44	9.33	5678	1.41	14.44	2.84
100	7.59	17.55	10.37	6309	1.72	17.55	3.16
110	9.06	20.93	11.40	6940	2.05	20.93	3.48
120	10.64	24.58	12.44	7570	2.41	24.58	3.79
130	12.34	28.51	13.48	8201	2.79	28.51	4.11
140	14.15	32.70	14.51	8832	3.20	32.70	4.42
150	16.08	37.15	15.55	9463	3.64	37.15	4.74
160	18.13	41.86	16.59	10094	4.10	41.86	5.06
170	20.28	46.83	17.62	10725	4.59	46.83	5.37
180	22.54	52.05	18.66	11356	5.10	52.05	5.69
190	24.92	57.53	19.70	11986	5.64	57.53	6.00
200	27.40	63.25	20.73	12617	6.20	63.25	6.32

2" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.1270 inches (54.026 mm)
 Minimum O.D. = 2.1230 inches (53.924 mm)
 Nominal Wall Thickness = 0.0580 inches (1.4732 mm)
 C Factor = 150

Nominal O.D. = 2.1250 inches (53.975 mm)
 Nominal I.D. = 2.0090 inches (51.0286 mm)
 Flow Area = 3.1699 sq. inches (2045.11 sq. mm)

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
10	0.10	0.23	1.01	631	0.02	0.23	0.31
20	0.36	0.84	2.02	1262	0.08	0.84	0.62
30	0.77	1.78	3.04	1893	0.17	1.78	0.93
40	1.31	3.04	4.05	2523	0.30	3.04	1.23
50	1.98	4.59	5.06	3154	0.45	4.59	1.54
60	2.78	6.43	6.07	3785	0.63	6.43	1.85
70	3.70	8.55	7.08	4416	0.84	8.55	2.16
80	4.74	10.95	8.10	5047	1.07	10.95	2.47
90	5.89	13.62	9.11	5678	1.33	13.62	2.78
100	7.16	16.55	10.12	6309	1.62	16.55	3.08
110	8.54	19.74	11.13	6940	1.93	19.74	3.39
120	10.03	23.19	12.15	7570	2.27	23.19	3.70
130	11.64	26.89	13.16	8201	2.63	26.89	4.01
140	13.35	30.84	14.17	8832	3.02	30.84	4.32
150	15.17	35.04	15.18	9463	3.43	35.04	4.63
160	17.10	39.48	16.19	10094	3.87	39.48	4.94
170	19.13	44.17	17.21	10725	4.33	44.17	5.24
180	21.26	49.09	18.22	11356	4.81	49.09	5.55
190	23.50	54.26	19.23	11986	5.32	54.26	5.86
200	25.84	59.66	20.24	12617	5.85	59.66	6.17

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

2 1/2" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.6270 inches (66.7258 mm) Nominal O.D. = 2.6250 inches (66.675 mm)
 Minimum O.D. = 2.6230 inches (66.6242 mm) Nominal I.D. = 2.4350 inches (61.849 mm)
 Nominal Wall Thickness = 0.0950 inches (2.413 mm) Flow Area = 4.6568 sq. inches (3004.380 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
20	0.14	0.33	1.38	1262	0.03	0.33	0.42
40	0.51	1.19	2.76	2523	0.12	1.19	0.84
60	1.09	2.52	4.13	3785	0.25	2.52	1.26
80	1.86	4.30	5.51	5047	0.42	4.30	1.68
100	2.81	6.49	6.89	6309	0.64	6.49	2.10
120	3.94	9.10	8.27	7570	0.89	9.10	2.52
140	5.24	12.10	9.65	8832	1.18	12.10	2.94
160	6.71	15.49	11.02	10094	1.52	15.49	3.36
180	8.34	19.26	12.40	11356	1.89	19.26	3.78
200	10.14	23.41	13.78	12617	2.29	23.41	4.20
220	12.10	27.92	15.16	13879	2.74	27.92	4.62
240	14.21	32.79	16.53	15141	3.21	32.79	5.04
260	16.48	38.03	17.91	16403	3.73	38.03	5.46
280	18.91	43.62	19.29	17664	4.28	43.62	5.88
300	21.48	49.55	20.67	18926	4.86	49.55	6.30
320	24.21	55.84	22.05	20188	5.48	55.84	6.72

2 1/2" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.6270 inches (66.7258 mm) Nominal O.D. = 2.6250 inches (66.675 mm)
 Minimum O.D. = 2.6230 inches (66.6242 mm) Nominal I.D. = 2.4650 inches (62.611 mm)
 Nominal Wall Thickness = 0.0800 inches (2.032 mm) Flow Area = 4.7723 sq. inches (3078.87 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
20	0.13	0.31	1.34	1262	0.03	0.31	0.41
40	0.48	1.12	2.69	2523	0.11	1.12	0.82
60	1.03	2.38	4.03	3785	0.23	2.38	1.23
80	1.75	4.05	5.38	5047	0.40	4.05	1.64
100	2.65	6.12	6.72	6309	0.60	6.12	2.05
120	3.71	8.57	8.07	7570	0.84	8.57	2.46
140	4.93	11.40	9.41	8832	1.12	11.40	2.87
160	6.32	14.59	10.76	10094	1.43	14.59	3.28
180	7.86	18.15	12.10	11356	1.78	18.15	3.69
200	9.55	22.05	13.45	12617	2.16	22.05	4.10
220	11.40	26.30	14.79	13879	2.58	26.30	4.51
240	13.39	30.90	16.13	15141	3.03	30.90	4.92
260	15.53	35.83	17.48	16403	3.51	35.83	5.33
280	17.81	41.09	18.82	17664	4.03	41.09	5.74
300	20.24	46.69	20.17	18926	4.58	46.69	6.15
320	22.81	52.61	21.51	20188	5.16	52.61	6.56

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2 1/2" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 2.6270 inches (66.7258 mm)
 Minimum O.D. = 2.6230 inches (66.6242 mm)
 Nominal Wall Thickness = 0.0650 inches (1.651 mm)
 C Factor = 150

Nominal O.D. = 2.6250 inches (66.675 mm)
 Nominal I.D. = 2.4950 inches (63.373 mm)
 Flow Area = 4.8891 sq. inches (3154.27 sq. mm)

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
20	0.13	0.29	1.31	1262	0.03	0.29	0.40
40	0.46	1.06	2.62	2523	0.10	1.06	0.80
60	0.97	2.24	3.94	3785	0.22	2.24	1.20
80	1.65	3.82	5.25	5047	0.37	3.82	1.60
100	2.50	5.77	6.56	6309	0.56	5.77	2.00
120	3.50	8.08	7.87	7570	0.79	8.08	2.40
140	4.65	10.75	9.19	8832	1.05	10.75	2.80
160	5.96	13.76	10.50	10094	1.35	13.76	3.20
180	7.41	17.11	11.81	11356	1.68	17.11	3.60
200	9.01	20.79	13.12	12617	2.04	20.79	4.00
220	10.75	24.80	14.44	13879	2.43	24.80	4.40
240	12.62	29.13	15.75	15141	2.86	29.13	4.80
260	14.64	33.78	17.06	16403	3.31	33.78	5.20
280	16.80	38.75	18.37	17664	3.80	38.75	5.60
300	19.09	44.02	19.69	18926	4.32	44.02	6.00
320	21.51	49.60	21.00	20188	4.87	49.60	6.40

3" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.1270 inches (79.4258 mm)
 Minimum O.D. = 3.1230 inches (79.3242 mm)
 Nominal Wall Thickness = 0.1090 inches (2.7686 mm)
 C Factor = 150

Nominal O.D. = 3.1250 inches (79.375 mm)
 Nominal I.D. = 2.9070 inches (73.8378 mm)
 Flow Area = 6.6371 sq. inches (4282.01 sq. mm)

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.09	0.21	1.21	1577	0.02	0.21	0.37
50	0.33	0.76	2.42	3154	0.07	0.76	0.74
75	0.70	1.61	3.63	4732	0.16	1.61	1.11
100	1.19	2.74	4.83	6309	0.27	2.74	1.47
125	1.79	4.14	6.04	7886	0.41	4.14	1.84
150	2.51	5.80	7.25	9463	0.57	5.80	2.21
175	3.34	7.72	8.46	11040	0.76	7.72	2.58
200	4.28	9.88	9.67	12617	0.97	9.88	2.95
225	5.33	12.29	10.88	14195	1.20	12.29	3.32
250	6.47	14.94	12.08	15772	1.46	14.94	3.68
275	7.72	17.82	13.29	17349	1.75	17.82	4.05
300	9.07	20.93	14.50	18926	2.05	20.93	4.42
325	10.52	24.27	15.71	20503	2.38	24.27	4.79
350	12.07	27.83	16.92	22080	2.73	27.83	5.16
375	13.72	31.62	18.13	23658	3.10	31.62	5.53
400	15.46	35.63	19.34	25235	3.50	35.63	5.89
425	17.29	39.86	20.54	26812	3.91	39.86	6.26

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3" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.1270 inches (79.4258 mm) Nominal O.D. = 3.1250 inches (79.375 mm)
 Minimum O.D. = 3.1230 inches (79.3242 mm) Nominal I.D. = 2.9450 inches (74.803 mm)
 Nominal Wall Thickness = 0.0900 inches (2.286 mm) Flow Area = 6.8118 sq. inches (4394.69 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.09	0.20	1.18	1577	0.02	0.20	0.36
50	0.31	0.71	2.35	3154	0.07	0.71	0.72
75	0.65	1.51	3.53	4732	0.15	1.51	1.08
100	1.11	2.57	4.71	6309	0.25	2.57	1.44
125	1.68	3.89	5.89	7886	0.38	3.89	1.79
150	2.36	5.45	7.06	9463	0.53	5.45	2.15
175	3.14	7.25	8.24	11040	0.71	7.25	2.51
200	4.02	9.28	9.42	12617	0.91	9.28	2.87
225	5.00	11.54	10.60	14195	1.13	11.54	3.23
250	6.08	14.02	11.77	15772	1.37	14.02	3.59
275	7.25	16.72	12.95	17349	1.64	16.72	3.95
300	8.52	19.65	14.13	18926	1.93	19.65	4.31
325	9.88	22.78	15.31	20503	2.23	22.78	4.67
350	11.33	26.13	16.48	22080	2.56	26.13	5.02
375	12.88	29.69	17.66	23658	2.91	29.69	5.38
400	14.51	33.45	18.84	25235	3.28	33.45	5.74
425	16.24	37.42	20.02	26812	3.67	37.42	6.10

3" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.1270 inches (79.4258 mm) Nominal O.D. = 3.1250 inches (79.375 mm)
 Minimum O.D. = 3.1230 inches (79.3242 mm) Nominal I.D. = 2.9810 inches (75.7174 mm)
 Nominal Wall Thickness = 0.0720 inches (1.8288 mm) Flow Area = 6.9793 sq. inches (4502.79 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.08	0.19	1.15	1577	0.02	0.19	0.35
50	0.29	0.67	2.30	3154	0.07	0.67	0.70
75	0.62	1.42	3.45	4732	0.14	1.42	1.05
100	1.05	2.43	4.60	6309	0.24	2.43	1.40
125	1.59	3.67	5.75	7886	0.36	3.67	1.75
150	2.22	5.14	6.90	9463	0.50	5.14	2.10
175	2.96	6.83	8.04	11040	0.67	6.83	2.45
200	3.79	8.75	9.19	12617	0.86	8.75	2.80
225	4.71	10.88	10.34	14195	1.07	10.88	3.15
250	5.73	13.22	11.49	15772	1.30	13.22	3.50
275	6.83	15.76	12.64	17349	1.55	15.76	3.85
300	8.03	18.52	13.79	18926	1.82	18.52	4.20
325	9.31	21.47	14.94	20503	2.11	21.47	4.55
350	10.68	24.63	16.09	22080	2.42	24.63	4.90
375	12.14	27.98	17.24	23658	2.75	27.98	5.25
400	13.68	31.53	18.39	25235	3.09	31.53	5.60
425	15.30	35.27	19.54	26812	3.46	35.27	5.95

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3 1/2" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.6270 inches (92.1258 mm) Nominal O.D. = 3.6250 inches (92.075 mm)
 Minimum O.D. = 3.6230 inches (92.0242 mm) Nominal I.D. = 3.3850 inches (85.979 mm)
 Nominal Wall Thickness = 0.1200 inches (3.048 mm) Flow Area = 6.9993 sq. inches (5805.97 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.04	0.10	0.89	1577	0.01	0.10	0.27
50	0.16	0.36	1.78	3154	0.04	0.36	0.54
75	0.33	0.77	2.67	4732	0.08	0.77	0.81
100	0.57	1.31	3.57	6309	0.13	1.31	1.09
125	0.85	1.98	4.46	7886	0.19	1.98	1.36
150	1.20	2.77	5.35	9463	0.27	2.77	1.63
175	1.59	3.68	6.24	11040	0.36	3.68	1.90
200	2.04	4.71	7.13	12617	0.46	4.71	2.17
225	2.54	5.86	8.02	14195	0.57	5.86	2.44
250	3.09	7.12	8.91	15772	0.70	7.12	2.72
275	3.68	8.49	9.80	17349	0.83	8.49	2.99
300	4.33	9.98	10.70	18926	0.98	9.98	3.26
325	5.02	11.57	11.59	20503	1.13	11.57	3.53
350	5.76	13.27	12.48	22080	1.30	13.27	3.80
375	6.54	15.08	13.37	23658	1.48	15.08	4.07
400	7.37	16.99	14.26	25235	1.67	16.99	4.35
425	8.25	19.01	15.15	26812	1.87	19.01	4.62
450	9.17	21.12	16.04	28389	2.07	21.12	4.89
475	10.13	23.35	16.93	29966	2.29	23.35	5.16
500	11.14	25.67	17.83	31543	2.52	25.67	5.43
525	12.20	28.10	18.72	33121	2.76	28.10	5.70
550	13.29	30.62	19.61	34698	3.01	30.62	5.98
575	14.43	33.25	20.50	36275	3.26	33.25	6.25
600	15.62	35.97	21.39	37852	3.53	35.97	6.52

3 1/2" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.6270 inches (92.1258 mm) Nominal O.D. = 3.6250 inches (92.075 mm)
 Minimum O.D. = 3.6230 inches (92.0242 mm) Nominal I.D. = 3.4250 inches (86.995 mm)
 Nominal Wall Thickness = 0.1000 inches (2.540 mm) Flow Area = 9.2132 sq. inches (5944.00 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.04	0.09	0.87	1577	0.01	0.09	0.27
50	0.15	0.34	1.74	3154	0.03	0.34	0.53
75	0.31	0.73	2.61	4732	0.07	0.73	0.80
100	0.53	1.23	3.48	6309	0.12	1.23	1.06
125	0.81	1.87	4.35	7886	0.18	1.87	1.33
150	1.13	2.61	5.22	9463	0.26	2.61	1.59
175	1.51	3.48	6.09	11040	0.34	3.48	1.86
200	1.93	4.45	6.96	12617	0.44	4.45	2.12
225	2.40	5.53	7.84	14195	0.54	5.53	2.39
250	2.91	6.73	8.71	15772	0.66	6.73	2.65
275	3.48	8.02	9.58	17349	0.79	8.02	2.92
300	4.09	9.42	10.45	18926	0.92	9.42	3.18
325	4.74	10.93	11.32	20503	1.07	10.93	3.45
350	5.44	12.53	12.19	22080	1.23	12.53	3.71
375	6.18	14.24	13.06	23658	1.40	14.24	3.98
400	6.96	16.05	13.93	25235	1.57	16.05	4.25
425	7.79	17.95	14.80	26812	1.76	17.95	4.51
450	8.66	19.95	15.67	28389	1.96	19.95	4.78
475	9.57	22.05	16.54	29966	2.16	22.05	5.04
500	10.52	24.25	17.41	31543	2.38	24.25	5.31
525	11.52	26.54	18.28	33121	2.61	26.54	5.57
550	12.55	28.92	19.15	34698	2.84	28.92	5.84
575	13.63	31.40	20.02	36275	3.08	31.40	6.10
600	14.75	33.97	20.89	37852	3.34	33.97	6.37

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3 1/2" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 3.6270 inches (92.1258 mm) Nominal O.D. = 3.6250 inches (92.075 mm)
 Minimum O.D. = 3.6230 inches (92.0242 mm) Nominal I.D. = 3.4590 inches (87.8586 mm)
 Nominal Wall Thickness = 0.0830 inches (2.1082 mm) Flow Area = 9.397 sq. inches (6062.59 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
25	0.04	0.09	0.85	1577	0.01	0.09	0.26
50	0.14	0.33	1.71	3154	0.03	0.33	0.52
75	0.30	0.69	2.56	4732	0.07	0.69	0.78
100	0.51	1.18	3.41	6309	0.12	1.18	1.04
125	0.77	1.78	4.27	7886	0.17	1.78	1.30
150	1.08	2.49	5.12	9463	0.24	2.49	1.56
175	1.44	3.31	5.97	11040	0.32	3.31	1.82
200	1.84	4.24	6.83	12617	0.42	4.24	2.08
225	2.29	5.27	7.68	14195	0.52	5.27	2.34
250	2.78	6.41	8.54	15772	0.63	6.41	2.60
275	3.31	7.65	9.39	17349	0.75	7.65	2.86
300	3.89	8.98	10.24	18926	0.88	8.98	3.12
325	4.52	10.41	11.10	20503	1.02	10.41	3.38
350	5.18	11.94	11.95	22080	1.17	11.94	3.64
375	5.89	13.57	12.80	23658	1.33	13.57	3.90
400	6.63	15.29	13.66	25235	1.50	15.29	4.16
425	7.42	17.11	14.51	26812	1.68	17.11	4.42
450	8.25	19.02	15.36	28389	1.87	19.02	4.68
475	9.12	21.02	16.22	29966	2.06	21.02	4.94
500	10.03	23.11	17.07	31543	2.27	23.11	5.20
525	10.98	25.29	17.92	33121	2.48	25.29	5.46
550	11.96	27.56	18.78	34698	2.71	27.56	5.72
575	12.99	29.93	19.63	36275	2.94	29.93	5.98
600	14.06	32.38	20.49	37852	3.18	32.38	6.24

4" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 4.1270 inches (104.8258 mm) Nominal O.D. = 4.1250 inches (104.775 mm)
 Minimum O.D. = 4.1230 inches (104.7242 mm) Nominal I.D. = 3.8570 inches (97.9678 mm)
 Nominal Wall Thickness = 0.1340 inches (3.4036 mm) Flow Area = 11.6839 sq. inches (7538.01 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.08	0.19	1.37	3154	0.02	0.19	0.42
100	0.30	0.69	2.75	6309	0.07	0.69	0.84
150	0.63	1.47	4.12	9463	0.14	1.47	1.26
200	1.08	2.50	5.49	12617	0.24	2.50	1.67
250	1.64	3.77	6.86	15772	0.37	3.77	2.09
300	2.29	5.29	8.24	18926	0.52	5.29	2.51
350	3.05	7.03	9.61	22080	0.69	7.03	2.93
400	3.91	9.00	10.98	25235	0.88	9.00	3.35
450	4.86	11.19	12.36	28389	1.10	11.19	3.77
500	5.90	13.60	13.73	31543	1.34	13.60	4.18
550	7.04	16.23	15.10	34698	1.59	16.23	4.60
600	8.27	19.06	16.48	37852	1.87	19.06	5.02
650	9.60	22.10	17.85	41006	2.17	22.10	5.44
700	11.01	25.35	19.22	44161	2.49	25.35	5.86
750	12.51	28.80	20.59	47315	2.83	28.80	6.28
800	14.10	32.45	21.97	50469	3.19	32.45	6.70
850	15.77	36.30	23.34	53624	3.57	36.30	7.11
900	17.53	40.35	24.71	56778	3.97	40.35	7.53
950	19.38	44.60	26.09	59932	4.38	44.60	7.95
1000	21.31	49.04	27.46	63087	4.82	49.04	8.37

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4" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 4.1270 inches (104.8258 mm) Nominal O.D. = 4.1250 inches (104.775 mm)
 Minimum O.D. = 4.1230 inches (104.7242 mm) Nominal I.D. = 3.9050 inches (99.187 mm)
 Nominal Wall Thickness = 0.1100 inches (2.794 mm) Flow Area = 11.9766 sq. inches (7726.80 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.08	0.18	1.34	3154	0.02	0.18	0.41
100	0.28	0.65	2.68	6309	0.06	0.65	0.82
150	0.60	1.38	4.02	9463	0.14	1.38	1.22
200	1.02	2.35	5.36	12617	0.23	2.35	1.63
250	1.54	3.55	6.70	15772	0.35	3.55	2.04
300	2.16	4.98	8.04	18926	0.49	4.98	2.45
350	2.87	6.62	9.38	22080	0.65	6.62	2.86
400	3.68	8.48	10.72	25235	0.83	8.48	3.27
450	4.57	10.54	12.05	28389	1.03	10.54	3.67
500	5.56	12.81	13.39	31543	1.26	12.81	4.08
550	6.63	15.28	14.73	34698	1.50	15.28	4.49
600	7.79	17.95	16.07	37852	1.76	17.95	4.90
650	9.04	20.81	17.41	41006	2.04	20.81	5.31
700	10.37	23.87	18.75	44161	2.34	23.87	5.72
750	11.78	27.12	20.09	47315	2.66	27.12	6.12
800	13.27	30.56	21.43	50469	3.00	30.56	6.53
850	14.85	34.18	22.77	53624	3.36	34.18	6.94
900	16.51	38.00	24.11	56778	3.73	38.00	7.35
950	18.25	41.99	25.45	59932	4.13	41.99	7.76
1000	20.07	46.17	26.79	63087	4.54	46.17	8.17

4" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 4.1270 inches (104.8258 mm) Nominal O.D. = 4.1250 inches (104.775 mm)
 Minimum O.D. = 4.1230 inches (104.7242 mm) Nominal I.D. = 3.9350 inches (99.949 mm)
 Nominal Wall Thickness = 0.0950 inches (2.413 mm) Flow Area = 12.1613 sq. inches (7845.87 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.08	0.17	1.32	3154	0.02	0.17	0.40
100	0.27	0.63	2.64	6309	0.06	0.63	0.80
150	0.58	1.33	3.96	9463	0.13	1.33	1.21
200	0.98	2.27	5.28	12617	0.22	2.27	1.61
250	1.48	3.42	6.60	15772	0.34	3.42	2.01
300	2.08	4.80	7.91	18926	0.47	4.80	2.41
350	2.77	6.38	9.23	22080	0.63	6.38	2.81
400	3.54	8.17	10.55	25235	0.80	8.17	3.22
450	4.41	10.15	11.87	28389	1.00	10.15	3.62
500	5.36	12.34	13.19	31543	1.21	12.34	4.02
550	6.39	14.72	14.51	34698	1.45	14.72	4.42
600	7.51	17.29	15.83	37852	1.70	17.29	4.82
650	8.71	20.05	17.15	41006	1.97	20.05	5.23
700	9.99	23.00	18.47	44161	2.26	23.00	5.63
750	11.35	26.13	19.79	47315	2.57	26.13	6.03
800	12.79	29.44	21.11	50469	2.89	29.44	6.43
850	14.31	32.93	22.42	53624	3.24	32.93	6.83
900	15.91	36.61	23.74	56778	3.60	36.61	7.24
950	17.58	40.46	25.06	59932	3.98	40.46	7.64
1000	19.33	44.49	26.38	63087	4.37	44.49	8.04

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5" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 5.1270 inches (130.2258 mm) Nominal O.D. = 5.1250 inches (130.175 mm)
 Minimum O.D. = 5.1230 inches (130.1242 mm) Nominal I.D. = 4.8050 inches (122.047 mm)
 Nominal Wall Thickness = 0.1600 inches (4.064 mm) Flow Area = 18.1333 sq. inches (11698.87 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.03	0.07	0.88	3154	0.01	0.07	0.27
100	0.10	0.24	1.77	6309	0.02	0.24	0.54
150	0.22	0.50	2.65	9463	0.05	0.50	0.81
200	0.37	0.86	3.54	12617	0.08	0.86	1.08
250	0.56	1.30	4.42	15772	0.13	1.30	1.35
300	0.79	1.81	5.31	18926	0.18	1.81	1.62
350	1.05	2.41	6.19	22080	0.24	2.41	1.89
400	1.34	3.09	7.08	25235	0.30	3.09	2.16
450	1.67	3.84	7.96	28389	0.38	3.84	2.43
500	2.03	4.67	8.85	31543	0.46	4.67	2.70
550	2.42	5.57	9.73	34698	0.55	5.57	2.97
600	2.84	6.54	10.62	37852	0.64	6.54	3.24
650	3.29	7.59	11.50	41006	0.75	7.59	3.51
700	3.78	8.70	12.39	44161	0.85	8.70	3.77
750	4.29	9.89	13.27	47315	0.97	9.89	4.04
800	4.84	11.14	14.15	50469	1.09	11.14	4.31
850	5.41	12.46	15.04	53624	1.22	12.46	4.58
900	6.02	13.85	15.92	56778	1.36	13.85	4.85
950	6.65	15.31	16.81	59932	1.50	15.31	5.12
1000	7.32	16.83	17.69	63087	1.65	16.83	5.39
1050	8.01	18.42	18.58	66241	1.81	18.42	5.66
1100	8.73	20.08	19.46	69395	1.97	20.08	5.93
1150	9.48	21.80	20.35	72550	2.14	21.80	6.20

5" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 5.1270 inches (130.2258 mm) Nominal O.D. = 5.1250 inches (130.175 mm)
 Minimum O.D. = 5.1230 inches (130.1242 mm) Nominal I.D. = 4.8750 inches (123.825 mm)
 Nominal Wall Thickness = 0.1250 inches (3.175 mm) Flow Area = 18.6655 sq. inches (12042.22 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.03	0.06	0.86	3154	0.01	0.06	0.26
100	0.10	0.22	1.72	6309	0.02	0.22	0.52
150	0.20	0.47	2.58	9463	0.05	0.47	0.79
200	0.35	0.80	3.44	12617	0.08	0.80	1.05
250	0.52	1.21	4.30	15772	0.12	1.21	1.31
300	0.73	1.69	5.16	18926	0.17	1.69	1.57
350	0.98	2.25	6.02	22080	0.22	2.25	1.83
400	1.25	2.88	6.88	25235	0.28	2.88	2.10
450	1.55	3.58	7.73	28389	0.35	3.58	2.36
500	1.89	4.35	8.59	31543	0.43	4.35	2.62
550	2.25	5.19	9.45	34698	0.51	5.19	2.88
600	2.65	6.10	10.31	37852	0.60	6.10	3.14
650	3.07	7.07	11.17	41006	0.69	7.07	3.41
700	3.52	8.11	12.03	44161	0.80	8.11	3.67
750	4.00	9.21	12.89	47315	0.91	9.21	3.93
800	4.51	10.38	13.75	50469	1.02	10.38	4.19
850	5.05	11.61	14.61	53624	1.14	11.61	4.45
900	5.61	12.91	15.47	56778	1.27	12.91	4.72
950	6.20	14.27	16.33	59932	1.40	14.27	4.98
1000	6.82	15.69	17.19	63087	1.54	15.69	5.24
1050	7.46	17.17	18.05	66241	1.69	17.17	5.50
1100	8.13	18.71	18.91	69395	1.84	18.71	5.76
1150	8.83	20.32	19.77	72550	2.00	20.32	6.02

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5" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 5.1270 inches (130.2258 mm) Nominal O.D. = 5.1250 inches (130.175 mm)
 Minimum O.D. = 5.1230 inches (130.1242 mm) Nominal I.D. = 4.9070 inches (124.6378 mm)
 Nominal Wall Thickness = 0.1090 inches (2.7686 mm) Flow Area = 18.9113 sq. inches (12200.83 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
50	0.03	0.06	0.85	3154	0.01	0.06	0.26
100	0.09	0.21	1.70	6309	0.02	0.21	0.52
150	0.20	0.45	2.54	9463	0.04	0.45	0.78
200	0.34	0.77	3.39	12617	0.08	0.77	1.03
250	0.51	1.17	4.24	15772	0.11	1.17	1.29
300	0.71	1.64	5.09	18926	0.16	1.64	1.55
350	0.95	2.18	5.94	22080	0.21	2.18	1.81
400	1.21	2.79	6.79	25235	0.27	2.79	2.07
450	1.51	3.47	7.63	28389	0.34	3.47	2.33
500	1.83	4.22	8.48	31543	0.41	4.22	2.59
550	2.18	5.03	9.33	34698	0.49	5.03	2.84
600	2.56	5.91	10.18	37852	0.58	5.91	3.10
650	2.97	6.85	11.03	41006	0.67	6.85	3.36
700	3.41	7.86	11.88	44161	0.77	7.86	3.62
750	3.88	8.93	12.72	47315	0.88	8.93	3.88
800	4.37	10.06	13.57	50469	0.99	10.06	4.14
850	4.89	11.25	14.42	53624	1.11	11.25	4.40
900	5.43	12.51	15.27	56778	1.23	12.51	4.65
950	6.01	13.82	16.12	59932	1.36	13.82	4.91
1000	6.60	15.20	16.97	63087	1.49	15.20	5.17
1050	7.23	16.63	17.81	66241	1.64	16.63	5.43
1100	7.88	18.13	18.66	69395	1.78	18.13	5.69
1150	8.56	19.68	19.51	72550	1.94	19.68	5.95

6" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 6.1270 inches (155.6258 mm) Nominal O.D. = 6.1250 inches (155.575 mm)
 Minimum O.D. = 6.1230 inches (155.5242 mm) Nominal I.D. = 5.7410 inches (145.8214 mm)
 Nominal Wall Thickness = 0.1920 inches (4.8768 mm) Flow Area = 25.8860 sq. inches (16700.61 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
100	0.04	0.10	1.24	6309	0.01	0.10	0.38
200	0.16	0.36	2.48	12617	0.04	0.36	0.76
300	0.33	0.76	3.72	18926	0.07	0.76	1.13
400	0.56	1.30	4.96	25235	0.13	1.30	1.51
500	0.85	1.96	6.20	31543	0.19	1.96	1.89
600	1.19	2.75	7.44	37852	0.27	2.75	2.27
700	1.59	3.66	8.68	44161	0.36	3.66	2.64
800	2.04	4.69	9.92	50469	0.46	4.69	3.02
900	2.53	5.83	11.15	56778	0.57	5.83	3.40
1000	3.08	7.08	12.39	63087	0.70	7.08	3.78
1100	3.67	8.45	13.63	69395	0.83	8.45	4.16
1200	4.31	9.92	14.87	75704	0.98	9.92	4.53
1300	5.00	11.50	16.11	82013	1.13	11.50	4.91
1400	5.74	13.19	17.35	88321	1.30	13.19	5.29
1500	6.52	14.99	18.59	94630	1.47	14.99	5.67
1600	7.35	16.89	19.83	100939	1.66	16.89	6.04
1700	8.22	18.90	21.07	107247	1.86	18.90	6.42
1800	9.14	21.00	22.31	113556	2.07	21.00	6.80

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6" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 6.1270 inches (155.6258 mm) Nominal O.D. = 6.1250 inches (155.575 mm)
 Minimum O.D. = 6.1230 inches (155.5242 mm) Nominal I.D. = 5.8450 inches (148.463 mm)
 Nominal Wall Thickness = 0.1400 inches (3.556 mm) Flow Area = 26.8324 sq. inches (17311.17 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
100	0.04	0.09	1.20	6309	0.01	0.09	0.36
200	0.14	0.33	2.39	12617	0.03	0.33	0.73
300	0.30	0.70	3.59	18926	0.07	0.70	1.09
400	0.52	1.19	4.78	25235	0.12	1.19	1.46
500	0.78	1.80	5.98	31543	0.18	1.80	1.82
600	1.09	2.52	7.17	37852	0.25	2.52	2.19
700	1.46	3.35	8.37	44161	0.33	3.35	2.55
800	1.87	4.29	9.57	50469	0.42	4.29	2.92
900	2.32	5.34	10.76	56778	0.52	5.34	3.28
1000	2.82	6.49	11.96	63087	0.64	6.49	3.64
1100	3.36	7.74	13.15	69395	0.76	7.74	4.01
1200	3.95	9.09	14.35	75704	0.89	9.09	4.37
1300	4.58	10.54	15.54	82013	1.04	10.54	4.74
1400	5.26	12.09	16.74	88321	1.19	12.09	5.10
1500	5.98	13.74	17.94	94630	1.35	13.74	5.47
1600	6.73	15.48	19.13	100939	1.52	15.48	5.83
1700	7.53	17.32	20.33	107247	1.70	17.32	6.20
1800	8.38	19.25	21.52	113556	1.89	19.25	6.56

6" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 6.1270 inches (155.6258 mm) Nominal O.D. = 6.1250 inches (155.575 mm)
 Minimum O.D. = 6.1230 inches (155.5242 mm) Nominal I.D. = 5.8810 inches (149.3774 mm)
 Nominal Wall Thickness = 0.1220 inches (3.0988 mm) Flow Area = 27.1639 sq. inches (17525.07 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
100	0.04	0.09	1.18	6309	0.01	0.09	0.36
200	0.14	0.32	2.36	12617	0.03	0.32	0.72
300	0.29	0.68	3.54	18926	0.07	0.68	1.08
400	0.50	1.16	4.72	25235	0.11	1.16	1.44
500	0.76	1.75	5.91	31543	0.17	1.75	1.80
600	1.06	2.45	7.09	37852	0.24	2.45	2.16
700	1.41	3.26	8.27	44161	0.32	3.26	2.52
800	1.81	4.17	9.45	50469	0.41	4.17	2.88
900	2.25	5.18	10.63	56778	0.51	5.18	3.24
1000	2.74	6.30	11.81	63087	0.62	6.30	3.60
1100	3.27	7.51	12.99	69395	0.74	7.51	3.96
1200	3.84	8.82	14.17	75704	0.87	8.82	4.32
1300	4.45	10.23	15.35	82013	1.01	10.23	4.68
1400	5.10	11.74	16.54	88321	1.15	11.74	5.04
1500	5.80	13.33	17.72	94630	1.31	13.33	5.40
1600	6.54	15.02	18.90	100939	1.48	15.02	5.76
1700	7.31	16.81	20.08	107247	1.65	16.81	6.12
1800	8.13	18.68	21.26	113556	1.84	18.68	6.48

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8" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 8.1270 inches (206.4258 mm) Nominal O.D. = 8.1240 inches (206.3496 mm)
 Minimum O.D. = 8.1210 inches (206.2734 mm) Nominal I.D. = 7.5820 inches (192.5828 mm)
 Nominal Wall Thickness = 0.2710 inches (6.8834 mm) Flow Area = 45.1500 sq. inches (29128.95 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.04	0.09	1.42	12617	0.01	0.09	0.43
400	0.15	0.34	2.84	25235	0.03	0.34	0.87
600	0.31	0.71	4.26	37852	0.07	0.71	1.30
800	0.53	1.21	5.68	50469	0.12	1.21	1.73
1000	0.80	1.83	7.11	63087	0.18	1.83	2.17
1200	1.11	2.56	8.53	75704	0.25	2.56	2.60
1400	1.48	3.41	9.95	88321	0.34	3.41	3.03
1600	1.90	4.36	11.37	100939	0.43	4.36	3.47
1800	2.36	5.43	12.79	113556	0.53	5.43	3.90
2000	2.87	6.60	14.21	126173	0.65	6.60	4.33
2200	3.42	7.87	15.63	138791	0.77	7.87	4.76
2400	4.02	9.24	17.05	151408	0.91	9.24	5.20
2600	4.67	10.72	18.48	164025	1.06	10.72	5.63
2800	5.35	12.29	19.90	176643	1.21	12.29	6.06
3000	6.08	13.96	21.32	189260	1.38	13.96	6.50
3200	6.85	15.73	22.74	201877	1.55	15.73	6.93
3400	7.67	17.60	24.16	214495	1.73	17.60	7.36
3600	8.53	19.57	25.58	227112	1.93	19.57	7.80
3800	9.42	21.62	27.00	239729	2.13	21.62	8.23
4000	10.36	23.78	28.42	252347	2.34	23.78	8.66

8" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 8.1270 inches (206.4258 mm) Nominal O.D. = 8.1240 inches (206.3496 mm)
 Minimum O.D. = 8.1210 inches (206.2734 mm) Nominal I.D. = 7.7240 inches (196.1896 mm)
 Nominal Wall Thickness = 0.2000 inches (5.080 mm) Flow Area = 46.8570 sq. inches (30230.26 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.04	0.09	1.37	12617	0.01	0.09	0.42
400	0.13	0.31	2.74	25235	0.03	0.31	0.83
600	0.28	0.65	4.11	37852	0.06	0.65	1.25
800	0.48	1.11	5.48	50469	0.11	1.11	1.67
1000	0.73	1.67	6.85	63087	0.16	1.67	2.09
1200	1.02	2.34	8.22	75704	0.23	2.34	2.50
1400	1.35	3.12	9.59	88321	0.31	3.12	2.92
1600	1.73	3.99	10.96	100939	0.39	3.99	3.34
1800	2.16	4.96	12.32	113556	0.49	4.96	3.76
2000	2.62	6.03	13.69	126173	0.59	6.03	4.17
2200	3.13	7.19	15.06	138791	0.71	7.19	4.59
2400	3.68	8.44	16.43	151408	0.83	8.44	5.01
2600	4.26	9.79	17.80	164025	0.96	9.79	5.43
2800	4.89	11.23	19.17	176643	1.11	11.23	5.84
3000	5.56	12.76	20.54	189260	1.26	12.76	6.26
3200	6.26	14.38	21.91	201877	1.42	14.38	6.68
3400	7.01	16.08	23.28	214495	1.58	16.08	7.10
3600	7.79	17.88	24.65	227112	1.76	17.88	7.51
3800	8.61	19.76	26.02	239729	1.95	19.76	7.93
4000	9.47	21.72	27.39	252347	2.14	21.72	8.35

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

8" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 8.1270 inches (206.4258 mm) Nominal O.D. = 8.1240 inches (206.3496 mm)
 Minimum O.D. = 8.1210 inches (206.2734 mm) Nominal I.D. = 7.7840 inches (197.7136 mm)
 Nominal Wall Thickness = 0.1700 inches (4.3180 mm) Flow Area = 47.5878 sq. inches (30701.74 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm./sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.04	0.08	1.35	12617	0.01	0.08	0.41
400	0.13	0.30	2.70	25235	0.03	0.30	0.82
600	0.27	0.63	4.05	37852	0.06	0.63	1.23
800	0.46	1.07	5.39	50469	0.10	1.07	1.64
1000	0.70	1.61	6.74	63087	0.16	1.61	2.05
1200	0.98	2.26	8.09	75704	0.22	2.26	2.47
1400	1.30	3.00	9.44	88321	0.30	3.00	2.88
1600	1.67	3.84	10.79	100939	0.38	3.84	3.29
1800	2.08	4.78	12.14	113556	0.47	4.78	3.70
2000	2.53	5.80	13.48	126173	0.57	5.80	4.11
2200	3.01	6.92	14.83	138791	0.68	6.92	4.52
2400	3.54	8.13	16.18	151408	0.80	8.13	4.93
2600	4.11	9.43	17.53	164025	0.93	9.43	5.34
2800	4.71	10.81	18.88	176643	1.07	10.81	5.75
3000	5.35	12.29	20.23	189260	1.21	12.29	6.16
3200	6.03	13.85	21.57	201877	1.36	13.85	6.58
3400	6.75	15.49	22.92	214495	1.53	15.49	6.99
3600	7.50	17.22	24.27	227112	1.70	17.22	7.40
3800	8.29	19.03	25.62	239729	1.88	19.03	7.81
4000	9.12	20.92	26.97	252347	2.06	20.92	8.22

10" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 10.1270 inches (257.2258 mm) Nominal O.D. = 10.1230 inches (257.1242 mm)
 Minimum O.D. = 10.1190 inches (257.0226 mm) Nominal I.D. = 9.4470 inches (239.9538 mm)
 Nominal Wall Thickness = 0.3380 inches (8.5852 mm) Flow Area = 70.0935 sq. inches (45221.52 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm./sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.01	0.03	0.92	12617	0.00	0.03	0.28
400	0.05	0.12	1.83	25235	0.01	0.12	0.56
600	0.11	0.24	2.75	37852	0.02	0.24	0.84
800	0.18	0.42	3.66	50469	0.04	0.42	1.12
1000	0.27	0.63	4.58	63087	0.06	0.63	1.40
1200	0.38	0.88	5.49	75704	0.09	0.88	1.67
1400	0.51	1.17	6.41	88321	0.12	1.17	1.95
1600	0.65	1.50	7.32	100939	0.15	1.50	2.23
1800	0.81	1.86	8.24	113556	0.18	1.86	2.51
2000	0.98	2.26	9.15	126173	0.22	2.26	2.79
2200	1.17	2.70	10.07	138791	0.27	2.70	3.07
2400	1.38	3.17	10.99	151408	0.31	3.17	3.35
2600	1.60	3.68	11.90	164025	0.36	3.68	3.63
2800	1.84	4.22	12.82	176643	0.42	4.22	3.91
3000	2.09	4.79	13.73	189260	0.47	4.79	4.19
3200	2.35	5.40	14.65	201877	0.53	5.40	4.46
3400	2.63	6.04	15.56	214495	0.60	6.04	4.74
3600	2.92	6.71	16.48	227112	0.66	6.71	5.02
3800	3.23	7.42	17.39	239729	0.73	7.42	5.30
4000	3.55	8.16	18.31	252347	0.80	8.16	5.58
4200	3.89	8.93	19.22	264964	0.88	8.93	5.86
4400	4.24	9.73	20.14	277581	0.96	9.73	6.14

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10" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 10.1270 inches (257.2258 mm) Nominal O.D. = 10.1230 inches (257.1242 mm)
 Minimum O.D. = 10.1190 inches (257.0226 mm) Nominal I.D. = 9.6230 inches (244.4242 mm)
 Nominal Wall Thickness = 0.2500 inches (6.3500 mm) Flow Area = 72.7295 sq. inches (46922.19 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.01	0.03	0.88	12617.33	0.00	0.03	0.27
400	0.05	0.11	1.76	25234.67	0.01	0.11	0.54
600	0.10	0.22	2.65	37852.00	0.02	0.22	0.81
800	0.16	0.38	3.53	50469.33	0.04	0.38	1.08
1000	0.25	0.57	4.41	63086.67	0.06	0.57	1.34
1200	0.35	0.80	5.29	75704.00	0.08	0.80	1.61
1400	0.46	1.07	6.18	88321.33	0.11	1.07	1.88
1600	0.60	1.37	7.06	100938.67	0.13	1.37	2.15
1800	0.74	1.70	7.94	113556.00	0.17	1.70	2.42
2000	0.90	2.07	8.82	126173.33	0.20	2.07	2.69
2200	1.07	2.47	9.70	138790.67	0.24	2.47	2.96
2400	1.26	2.90	10.59	151408.00	0.29	2.90	3.23
2600	1.46	3.36	11.47	164025.33	0.33	3.36	3.50
2800	1.68	3.85	12.35	176642.67	0.38	3.85	3.76
3000	1.91	4.38	13.23	189260.00	0.43	4.38	4.03
3200	2.15	4.93	14.12	201877.33	0.49	4.93	4.30
3400	2.40	5.52	15.00	214494.67	0.54	5.52	4.57
3600	2.67	6.13	15.88	227112.00	0.60	6.13	4.84
3800	2.95	6.78	16.76	239729.33	0.67	6.78	5.11
4000	3.25	7.45	17.65	252346.67	0.73	7.45	5.38
4200	3.56	8.16	18.53	264964.00	0.80	8.16	5.65
4400	3.88	8.89	19.41	277581.33	0.88	8.89	5.92

10" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 10.1270 inches (257.2258 mm) Nominal O.D. = 10.1230 inches (257.1242 mm)
 Minimum O.D. = 10.1190 inches (257.0226 mm) Nominal I.D. = 9.6990 inches (247.3546 mm)
 Nominal Wall Thickness = 0.2120 inches (5.3848 mm) Flow Area = 73.8829 sq. inches (47666.28 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
200	0.01	0.03	0.87	12617	0.00	0.03	0.26
400	0.04	0.10	1.74	25235	0.01	0.10	0.53
600	0.09	0.21	2.61	37852	0.02	0.21	0.79
800	0.16	0.37	3.47	50469	0.04	0.37	1.06
1000	0.24	0.55	4.34	63087	0.05	0.55	1.32
1200	0.34	0.77	5.21	75704	0.08	0.77	1.59
1400	0.45	1.03	6.08	88321	0.10	1.03	1.85
1600	0.57	1.32	6.95	100939	0.13	1.32	2.12
1800	0.71	1.64	7.82	113556	0.16	1.64	2.38
2000	0.87	1.99	8.68	126173	0.20	1.99	2.65
2200	1.03	2.37	9.55	138791	0.23	2.37	2.91
2400	1.21	2.79	10.42	151408	0.27	2.79	3.18
2600	1.41	3.23	11.29	164025	0.32	3.23	3.44
2800	1.62	3.71	12.16	176643	0.37	3.71	3.71
3000	1.84	4.21	13.03	189260	0.42	4.21	3.97
3200	2.07	4.75	13.90	201877	0.47	4.75	4.24
3400	2.31	5.31	14.76	214495	0.52	5.31	4.50
3600	2.57	5.90	15.63	227112	0.58	5.90	4.76
3800	2.84	6.53	16.50	239729	0.64	6.53	5.03
4000	3.13	7.17	17.37	252347	0.71	7.17	5.29
4200	3.42	7.85	18.24	264964	0.77	7.85	5.56
4400	3.73	8.56	19.11	277581	0.84	8.56	5.82

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12" TYPE "K" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 12.1270 inches (308.0258 mm) Nominal O.D. = 12.1230 inches (307.9242 mm)
 Minimum O.D. = 12.1190 inches (307.8226 mm) Nominal I.D. = 11.3130 inches (287.3502 mm)
 Nominal Wall Thickness = 0.4050 inches (10.2870 mm) Flow Area = 100.5184 sq. inches (64850.43 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1000	0.11	0.26	3.19	63087	0.03	0.26	0.97
1200	0.16	0.37	3.83	75704	0.04	0.37	1.17
1400	0.21	0.49	4.47	88321	0.05	0.49	1.36
1600	0.27	0.62	5.11	100939	0.06	0.62	1.56
1800	0.34	0.77	5.75	113556	0.08	0.77	1.75
2000	0.41	0.94	6.38	126173	0.09	0.94	1.95
2200	0.49	1.12	7.02	138791	0.11	1.12	2.14
2400	0.57	1.32	7.66	151408	0.13	1.32	2.33
2600	0.67	1.53	8.30	164025	0.15	1.53	2.53
2800	0.76	1.75	8.94	176643	0.17	1.75	2.72
3000	0.87	1.99	9.58	189260	0.20	1.99	2.92
3200	0.98	2.25	10.21	201877	0.22	2.25	3.11
3400	1.09	2.51	10.85	214495	0.25	2.51	3.31
3600	1.22	2.79	11.49	227112	0.28	2.79	3.50
3800	1.34	3.09	12.13	239729	0.30	3.09	3.70
4000	1.48	3.39	12.77	252347	0.33	3.39	3.89
4200	1.62	3.71	13.41	264964	0.37	3.71	4.09
4400	1.76	4.05	14.04	277581	0.40	4.05	4.28
4600	1.92	4.39	14.68	290199	0.43	4.39	4.48
4800	2.07	4.75	15.32	302816	0.47	4.75	4.67
5000	2.24	5.13	15.96	315433	0.51	5.13	4.86
5200	2.40	5.51	16.60	328051	0.54	5.51	5.06
5400	2.58	5.91	17.24	340668	0.58	5.91	5.25
5600	2.76	6.32	17.87	353285	0.62	6.32	5.45
5800	2.94	6.75	18.51	365903	0.67	6.75	5.64
6000	3.13	7.18	19.15	378520	0.71	7.18	5.84
6200	3.33	7.63	19.79	391137	0.75	7.63	6.03

12" TYPE "L" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 12.1270 inches (308.0258 mm) Nominal O.D. = 12.1230 inches (307.9242 mm)
 Minimum O.D. = 12.1190 inches (307.8226 mm) Nominal I.D. = 11.5630 inches (293.7002 mm)
 Nominal Wall Thickness = 0.2800 inches (7.1120 mm) Flow Area = 105.0101 sq. inches (67748.29 sq. mm)
 C Factor = 150

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1000	0.10	0.23	3.06	63087	0.02	0.23	0.93
1200	0.14	0.33	3.67	75704	0.03	0.33	1.12
1400	0.19	0.44	4.28	88321	0.04	0.44	1.30
1600	0.24	0.56	4.89	100939	0.06	0.56	1.49
1800	0.30	0.70	5.50	113556	0.07	0.70	1.68
2000	0.37	0.85	6.11	126173	0.08	0.85	1.86
2200	0.44	1.01	6.72	138791	0.10	1.01	2.05
2400	0.52	1.19	7.33	151408	0.12	1.19	2.23
2600	0.60	1.37	7.94	164025	0.14	1.37	2.42
2800	0.69	1.58	8.55	176643	0.16	1.58	2.61
3000	0.78	1.79	9.17	189260	0.18	1.79	2.79
3200	0.88	2.02	9.78	201877	0.20	2.02	2.98
3400	0.98	2.26	10.39	214495	0.22	2.26	3.17
3600	1.09	2.51	11.00	227112	0.25	2.51	3.35
3800	1.21	2.77	11.61	239729	0.27	2.77	3.54
4000	1.33	3.05	12.22	252347	0.30	3.05	3.72
4200	1.46	3.34	12.83	264964	0.33	3.34	3.91
4400	1.59	3.64	13.44	277581	0.36	3.64	4.10
4600	1.72	3.95	14.05	290199	0.39	3.95	4.28
4800	1.86	4.27	14.67	302816	0.42	4.27	4.47
5000	2.01	4.61	15.28	315433	0.45	4.61	4.66
5200	2.16	4.96	15.89	328051	0.49	4.96	4.84
5400	2.32	5.31	16.50	340668	0.52	5.31	5.03
5600	2.48	5.68	17.11	353285	0.56	5.68	5.21
5800	2.65	6.07	17.72	365903	0.60	6.07	5.40
6000	2.82	6.46	18.33	378520	0.64	6.46	5.59
6200	2.99	6.86	18.94	391137	0.68	6.86	5.77

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12" TYPE "M" COPPER TUBE — WATER FLOW AND FRICTION LOSS PER 100 FEET

Maximum O.D. = 12.1270 inches (308.0258 mm)
 Minimum O.D. = 12.1190 inches (307.8226 mm)
 Nominal Wall Thickness = 0.2540 inches (6.4516 mm)
 C Factor = 150

Nominal O.D. = 12.1230 inches (307.9242 mm)
 Nominal I.D. = 11.6150 inches (295.021 mm)
 Flow Area = 105.9567 sq. inches (68359.01 sq. mm)

Hazen Williams Formula

FLOW, Q (GPM)	Pressure Loss (psi/100 ft)	Head Loss (ft/100 ft)	Velocity (ft./sec.)	FLOW, Q (cu. cm/sec.)	Pressure Loss (kPa/100 m)	Head Loss (m/100 m)	Velocity (m/sec.)
1000	0.10	0.23	3.03	63087	0.02	0.23	0.92
1200	0.14	0.32	3.63	75704	0.03	0.32	1.11
1400	0.19	0.43	4.24	88321	0.04	0.43	1.29
1600	0.24	0.55	4.84	100939	0.05	0.55	1.48
1800	0.30	0.68	5.45	113556	0.07	0.68	1.66
2000	0.36	0.83	6.06	126173	0.08	0.83	1.85
2200	0.43	0.99	6.66	138791	0.10	0.99	2.03
2400	0.51	1.16	7.27	151408	0.11	1.16	2.22
2600	0.59	1.35	7.87	164025	0.13	1.35	2.40
2800	0.67	1.54	8.48	176643	0.15	1.54	2.58
3000	0.76	1.75	9.08	189260	0.17	1.75	2.77
3200	0.86	1.98	9.69	201877	0.19	1.98	2.95
3400	0.96	2.21	10.30	214495	0.22	2.21	3.14
3600	1.07	2.46	10.90	227112	0.24	2.46	3.32
3800	1.18	2.71	11.51	239729	0.27	2.71	3.51
4000	1.30	2.98	12.11	252347	0.29	2.98	3.69
4200	1.42	3.27	12.72	264964	0.32	3.27	3.88
4400	1.55	3.56	13.32	277581	0.35	3.56	4.06
4600	1.68	3.87	13.93	290199	0.38	3.87	4.25
4800	1.82	4.18	14.53	302816	0.41	4.18	4.43
5000	1.97	4.51	15.14	315433	0.44	4.51	4.61
5200	2.11	4.85	15.75	328051	0.48	4.85	4.80
5400	2.27	5.20	16.35	340668	0.51	5.20	4.98
5600	2.43	5.56	16.96	353285	0.55	5.56	5.17
5800	2.59	5.93	17.56	365903	0.59	5.93	5.35
6000	2.76	6.32	18.17	378520	0.62	6.32	5.54
6200	2.93	6.71	18.77	391137	0.66	6.71	5.72

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Copper Water Tube continued

COPPER TUBE – TYPES, STANDARDS, APPLICATIONS, TEMPER AND LENGTHS

Tube Type	Color Code	Standard	Application	Commercially Available Lengths			
				Nominal or Standard Sizes	Drawn	Annealed	
Type K	Green	ASTM B 88	Domestic Water Service Distribution Fire Protection Solar Fuel/Fuel Oil HVAC Snow Melting	Straight Lengths:	1/4-inch to 8-inch	20 ft. (6.1m)	20 ft. (6.1m)
					10-inch	18 ft. (5.5m)	18 ft. (5.5m)
					12-inch	12 ft. (3.7m)	12 ft. (3.7m)
				Coils:	1/4-inch to 1-inch	–	60 ft. (18.3m)
						–	100 ft. (30.5m)
					1 1/4-inch & 1 1/2-inch	–	60 ft. (18.3m)
					2-inch	–	40 ft. (12.2m)
		–	45 ft. (13.7m)				
Type L	Blue	ASTM B 88	Domestic Water Service Distribution Fire Protection Solar Fuel/Fuel Oil Natural Gas Liquified Petroleum (LP) Gas HVAC Snow Melting	Straight Lengths:	1/4-inch to 10-inch	20 ft. (6.1m)	20 ft. (6.1m)
					12-inch	18 ft. (5.5m)	18 ft. (5.5m)
				Coils:	1/4-inch to 1-inch	–	60 ft. (18.3m)
						–	100 ft. (30.5m)
					1 1/4-inch & 1 1/2-inch	–	60 ft. (18.3m)
					2-inch	–	40 ft. (12.2m)
						–	45 ft. (13.7m)
Type M	Red	ASTM B 88	Domestic Water Service Distribution Fire Protection Solar Fuel/Fuel Oil HVAC Snow Melting	Straight Lengths:	1/4-inch to 12-inch	20 ft. (6.1m)	N/A
DWW	Yellow	ASTM B 306	Drain Waste Vent HVAC Solar	Straight Lengths:	1 1/4-inch to 8-inch	20 ft. (6.1m)	N/A
ACR	Blue	ASTM B 280	Air Conditioning Refrigeration Natural Gas Liquified Petroleum (LP) Gas	Straight Lengths:	1/4-inch to 4 1/8-inch	20 ft. (6.1m)	20 ft. (6.1m) ¹
					Coils:	1/8-inch to 1 5/8-inch	–
OXY MED OXY/MED OXY/ACR ACR/MED	Type K Green	ASTM B 819	Medical Gas	Straight Lengths:	1/4-inch to 8-inch	20 ft. (6.1m)	N/A
	Type L Blue						
Type G	Yellow	ASTM B 837	Natural Gas Liquified Petroleum (LP) Gas	Straight Lengths:	3/8-inch to 1 1/8-inch	12 ft. (3.7m)	12 ft. (3.7m) ¹
						20 ft. (6.1m)	20 ft. (6.1m) ¹
				Coils:	3/8-inch to 7/8-inch	–	60 ft. (18.3m) ¹
					–	100 ft. (30.5m) ¹	

¹ Available as special order only.

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