Hunter®

THE HANDBOOK OF TECHNICAL IRRIGATION INFORMATION

A Complete Reference Source for the Professional

RESIDENTIAL & COMMERCIAL IRRIGATION
Built on Innovation®

PREFACE

Hunter's Handbook of Technical Irrigation Information is a reference guide for all professionals whose livelihood takes them into the realm of irrigation. Contractors, architects, designers and engineers alike are now able to benefit from the wide spectrum of information that has been gathered from numerous sources into a single document.

For additional information on irrigation, visit our website at hunterindustries.com

FORMULAS

Slope, as used in irrigation, is a measure of the incline of an area. It can be described as (1) a percent, formula "A", (2) a degree, formulas "B" and "C", or (3) a ratio, formula "D". The greater the incline, the greater the tendency for runoff.

A. The percent of slope can be determined by dividing the net change in elevation between two points (Rise) by the horizontal distance between those two points (Run).

$$S = \frac{Rise}{Run}$$
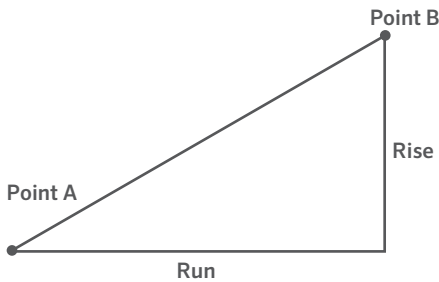
Where:

S = the percent of slope

Rise = the net elevation change in elevation between two points

Run = the horizontal distance between the two points

Note: The units for Rise and Run can be any unit of linear measure, but they must be the same for both the Rise and Run.

Example:
What is the slope for a bank 40 ft. wide (run) on which the elevation at the top (point "B") is 20 ft. higher than the toe of the slope (point "A")

$$S = \frac{20}{40}$$

$$S = 0.50 \; or \; 50\%$$

B. The degree of slope describes a slope as the angle of the slope (at "A") from the horizontal plane. This method is useful when taking field measurements as "c" represents the measured distance up a slope and "a" equals the elevation change.

$$\sin A = \frac{a}{c}$$

Where:

A = the angle

a = the height of the right triangle

c = the length of the hypotenuse of a right triangle

Example:
a = 20 feet
c = 44.72 feet

$$\sin A = \frac{20}{44.72}$$

$$\sin A = 0.4472 \quad A = 26°\,34'$$

SLOPE *(continued)*

C. The degree of slope describes a slope as the angle of the slope (at "A") from the horizontal plane. This method is useful when determining the slope from plot plans that include elevation. In this diagram "b" represents the horizontal distance between points "A" and "B" and "a" equals the elevation change between points "A" and "B."

$$\tan A = \frac{a}{b}$$

Point B

a

Point A

b

Horizontal Plane
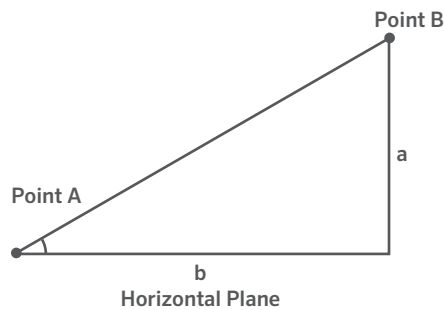
Where:

A = the angle

a = the height of the right triangle

b = the horizontal distance

Example:

a = 20.0 feet
b = 40.0 feet

$$\tan A = \frac{20.0}{40.0}$$

$$\tan A = 0.4472 \quad A = 26°34'$$

D. Describing a slope as a ratio such as 2:1, 1:1 or 4:1, indicates the number of feet of runfor every one foot of rise. For instance a 2:1 slope indicates there would be two feet ofhorizontal distance for every one foot change of elevation. A 1:1 would change one foot of elevation for every one foot of horizontal run.

This can be calculated by dividing the amount of elevation change by the horizontal distance over which this change occurred.

$$Sr = \frac{Rise}{Run} : 1$$

Point B

Rise

Point A

Run
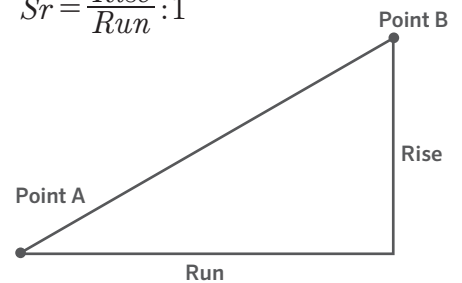
Where:

Sr = the slope ratio

Rise = the net elevation change between two points

Run = the horizontal distance between the two points

Note: the units for Rise and Run can be any unit of linear measure, but they must be the same for both the Rise and Run.
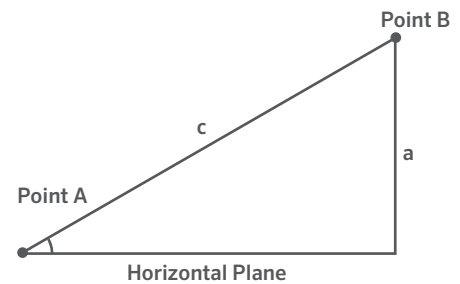
Example:

A slope on a project is 20 feet high (rise) over a distance of 40 feet (run). What is the slope ratio?

$$Sr = \frac{40}{20} : 1$$

$$Sr = 2:1$$

Note: See page 46 and page 47 for more information on slopes.

Dynamic pressure is the pressure when water is flowing in the system. Dynamic pressure in a system can be determined by flow tests, using pressure gauges or by calculation if information on pipe types and sizes, valves, meters or other appurtenances are known. The dynamic pressure can be calculated at a given point in the system by starting with a known dynamic pressure at some point, adjusting for elevation change and subtracting friction losses in pipe, fittings, valves, meters, etc. as shown below:

$$Dynamic\ Pressure = (PSI_{dynamic} \pm h_{e\ elevation}) - h_{f\ pipe} - h_{f\ fittings} - h_{f\ valves}$$

Where:

$PSI_{dynamic}$ = the known dynamic pressure at a given point in PSI

$h_{e\ elevation}$ = pressure change due to elevation in PSI

$h_{f\ pipe}$ = the PSI loss due to friction losses in the pipe

$h_{f\ fittings}$ = the PSI loss due to friction losses in fittings

$h_{f\ valves}$ = the PSI loss due to friction losses in valves, meters or other appurtenances between the source and the given point in the system
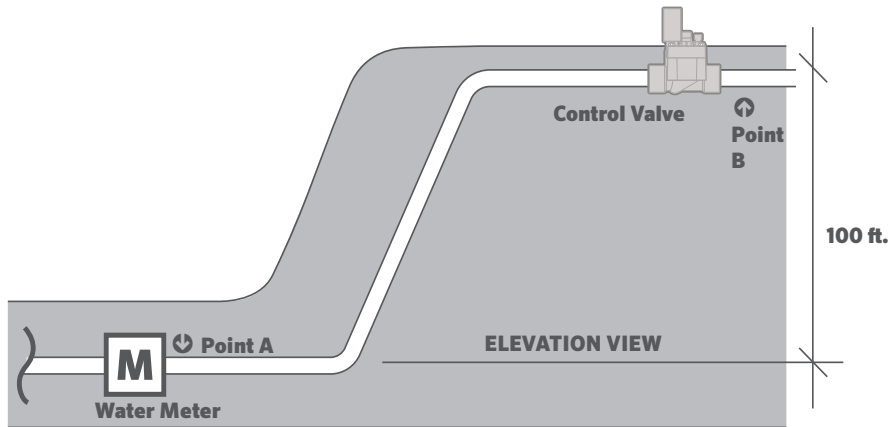
Example:

In the diagram above the dynamic pressure at point "A" is 90 PSI. The pipe is 2 inch class 315 PVC, 200 ft. from point "A" to point "B" with a flow rate of 40 GPM. According to the manufacturer, the control valve will lose 1.0 PSI at 40 GPM.

90.00	PSI at point "A"
− 43.30	PSI loss due to elevation gain (100 ft x 0.433 PSI per feet)
46.70	PSI at point "B"
− 2.82	PSI friction loss in pipe (1.41 PSI loss per 100 feet x 200 feet / 100)
43.88	Subtotal
− 0.28	PSI friction loss in fittings (estimate, 10% of friction loss in pipe)
43.60	Subtotal
− 1.00	PSI loss in valve (from manufacturer data)
42.60	PSI dynamic pressure at point "B"

FRICTION FACTOR PIPE SIZING

This Friction Factor is used to determine the maximum flow in gallons per minute through any section of lateral line pipe while not exceeding a predetermined pressure loss (pressure variation). In order to minimize uneven distribution, sprinklers should operate with pressure variation between sprinklers of not more than ± 10 to ± 20% of the desired sprinkler operating pressure.

$$F_f = \frac{P_0 \times P_v}{L_c}$$

Where:

F_f = Friction Factor, the allowable pressure loss per 100 feet of pipe, in psi

P_O = Sprinkler operating pressure in PSI

P_v = Pressure Variation allowed between the valve and the last sprinkler on the circuit being sized, usually 10% or 20% of the desired sprinkler operating pressure

L_c = Critical Length of pipe from control valve to farthest head in hundreds of feet

Example:

A) You must determine the amount of pressure variation you can allow between the valve and the last sprinkler head. This is usually 10% to 20% of the operating pressure of the sprinklers on that particular section. For this example we will use 10% (0.10) variation.

If a control valve operates a group of sprinklers which require 30 PSI to operate (operating pressure = P_O) the 10% pressure variation (pressure variation = P_v) would allow a total variation of 3.0 PSI from the valve to the farthest head. (0.10 x 30 PSI = 3.0 PSI)

B) Determine the Critical Length (Lc)
Next you must determine the distance the water travels from the control valve to the farthest head. That is not necessarily the total length of pipe in the section but just the length of the pipe through which the water flows from the valve to the farthest head. Divide this number by 100 to determine the hundreds of feet from the valve to the farthest head.

This is called the Critical Length and represents the hundreds of feet of pipe in which you can afford to lose the pressure you determined was acceptable for pressure variation in step "A".

⊗ = Control Valve for these sprinklers

● = Sprinkler head requiring 30 PSI and delivering 2.0 GPM at that pressure

20 ft.

40 ft.

80 ft.   40 ft.   60 ft.
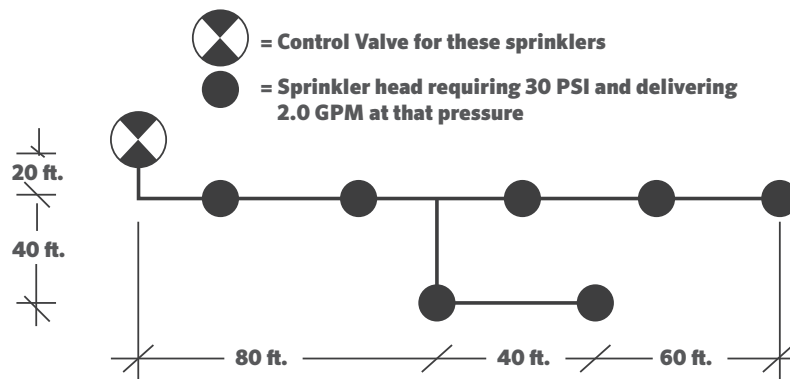
Figure 1

In this diagram you must decide the path the water flows from the valve to the farthest head and calculate that distance in feet. The water flow path is shown in Fig. 2 and is represented by the pipe with the check pattern. Notice the distance of the branch line is NOT included in the distance. This is because the water flowing to the farthest head does not travel down that length of pipe and therefore any pressure loss occurring in the branch does not affect the pressure in the Critical Length.
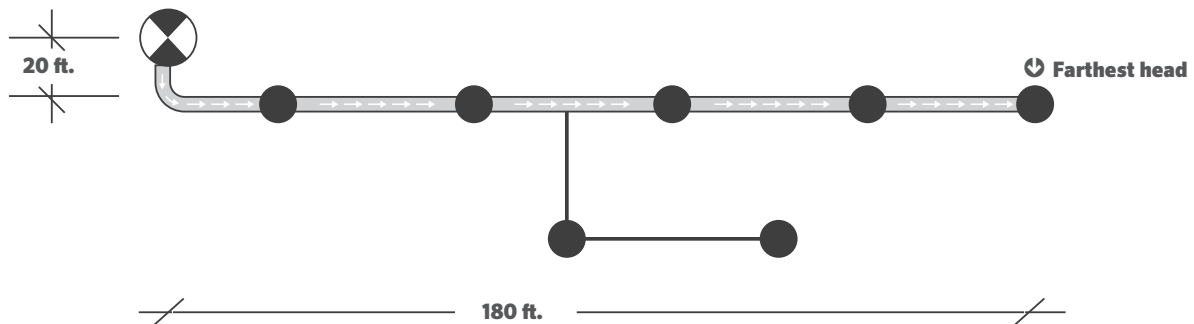
Figure 2

In Fig. 2 the water traveling from the valve to the farthest head must pass through 200 feet of pipe. This divided by 100 gives a Critical Length (L_C) in hundreds of feet, of 2.0.

C) Determine the rate at which you can lose pressure in the pipe. This is called the Friction Factor (Ff) which is the allowable PSI loss per one hundred feet of pipe. We can determine this allowable rate of loss by dividing the allowable pressure loss (in PSI) by the critical length (in hundreds of feet) by using the formula below.

The sprinklers mentioned in (Fig. 1) require 30 PSI to operate and a distance from the valve to the farthest head of 200 feet. Using the formula below we can determine the Friction Factor.

$$F_f = \frac{P_o \times P_v}{L_c / 100'}$$

$$F_f = \frac{30 \times 0.10}{200/100}$$

$$F_f = \frac{3}{2}$$

$$F_f = 1.5 \; allowable \; PSI \; loss \; per \; 100 \; ft \; of \; pipe$$

The Friction Factor indicates that the pipe is to be sized so that no section of pipe exceeds a pressure loss of 1.5 PSI per 100 ft. This ensures that over the 200 feet from the valve to the farthest head, the total PSI loss will not exceed the 3.0 PSI allowable loss (10% of the sprinkler operating pressure). The Friction Factor can be used like a budget. It gives us a guideline by which we can size the pipe without having excessive pressure loss in any section.

For the lateral pipes (those downstream of the control valve) use Class 315 PVC for Z\x inch pipe and Class 200 PVC for all larger sizes. Although this requirement for Class 315 and Class 200 is not mandatory and may vary on many larger installations, it is typical for landscape projects from residential through medium commercial projects in the South and Western United States.

Find the Chart for the Friction Factor closest to the one calculated for your sprinkler system section. (In this case there is a chart for a Friction Factor of 1.5 PSI allowable loss per 100 ft. When there is no chart for the exact Friction Factor calculated, round off the Friction Factor to the nearest chart value.)

Figure 3 represents a portion of the Friction Factor Shortcut chart from page 52. The chart in the appendix should look like Fig. 3 shown below.

Friction Factor	1.50 Max. GPM
½" CL 315 PVC	2.8
¾" CL 200 PVC	5.7
1" CL 200 PVC	10.8
1¼" CL 200 PVC	19.9
1½" CL 200 PVC	28.5
2" CL 200 PVC	51.1
2½" CL 200 PVC	84.3
3" CL 200 PVC	141.4

Figure 3

The "Max. GPM" listed in the chart represent the maximum GPM that each pipe type/size can sustain without exceeding a 1.5 PSI loss per 100 feet.

Using the maximum flow rates in the chart as guides, the lateral line pipes can be sized with the assurance the total PSI loss from the control valve to the farthest sprinkler will not exceed 10% of the sprinkler operating pressure (3.0 PSI).

First determine the quantity of water in GPM passing through each section of pipe. A section may need to be sized differently if there is any change in the GPM so it is important to determine the flows carefully. Figure 4 lists the GPM flowing through each section of pipe. Notice the section labeled "10" GPM. The 10 GPM is the flow to all sprinkler heads beyond that point and includes both the straight run and the branch line.
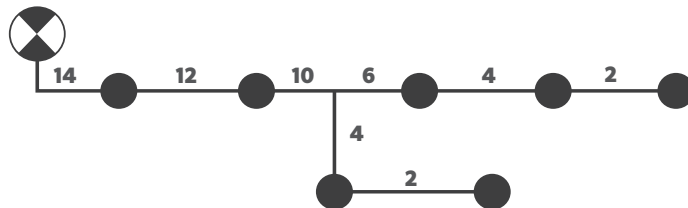
Figure 4

Using the chart (Fig. 3) as a guide, sizes can be assigned to each pipe section.
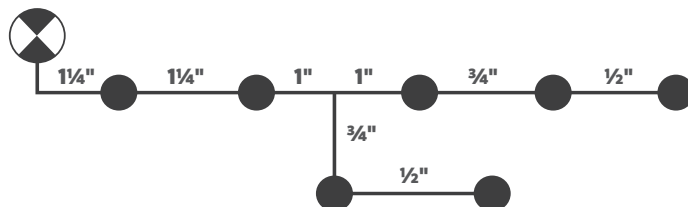
Figure 5

Note that in the section with 6 GPM we used 1" pipe. The chart allows up to 5.7 GPM in ¾" pipe and some designers may choose to use ¾" instead of 1". It is acceptable to use ¾" pipe even though it exceeds the allowable loss (the Friction Factor), because pressure is conserved in some sections where the flow is below the maximum allowed.

FRICTION LOSS IN PIPE

The Hazen-Williams equation can be expressed as follows and is the most commonly used formula for calculating pressure loss in PVC pipe.

$$h_f = 0.00090914 \left(\frac{100}{C}\right)^{1.852} \frac{Q^{1.852}}{d^{4.866}} L$$

Where:

h_f = Head loss due to friction in pounds per square inch (PSI)

C = Hazen Williams coefficient for roughness of the inside of the pipe

Q = Flow in gallons per minute (GPM)

d = Inside diameter of pipe in inches

L = Length of pipe in feet

Example:

A 2-inch class 200 PVC pipe (I.D. = 2.129") 500 feet in length will deliver 50 GPM to an irrigation system. Compute the friction loss in the pipeline.

$$h_f = 0.00090194 \left(\frac{100}{150}\right)^{1.852} \left(\frac{50^{1.852}}{2.129^{500}}\right) 500$$

$$h_f = 7.544 \; PSI$$

STATIC PRESSURE DETERMINATION

Static pressure is the measure of pressure when the water is at rest. This pressure is determined by the weight of a column of water resting on one square inch and expressed as the pounds per square inch (PSI). The weight of a column of water one foot high will create 0.433 pounds of pressure over every square inch. Static pressure can be determined as follows:

$$P_s = A \pm 0.433 \, H$$

Where:

P_S = Static pressure at a given point in the system, in pounds per square inch (PSI)

A = Static pressure at starting point in PSI

0.433 = A constant representing the weight of water in a column one foot high as expressed in pounds per square inch

H = The net vertical change in elevation from the surface of the water to the given point in the system in feet, increase in elevation, uphill, results in PSI loss (−0.433) downhill results PSI gain (+0.433)

Control Valve

40 ft (12 m)

Water Meter

M

ELEVATION VIEW

🎧 **Point A**

60 PSI (414 kPa) (Static pressure)
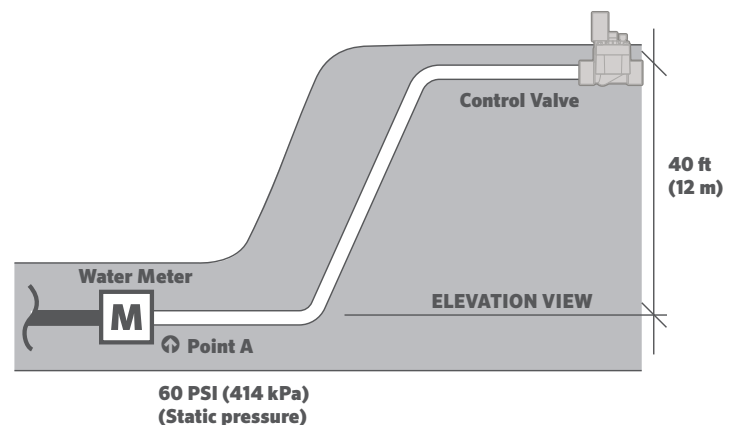
STATIC PRESSURE DETERMINATION *(continued)*

Example:
Determine the static pressure at the entrance to the control valve if the static pressure at the meter is 60 PSI. (Note: If change in elevation is downhill, the elevation change (H) would be a positive.)

$$P_s = 60 - (0.433 \times 40)$$
$$P_s = 42.68 \; PSI$$

For static pressure in metric units, use:

$$P_s = A - 9.79\,H$$
$$P_s = 414 - (9.79 \times 12)$$
$$P_s = 296.52 \; kPa$$

Where:

P_S = Static pressure at a given point in the system, in kiloPascals (kPa)

A = Static pressure at starting point in kPa

9.79 = A constant representing the weight of water in a column one meter high as expressed in kPa

H = the net vertical change in elevation from the surface of the water to the given point in the system in meters

VELOCITY HEAD

The velocity head is the pressure required to move the water through the system.

$$H_v = V^2 / 2g$$

Where:

H_V = velocity head, the energy required to move the water at the intended velocity, in feet

V = water velocity, in feet per second

g = acceleration due to gravity (32.2)

Example:
What is the Velocity Head required to move 40 GPM through a 2 inch Class 315 PVC pipe?

$$H_v = (4.15)^2 / 64.4$$
$$H_v = 0.27 \; feet$$

VELOCITY OF FLOW

The velocity of flow is a calculation of the speed of water moving in a closed pipe system.

$$V = 0.408 \frac{Q}{d^2}$$

Where:

V = flow velocity in feet per second (fps)

Q = flow in gallons per minute (GPM)

d = inside diameter of pipe in inches

0.408 = constant used to convert units into feet per second

Example:
What is the velocity of flow for a 1 inch class 200 PVC pipe (1.169 inch I.D.) with a flow rate of 10 GPM?

$$V = 0.408\left(\frac{10}{(1.169)^2}\right)$$
$$V = 2.99 \; fps$$

WATER HAMMER

This formula is used to estimate the total surge pressure developed when there is a sudden reduction or cessation in the velocity of flow. This is typical when a control valve closes.

$$P_t = P_o + \left(\frac{V \times L \times 0.07}{t} \right)$$

Where:

P_t = the total pressure developed, in PSI

P_o = the operating pressure at the time of valve closing, in PSI

V = velocity at the time the reduction in velocity occurred, in feet per second

L = Length of straight pipe between source and point where reduction in velocity occurred, this would be the longest section, in feet (straight pipe means no tee or ell fittings)

t = seconds during which the velocity was reduced, for example, a valve that closes in a half second would have a value for "t" of 0.5

0.07= constant used to convert velocity, length and time into pressure

Example:

An electric remote control valve has a hydraulic closure time of 0.8 seconds. The main line leading to the valve is 450 feet long with a velocity of 4.2 fps. The system is operating at 65 PSI at the time of valve closure. What is the total surge pressure?

$$P_t = 65 + \left(\frac{4.2 \times 450 \times 0.07}{0.8} \right)$$
$$P_t = 65 + \frac{132.3}{0.8}$$
$$P_t = 230.38 \; PSI$$

AB 1881, CALIFORNIA CALCULATION OF MAXIMUM APPLIED WATER ALLOWANCE (MAWA)

The Maximum Applied Water Allowance (MAWA) is used to determine the amount of water a project will be allowed to use for landscape purposes. This amount determines the limit for projected water use. Projects must be designed with an Estimated Total Water Use (ETWU) less than the limit allowed in the MAWA calculation. The use of this formula is mandated by California State Assembly Bill 1881.

$$MAWA = (ET_o)(0.62)[(0.7 \times LA) + (0.3 \times SLA)]$$

Where:

MAWA	=	Maximum Applied Water Allowance (gallons per year)	0.62	=	Conversion Factor (to gallons)
			0.7	=	ET Adjustment Factor (ETAF)
Et_O	=	Reference Evapotranspiration (inches per year)	LA	=	Landscape Area including SLA (square feet)
			0.3	=	Additional Water Allowance for SLA
			SLA	=	Special Landscape Area (square feet)

Example:

(1) A hypothetical landscape project in Fresno, CA, with an irrigated landscape area of 50,000 square feet without any Special Landscape Area (SLA= 0, no edible plants, recreational areas, or use of recycled water). To calculate MAWA, the annual reference evapotranspiration value for Fresno is 51.1 inches.

$$MAWA = (51.1in)(0.62)[(0.7 \times 50,000ft^2)(0.3 \times 0)]$$
$$= 1,108,870 \; gallons \; per \; year$$

To convert from gallons per year to hundred-cubic-feet per year:

$$= \frac{1,108,870}{748} = 1,482 \; hundred \; cubic\text{-}feet \; per \; year$$
$$(100 \; cubic\text{-}feet = 784 \; gallons)$$

(2) In this next hypothetical example, the landscape project in Fresno, CA, has the same ETo value of 51.1 inches and a total landscape area of 50,000 square feet. Within the 50,000 square foot project, there is now a 2,000 square foot area planted with edible plants. This 2,000 square foot area is considered to be a Special Landscape Area.

$$MAWA = (51.1 \, in)(0.62)[(0.7 \times 50,000ft^2) + (0.3 \times 2,000ft^2)]$$
$$= 31.68 \times [35,000 + 600] gallons \; per \; year$$
$$= 31.68 \times 35,600 \; gallons \; per \; year$$
$$= 1,127,808 \; gallons \; per \; year \; or \; 1,508 \; hundred \; cubic\text{-}feet \; per \; year$$

For complete information about the California Model Water Efficient Landscape Ordinance, visit the California Department of Water Resources website at:
http://www.water.ca.gov/wateruseefficiency/landscapeordinance/technical.cfm

AB 1881, CALIFORNIA CALCULATION OF ESTIMATED TOTAL WATER USE (ETWU)

This formula is used to calculate the estimated amount of water used in a landscape. The ETWU must be less than the Maximum Applied Water Allowance (MAWA), as shown in the previous formula, in order to receive project approval. The use of this formula is mandated by California State Assembly Bill 1881.

$$ETWU = (ET_o)(0.62)\left(\frac{PF \times HA \times SLA}{IE}\right)$$

Where:

ETWU	=	Estimated Total Water Use per year (gallons)
ET_o	=	Reference Evapotranspiration (inches)
PF	=	Plant Factor from WUCOLS (see Section 491)
HA	=	Hydrozone Area [high, medium, and low water use areas] (square feet)
SLA	=	Special Landscape Area (square feet)
0.62	=	Conversion Factor
IE	=	Irrigation Efficiency (minimum 0.71)

Example:

Using example 1 from page 11, determine the ETWU of an irrigated landscape area of 50,000 square feet without any Special Landscape Areas (SLA=0, no edible plants, recreational areas, or use of recycled water). The ET_O value is 51.1 inches annually, and the plant water use type, plant factor, and hydrozone area are shown in the table below.

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	10,000	7,000
3	Medium	0.5	16,000	8,000
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
			Sum	**24,700**

*Plant Factor from WUCOLS

$$ETWU = (51.1)(0.62)\left(\frac{24,700 + 0}{0.71}\right)$$
$$= 1,102,176 \; gallons \; per \; year$$

Compare ETWU with MAWA: For this example MAWA = (51.1) (0.62) [(0.7 x 50,000) + (0.3 x 0)] = 1,108,870 gallons per year. The ETWU (1,102,176 gallons per year) is less than MAWA (1,108,870 gallons per year). In this example, the water budget complies with the MAWA.

Using example 2 from page 11, determine the ETWU of an irrigated landscape area of 50,000 square feet with 2,000 square feet of edible plants (Special Landscape Area). The ETo value is 51.1 inches annually, and the plant water use type, plant factor, and hydrozone area are shown in the table below.

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)*	Hydrozone Area (HA) (square feet)	PF x HA (square feet)
1	High	0.8	7,000	5,600
2	High	0.7	9,000	6,300
3	Medium	0.5	15,000	7,500
4	Low	0.3	7,000	2,100
5	Low	0.2	10,000	2,000
			Sum	23,500
6	SLA	1.0	2,000	2,000

*Plant Factor from WUCOLS

$$ETWU = (51.1)(0.62)\left(\frac{23,500}{0.71} + 2,000\right)$$
$$= (31.68)(33,099 + 2,000)$$
$$= 1,111,993 \; gallons \; per \; year$$

Compare ETWU with MAWA. For this example:

$$MAWA = (51.1)(0.62)[(0.7 \times 50,000) + (0.3 \times 2,000)]$$
$$= 31.68 \times [35,000 + 600]$$
$$= 31.68 + 35,600$$
$$= 1,127,808 \; gallons \; per \; year$$

The ETWU (1,111,993 gallons per year) is less than MAWA (1,127,808 gallons per year). For this example, the water budget complies with the MAWA.

For complete information about the California Model Water Efficient Landscape Ordinance, visit the California Department of Water Resources website at:

http://www.water.ca.gov/wateruseefficiency/landscapeordinance/technical.cfm

MAXIMUM SYSTEM CAPACITY REQUIREMENT

The following formula is to be used to determine the gallons per minute (GPM) necessary for peak water demand periods. While an area might survive for short periods with less water by utilizing soil moisture reserves, extended periods of drought would require the maximum system capacity. The formulas below are a guide—the answer is no better than the factors that go into the formula (e.g. Reference Evapotranspiration Rate, Area, Distribution Uniformity, etc.).

GPM per hydrozone(s): This formula is used to determine the maximum water required, in GPM, from the source based on the hydrozone's characteristics.

$$GPM = \frac{0.0104 \times Et_o \times Area \times K_c}{DU \times Hrs.\ Available}$$

Variable Value Ranges:

GPM = gallons per minute required

Et_O = peak daily evapotranspiration for the worst case scenario in inches

Area = area to be irrigated in square feet

K_C = Crop Coefficient (use 1.0 if actual crop coefficient is not known)

DU = distribution uniformity or irrigation efficiency

Hrs. Available = hours available for irrigation each day in the worst case

0.0104 = constant for conversion of area, flow and inches per day, etc. into common units

Example:

A park has been designed with 450,000 square feet of turf, and all areas must be irrigated between 10 p.m. and 6 a.m. The crop coefficient is 60% (0.6) with an average peak evapotranspiration rate of 0.35 inches per day. The system distribution uniformity has been estimated to be 65%. What will be the maximum GPM required for the park?

$$GPM = \frac{0.0104 \times 0.35 \times 450,000 \times 0.60}{0.65 \times 8}$$

$$GPM = 189$$

Total Area for Given GPM: This formula may be used to determine the area that can be irrigated if you know the gallons per minute of the water supply.

$$Area = \frac{GPM \times DU \times Hrs.\ Available}{0.0104 \times Et_o \times K_c}$$

Where:

Area = area to be irrigated in square feet

GPM = gallons per minute available from the water supply

DU = Distribution Uniformity or Irrigation Efficiency

Hrs. Available = hours available for irrigation on the worst case day

Et_O = peak daily evapotranspiration for the worst case scenario

K_C = Crop Coefficient (use 1.0 if actual crop coefficient is not known)

0.0104 = constant for conversion of area, flow and inches per day etc. into common units

Example:

A developer has a well on the site of a proposed golf course. The well will produce 350 GPM. The course will be designed with a distribution uniformity of 75%, and a watering window of 12 hours. The peak evapotranspiration rate in the area is 0.30 inches per day and the turf has a crop coefficient of 80% (0.80). How large an area can be watered with the existing well?

$$Area = \frac{350 \times 0.75 \times 12}{0.0104 \times 0.30 \times 0.80}$$

$$Area = 1,262,019\ ft^2\ (approx.\ 29\ acres)$$

MAXIMUM SYSTEM CAPACITY REQUIREMENT *(continued)*

Total Area for Given Gallons Per Day: This formula may be used to determine the area that can be irrigated if you know the gallons available per day. This is the case in some water rationing systems or where a well capacity is the limiting factor.

$$Area = \frac{DU \times Gallons}{0.62333 \times Et_o \times K_c}$$

Where:

Area = area to be irrigated in square feet

DU = Distribution Uniformity or Irrigation Efficiency

Gallons = gallons available from the water supply on the worst case day

Et_O = evapotranspiration for the worst case scenario

K_C = Crop Coefficient – use 1.0 if actual crop coefficient is not known

0.62333 = constant for conversion of area, flow and inches per day, etc. into common units

Example:

The city has developed guidelines that allot a commercial project 36,000 gallons of water per day during an extended drought. The area being watered has a distribution uniformity of 60%, an average evapotranspiration rate of 0.22 inches per day and an average crop coefficient of 70% (0.70). How much of their project can be sustained with the city's water allotment?

$$Area = \frac{0.60 \times 36,000}{0.62333 \times 0.22 \times 0.70}$$

$$Area = 225,017 \; ft^2 \; (approx. \, 5.2 \, acres)$$

BREAK HORSEPOWER

This formula determines the amount of power required at the pump shaft based on the pump efficiency. It does not take into account any losses in the engine or electric motor.

$$BHP = \frac{Q \times h}{3960 \times E_f}$$

Where:

BHP = brake horsepower (1 HP = 550 ft-lbs/sec)

Q = pump discharge in gallons per minute (GPM)

h = total dynamic head in feet

3960 = constant for conversion of units to brake horsepower

E_f = pump efficiency (decimal)

Example:

A pump with an efficiency of 85% is pumping 500 GPM with a total dynamic head of 230 feet. What is the brake horsepower required to drive the pump?

$$BHP = \frac{500 \times 230}{3960 \times 0.85}$$

$$BHP = 34.17$$

HORSEPOWER REQUIRED IN PUMPING WATER

This formula is used to determine the brake horsepower requirements.

$$BHP = \frac{ft \times GPM}{3960 \times E_f}$$

Where:

BHP = Brake Horsepower

ft = the number of feet the water is lifted from the surface of the water source to the discharge point

GPM = the gallons per minute being pumped

3960 = constant for conversion to horsepower

E_f = pump efficiency (decimal)

Example:

A pump system is needed to pump 500 GPM from a river 70 feet up to a golf course water reservoir. What is the minimum horsepower required to pump this water? This pump is rated at 75% efficient.

$$HP = \frac{70 \times 500}{3960 \times 0.75}$$

$$HP = 11.78 \approx 12$$

Brake horsepower is the power required at the pump shaft required to drive the pump.

NET POSITIVE HEAD AVAILABLE

The Net Positive Suction Head available is the absolute pressure available at the pump impeller. The Net Positive Suction Head Available (NPSHA) must exceed the Net Positive Suction Head Requirement (NPSHR) or cavitation will cause damage to the pump impeller. The NPSHR is determined by the pump manufacturer and is dependent upon pump design and operating conditions.

$$NPSHA = (H_o - H_v) - H_s - H_f$$

Where:

H_O = atmospheric pressure in feet of water

H_v = saturation vapor pressure in feet of water

H_S = vertical height of the impeller eye above the water surface in feet

h_f = pressure loss due to friction in the suction (intake) line in feet of head (pressure losses in PSI must be multiplied by 2.31 to convert to feet)

Example:

Use the diagram and the chart to determine the Net Positive Suction Head Available. The pump is located 3,000 feet above sea level, the water temperature is 60° F. The intake line is 20 feet long and the flow rate is 100 GPM. The pressure loss through the foot valve is 1.5 PSI and the pressure loss through the fittings is estimated at 0.5 PSI.

$$NPSHA = 30 - 6 - (1.5 \times 2.31) - (0.33 \times 0.2 \times 2.31) - (0.5 \times 2.31)$$

$$NPSHA = 19.21 \; feet \; of \; head$$

The Net Positive Suction Head Available (NPSHA) can be calculated by the formula above while the Net Positive Suction Head Required (NPSHR) varies from one pump model to another and can be found with the pump performance curves provided by the manufacturer. For any given pumping situation and pump model, the NPSHA must exceed the pump's NPSHR in order for the pump to operate properly and avoid cavitation.

$(H_o - H_v)$ FOR A RANGE OF TEMPERATURES AND ELEVATIONS

Water Temp. °F	Elevation Above Sea Level (ft)						
	0	1000	2000	3000	4000	5000	6000
40°	33.7	32.5	31.4	30.3	29.2	28.1	27.0
50°	33.6	32.4	31.3	30.2	29.1	28.0	26.9
60°	33.4	32.2	31.1	30.0	28.9	27.8	26.7
70°	33.2	32.0	30.9	29.8	28.7	27.6	26.5
80°	32.8	31.6	31.5	29.4	28.3	27.2	26.1
90°	32.4	31.2	30.1	29.0	27.9	26.8	25.7
100°	31.8	30.6	29.5	28.4	27.3	26.2	25.1
110°	31.1	29.9	28.8	27.7	26.6	25.5	24.4
120°	30.1	28.9	27.8	26.7	25.6	24.5	23.4
130°	28.9	27.7	26.6	25.5	24.5	23.3	22.2
140°	27.3	26.1	25.0	23.9	22.8	21.7	20.6
150°	25.4	24.2	23.1	22.0	20.9	19.8	18.7

4 inch Class 315 PVC

6 feet

Min. Water Level

Foot Valve
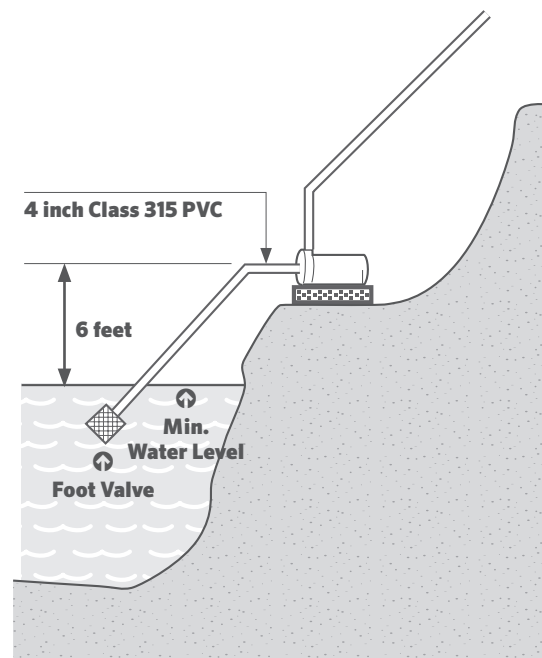
TOTAL DYNAMIC HEAD

Total Dynamic Head is the amount of pressure that one pump must generate or be available for proper sprinkler system operation. It represents the total of all pressure losses and requirements including: 1) pressure change due to elevation, 2) sprinkler operating pressure, 3) friction loss in pipes, fittings and valves and 4) the pressure required to move the water.

$$TDH = H_s + H_p + h_f + H_v$$

Where:

TDH = Total Dynamic Head is the maximum pressure the pump will be required to generate.

H_s = Static Head, the vertical distance in feet from the surface of the water source to the point of discharge, in feet.

H_p = Pressure Head, the pressure required at the discharge (sprinkler, emitter or discharge pipe) in feet. (If sprinkler PSI is used it must be multiplied by 2.31 to convert to feet.)

h_f = Friction Head, the pressure lost due to friction in pipe, valves and and fittings from the water intake to the discharge point, in feet. (If pressure loss is calculated in PSI, it must be multiplied by 2.31 to convert to feet.)

H_v = Velocity Head, the energy required to move the water at the intended velocity (see velocity head) in feet. Because this is an insignificant loss in Total Dynamic Head, it is sometimes ignored in these calculations.

Example:

Determine the Total Dynamic Head where the sprinkler operating pressure is 50 PSI, the maximum flow is 150 GPM, the intake line is 35 feet long and the discharge line is 450 feet. The pressure loss in the foot valve at that flow rate is given by the manufacturer to be 1 PSI. In this sample problem we ignore the pressure loss in fittings.

$$TDH = H_s + H_p + h_f + H_v$$

$$TDH = (90 + 6)(50 + 2.31) + \left[(35 + 450) \times \left(\frac{0.69}{100}\right) \times 2.31\right] + (1 \times 2.31) + \frac{4.25}{64.4}$$

$$TDH = 221.82 \; feet$$

4 inch Class 315 PVC

Pump

6 feet

Min.
Water Level

Foot Valve
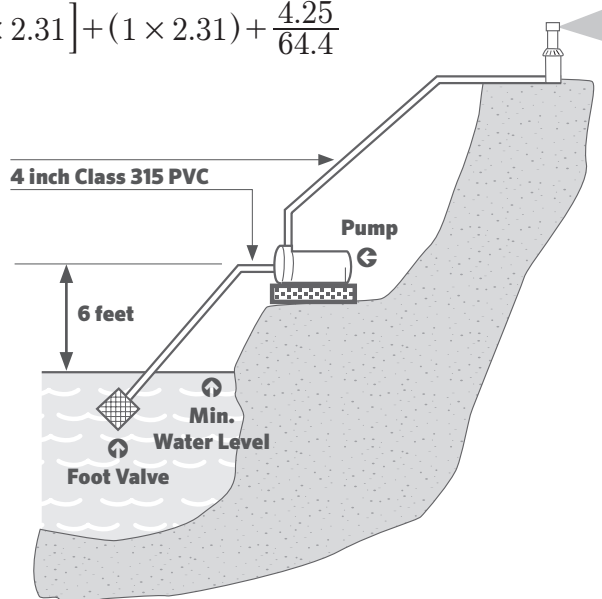
WATER HORSEPOWER REQUIREMENTS

This formula, also called Theoretical Horsepower, is used to calculate the amount of power required to pump a given volume of water at a specified head.

$$WHP = \frac{GPM \times TDH}{3960}$$

Where:

WHP = horsepower output required

GPM = gallons per minute flow from the pump

TDH = Total Dynamic Head in feet of head

3960 = constant used to convert flow and head into horsepower

Example:

What is the water horsepower requirement to pump 200 GPM at 350 feet of head?

$$WHP = \frac{200 \times 350}{3960}$$

$$WHP = 17.7$$

COEFFICIENT OF UNIFORMITY

This formula is used to measure the variability of water distribution over a given area. It is calculated by using a series of catchments and comparing the average (mean) catchment and the deviation from that average. This formula was developed by J.E. Christiansen.

$$C_u = 100\left(1.0\frac{\Sigma x}{mn}\right)$$

Where:

C_u = Uniformity Coefficient

x = the deviation of individual observations or catchments

Σx = the sum of the deviations of individual observations from the mean value, *m*

m = mean value of all observations in the distribution

n = number of observations in the distribution

100= constant for conversion to percent

Example:

In a landscape area, eight catchments are placed between sprinklers and the above observations recorded. What is the Coefficient of Uniformity?

$$C_u = 100\left(\frac{1.0 - 26.00}{46.75 \times 8}\right)$$

$$C_u = 93.0$$

Catchment #	Catchment Quantity (ml)	Deviation From Mean (mean = 46.75 ml)
1	48	1.25
2	51	4.25
3	44	2.75
4	41	5.75
5	45	1.75
6	44	2.75
7	50	3.25
8	51	4.25
Total		**26.00**

⟳ **Sprinkler Head**
⟳ **Catchment (number)**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧
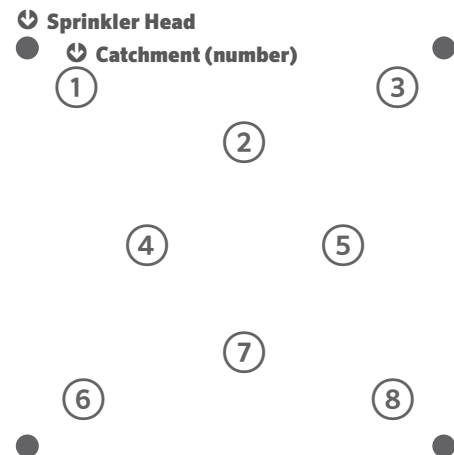
Note: catchment may be expressed in any convenient unit (i.e. milliliters, ounces, etc.), as long as all catchments are measured in the same units.

DISTRIBUTION UNIFORMITY

This formula is one of several that are titled Distribution Uniformity. It is used to estimate the variation in water application between sprinklers resulting from pressure variation, improper nozzle selection or lack of maintenance.

$$DU = 100 \times \left(\frac{MQ1}{M} \right)$$

Where:

DU = Distribution Uniformity expressed as a percent

MQ1 = mean of observations in lowest 25% of the distribution

M = mean of distribution

100 = constant for conversion to percent

Example:

Catchment #	Catchment Quantity after 15 Minutes in Milliliters
1	13*
2	18*
3	22
4	17*
5	19
6	23
7	19
8	21
9	22
10	23
11	24
12	22
Total	**243**

 * Lowest ¼ = 48

Note: catchment may be measured in any units (inches, ounces, millimeters, etc.)

$$DU = 100 \times \left(\frac{48 \div 3}{241 \div 12} \right)$$

$$DU = 100 \times \left(\frac{16}{20.25} \right)$$

$$DU = 100 \times 0.79$$

$$DU = 79\%$$
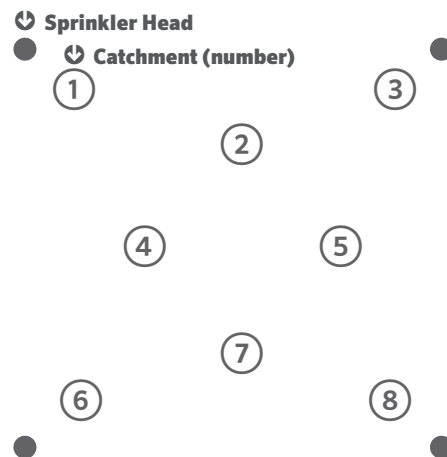
PRECIPITATION RATE

Two formulas are shown below, the first is most useful when comparing precipitation rates between different types of sprinklers or calculating precipitation rates on areas with a single type of sprinkler and uniform head and row spacing. The second method is better suited to areas where sprinkler head flows or spacing varies. **Metric versions are shown in parenthesis.**

Method #1: Individual Head Method

$$PR = \frac{34650 \times GPM \,(for\ any\ arc)}{Degrees\ Arc \times Head\ Spacing \times Row\ Spacing}$$

$$\left(PR = \frac{m^3/hr\,(for\ any\ arc) \times 360,000}{Degrees\ of\ Arc \times Head\ Spacing\,(m) \times Row\ Spacing\,(m)} = mm/hr\right)$$

$$\left(PR = \frac{l/\min\,(for\ any\ arc) \times 21,600}{Degrees\ of\ Arc \times Head\ spacing\,(m) \times Row\ Spacing\,(m)} = mm/hr\right)$$

Where:

PR = precipitation rate in inches per hour

GPM = flow for a given sprinkler of any arc, in gallons per minute

Degrees Arc = the arc of the given sprinkler in degrees

Head Spacing = the space between the heads in a row, in feet

Row Spacing = the space between rows of heads, in feet

34,650 = constant for conversion of area and flow into common units

Example:

What is the precipitation rate for a 270 degree sprinkler with 6.8 GPM spaced at 28' by 30'?

$$PR = \frac{34,650 \times 6.8}{270 \times 28 \times 30}$$

$$PR = 1.04\ inches\ per\ hour$$

Method #2 : Total Area Method

$$PR = \frac{96.25 \times Total\ GPM}{Total\ Area} \quad \left(PR = \frac{Total\ m^3/hr\ GPM}{Total\ Area\,(m^2)} = mm/hr\right) \quad \left(PR = \frac{Total\ l/\min \times 60}{Total\ Area\,(m^2)} = mm/hr\right)$$

Where:

PR = precipitation rate in inches per hour

Total GPM = total flow from all sprinklers in the given area in gallons per minute

Total Area = the given irrigated area in square feet

96.25 = constant for conversion of area and flow into common units

Example:

What is the average precipitation rate for a section of turf 325' by 80' if the total flow from all sprinklers in the area is 112 GPM.

$$PR = \frac{96.25 \times 112}{(325 \times 80)}$$

$$PR = 0.41\ inches\ per\ hour$$

PRECIPITATION RATE *(continued)*

This formula is used to determine the minimum precipitation rate than can be used to deliver the required water during the peak period of water usage.

$$Minimum\ PR = \frac{ET \times Total\ Acres}{Hours\ Avail. \times Acre\ per\ Section \times Valves \times Efficiency}$$

Where:

Minimum PR = minimum required precipitation rate in inches per hour

ET = amount of water to be applied in inches per day, including crop coefficient

Total Acres = the area to be irrigated in acres

Hours Avail. = hours available for irrigation each day

Acres per Section = average area covered by one control valve in acres

Valves = number of valves operating at one time

Efficiency = system operating efficiency in decimal equivalent of percent

Example:

What is the minimum precipitation rate that will deliver 0.28 inches of water to 15 acres under the following conditions:

• during a 12 hour period

• the average section is 0.40 acres (17,424 square feet)

• there will be two valves operating at one time

• the system efficiency is 75%

$$\frac{0.28 \times 15}{12 \times 0.40 \times 2 \times 0.75}$$

$$= 0.58\ inches\ per\ hour\ min\ imum\ precipitation\ rate\ required$$

HOW TO CALCULATE AREAS

Square or rectangle

$$A = L \times W$$

Where:

L = length

W = width

Example:

$$A = 90 \; ft \times 50 \; ft$$

$$A = 4,500 \; ft^2$$

W=50'

L=90'
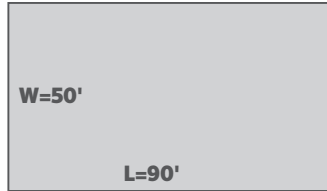
Ovals or egg shapes (within 5% accuracy)

$$A = 0.8 \; L \times W$$

Where:

L = length

W = width at midpoint

Example:

$$A = 0.8 \times 60 \times 40$$

$$A = 1,920 \; ft^2$$

L=60

W=40'
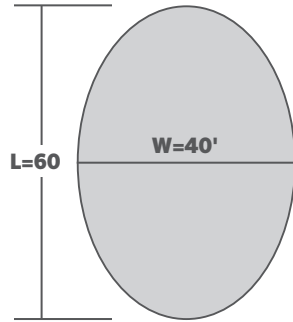
Circle (within 5% accuracy)

$$A = 0.8 \; D^2$$

Where:

D = diameter

Example:

$$A = 0.8 \times 50 \; ft \times 50 \; ft$$

$$A = 2,000 \; ft^2$$

R=25
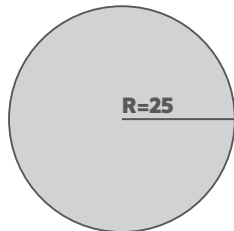
Unusual shapes

Divide the area into sections of regular geometric shapes, calculate the area of each section, then total:

Example:

$Area \; of \; triangle$

$+ \; Area \; of \; rectangle$

$+ \; Area \; of \; one\text{-}half \; of \; circle$

$= \; Total \; area$
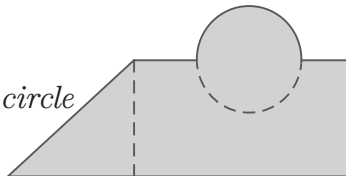
Irregular shapes

Find the length of the longest line across the area. Every 10 ft along the length line, measure the width of the area at right angles to the length line. Total all widths and multiply by 10.
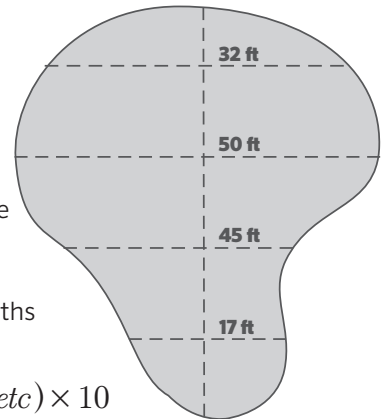
32 ft

50 ft

45 ft

17 ft

$$Area = (A + B + C, etc) \times 10$$

$$Area = (32 \; ft + 50 \; ft + 45 \; ft + 17 \; ft) \times 10$$

$$Area = 144 \times 10$$

$$Area = 1,440 \; ft^2$$

Triangle

$$Area = 0.5 \times B \times H$$

H=75

B=125

Where:

B = base

H = height

Example:

$$Area = 0.5 \times 125 \; ft \times 75 \; ft$$

$$Area = 4,687 \; ft^2$$
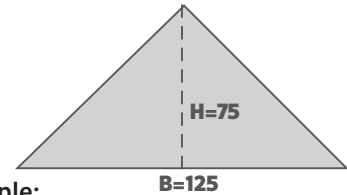
Trapezoid

$$Area = 0.5 \times (A + B) \times H$$

A=50

H=30

B=70

Where:

A = one parallel side

B = second parallel side

H = height perpendicular to parallel sides

Example:

$$Area = 0.5 \times (50 \; ft + 70 \; ft) \times 30 \; ft$$

$$Area = 0.5 \times 120 \; ft \times 30 \; ft$$

$$Area = 1,800 \; ft^2$$

Circle

$$Area = \pi r^2$$

R=30
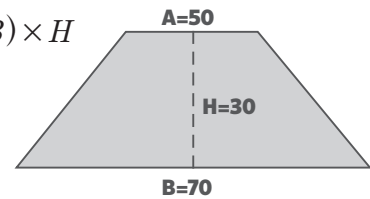
Where:

π = 3.14

R = radius

Example:

$$Area = 3.14 \times (30 \; ft \times 30 \; ft)$$

$$Area = 2,826 \; ft^2$$
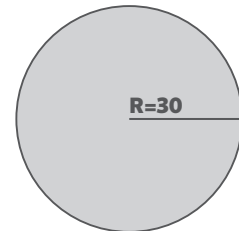
SCHEDULING COEFFICIENT

A scheduling coefficient is used to measure the uniformity of water distribution by relating the lowest precipitation rate for any contiguous region within an irrigated area to the overall precipitation rate of the entire area.

$$SC = \frac{PR}{LPR}$$

Where:

SC = Scheduling Coefficient, 1.0 would be perfect uniformity

PR = Precipitation Rate

LPR = Lowest Precipitation Rate in the irrigated area

Example:

In a catchment test, collectors are placed at two foot intervals. The average precipitation rate is calculated to be 1.6 inches per hour. The lowest precipitation rate of all catchments was 0.8 inches per hour. What is the Scheduling Coefficient?

$$SC = \frac{1.6}{0.8} \qquad SC = 2.0$$

IRRIGATION FREQUENCY

The Irrigation Frequency Formula calculates the maximum interval allowed between irrigation cycles. This irrigation interval is dependent on soil type, root zone depth, and water lost by evapotranspiration of a specific crop. The frequency, or "Set Days To Water", is calculated using the following formula:

$$F = \frac{AWHC \times RZ \times MAD}{ET_o \times K_c}$$

Where:

F = Irrigation frequency

AWHC = Available Water Holding Capacity is the moisture level in the soil which is above the plant's permanent wilting point, and below the soil's field capacity, in inches per foot

RZ = root zone, in feet

MAD = Management Allowable Depletion of water from the AWHC percent. MAD of 30-50% will sustain a healthy landscape.

ET_O = reference evapotranspiration rate, in inches per day

K_C = crop coefficient, decimal

Example:

A zone in your system is irrigating established warm season turf which is growing in a sandy loam on a slight slope with an available water holding capacity of 1 inch per foot of soil. The root depth of the turf is 9 inches. The average precipitation rate is 0.49 inches per hour. The system is located in San Marcos, CA where the daily moisture loss (ETo) to be replenished is 0.20 inches. The crop coefficient (Kc) is set at 70%. The allowable water depletion will be 50%.

$$F = \frac{1.0" \times 0.75' \times 50\%}{0.20" \times 0.70} = \frac{1.0 \times 0.75 \times 0.50}{0.20 \times 0.70}$$

$$F = 2.68$$

$$F = 2\,days$$

SPRINKLER RUN TIME

The sprinkler run time formula calculates the number of minutes required to apply enough water to replace the water lost by evapotranspiration for a specific crop irrigated with a system at a particular precipitation rate and efficiency.

The run time is calculated using the following formula:

$$T = \frac{60 \times D \times ET_o \times K_c}{PR \times IE}$$

Where:

T $\quad=\quad$ sprinkler run time in minutes

60 $\quad=\quad$ constant for conversion of area, flow, inches per hour and inches per day into common units

D $\quad=\quad$ watering frequency in days

ET_O $\quad=\quad$ reference evapotranspiration rate, in inches per day

K_C $\quad=\quad$ crop coefficient, decimal

PR $\quad=\quad$ precipitation rate of the area, in inches per hour

IE $\quad=\quad$ application efficiency of the system, percent

Example:

Determine the sprinkler run time for an athletic field with a daily ETo of 0.15 inches and a crop coefficient for the warm season turf of 0.70. The watering schedule is set for every three days. The sprinkler precipitation rate is 0.50 inches per hour with an application efficiency of 75%.

$$T = \frac{60 \times 3 \times 0.15" \times 0.70}{0.50" \times 75\%} \qquad = \frac{60 \times 30 \times 0.15 \times 0.70}{0.50 \times 0.75}$$

$$T = 50 \; minutes \; every \; 3 \; days$$

CONVERSIONS

VARIABLES AND UNITS

Symbol	Definition	Imperial Units	Metric Units
a	Cross-sectional area of pipe flow	inches^2	mm^2
A_r	Area of land	feet^2 acres	m^2, ha
A_e	Area of land	feet^2	m^2
AW	Available soil water	iches	centimeters
BP	Barometric pressure	feet	meters
C	Hazen-Willimas friction coefficient	none	none
C_u	Christiansen's coefficient of uniformity	percent	percent
d	Inside diameter of a pipe	inches	millimeters
d_v	Difference between an observed value and the mean value	inches^3	mL
D_t	Diameter of throw of sprinkler	feet	meters
DU	Distribution uniformity	percent	percent
E	Elevation of a point	feet	meters
EA	Application Efficiency	percent	percent
ET_c	Crop Evapotranspiration	inches per day	millimeters per day
ET_o	Reference Evapotranspiration	inches per day	millimeters per day
H	Energy head, usually sum of elevation and pressure	feet	meters
I	Electrical current	amps	A
ID	Inside diameter of pipe	inches	meters/meters
h_f	Energy loss due to friction	feet/feet	meters/meters
K_c	Crop Coefficient	percent	percent
kPa	Kilopascals	PSI	bars
k_s	Constant used to compute sprinkler spacing	none	none
L	Spacing between lateral lines	feet	meters
MAD	Management allowed depletion	none	none
MC	Maximum coverage for single row sprinklers	feet	meters
n	Number of observations in a uniformity test	none	none
NPSHA	Net positive suction head available	feet	meters
NPSHR	Net positive suction head required	feet	meters
OD	Outside diameter of pipe	inches	millimeters
P	Pressure of water	pounds per inch^2 (PSI)	kPa, bars
Pal	Allowable loss in pressure	pounds per inch^2 (PSI)	kPa, bars
Pav	Average pressure in a zone	pounds per inch^2 (PSI)	kPa, bars
PET	Potential evapotranspiration	inches per day	millimeters per day
PSI	Pounds per square inch		
PR	Precipitation rate	inches per hour	millimeters per hour
PL	Pressure losses due to friction	feet	meters
Po	Sprinkler operating pressure	PSI	kPa, bars
Pv	Pressure Variation	percent	percent
P_s	Static Pressure	PSI	kPa, bars
Q	Flow of water in a pipe or from a sprinkler	gallons per minute	liters per second
q_e	Flow of water	gallons per minute	1/minute, m^3/hr
R	Electrical resistance	ohms	
Rt	Radius of throw of sprinkler	feet	meters
RAW	Readily available water	inches	millimeters
S	Sprinkler spacing	feet	meters
SC	Scheduling coefficient	ratio	ratio
SD	Scalloped distance	feet	meters
t	Time of application or other timed events	h	h
TDH	Total dynamic head	feet	meters
v	Average velocity of water in a pipe	feet per second (fps)	meters per second
V_o	Electrical voltage	volts	V
VP	Vapor pressure of water	feet	meters
X	Mean of all values in Cu eq.		
X_{LQ}	Mean of the lower one-fourth of the application values, Du eq.		
z	Change in elevation between two points	feet	meters

CONVERSION TABLE

Note: Conversions listed in this manual are not exact. Refer to sources such as *Handbook of Chemistry and Physics* and *C.R.C. Standard Math Tables* by the Chemical Rubber Company, *Scientific Tables* by Ciba-Geigy Ltd., *Websters Desk Encyclopedia* by Griesewood and Dempsey, *Field Geologists Manual* by the Australian Institute of Mining and Metallurgy, *Conversion Factors* by Forney's Inc., *Conversions* by Cahn Instruments and *Technical Reference Handbook* by E.P. Rasis for more detailed conversions and specifications.

Convert From	Into	Multiply By
AREA		
acres	hectares or square hectometer	0.4047
	square feet	43,560
	square meters	4,047
	square miles	0.0015625
	square yards	4,840
	square inches	6,272,640
hectares	acres	2.471
	square centimeter	100,000,000
	square feet	107,629
	square meters	10,000
	square miles	0.00386
square centimeters	acres	2.4702×10^{-8}
	square feet	0.001076
	square inches	0.155
	square millimeters	100
	square miles	3.861×10^{-11}
	square yards	0.0001196
square feet	acres	2.2957×10^{-5}
	square centimeters	929.03
	square inches	144
	square meters	0.0929
	square miles	3.58701×10^{-8}
	square millimeters	9.29×10^{4}
	square yards	0.1111
square inches	acres	1.594×10^{-7}
	square centimeters	6.4516
	square feet	0.00694
	square meters	0.000645
	square miles	2.491×10^{-10}
	square millimeters	645.16
square kilometers	acres	247.105
	square centimeters	1.0×10^{10}
	square feet	1.07639×10^{7}
	square inches	1.550003×10^{9}
	square meters	1.0×10^{6}
	square miles	0.3861
	square yards	1.196×10^{6}

Convert From	Into	Multiply By
AREA *(continued)*		
square meters	acres	0.000247
	hectares	0.0001
	square centimeters	10,000
	square feet	10.7639
	square inches	1,550.003
	square kilometers	1.0×10^{-6}
	square miles	3.86×10^{-7}
	square millimeters	1×10^{6}
	square yards	1.195961
square miles	acres	640
	hectares	258.999
	square feet	2.78783×10^{7}
	square kilometers	2.58999
	square meters	258,999
	square yards	3,098,000 (3.098×10^{6})
square millimeters	square centimeters	0.01
	square feet	1.076×10^{-5}
	square inches	0.00155
	square meters	1.0×10^{-6}
square yards	acres	0.000207
	hectares	8.3613×10^{-5}
	square centimeters	8,361.27
	square feet	9
	square inches	1296
	square meters	0.8361
	square miles	3.228×10^{-7}
CONCENTRATION		
kilograms per hectare	pounds per acre	0.8924
part per million	grams per liter	0.001
	milligrams per liter	1
	ounces per ton (short)	0.0292
	percent	0.0001
	pounds per millions gallons	8.345
pounds per cubic foot	grams per cubic centimeter	0.016018
	kilograms per cubic meter	16.018
	pounds per cubic inch	5.787×10^{-4}
	pounds per cubic yard	27
FLOW		
cubic feet per minute	acre-feet per hour	0.00138
	acre-feet per minute	2.2956×10^{-5}
	cubic meters per second	0.00047195
	gallons (U.S.) per minute	7.48052
	liters per second	0.47193

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
FLOW *(continued)*		
cubic feet per second	acre-inches per hour	0.99173
	cubic meters per second	0.02832
	gallons (U.S.) per minute	448.83
	liters per minute	1,698.96
	liters per second	28.316
	millions gallons (U.S.) per day	0.64632
gallons (U.S.) per day	cubic feet per hour	0.00557
gallons (British) per hour	cubic meters per minute	7.5768×10^{-5}
gallons (U.S.) per hour	acre-feet per hour	3.0689×10^{-6}
	cubic feet per hour	0.13368
	cubic meters per minute	6.309×10^{-5}
	gallons per minute	0.0166667
	liters per hour	3.7853
gallons (U.S.) per minute	acre-feet per day	0.0044192
	cubic feet per hour	8.0208
	cubic feet per second	0.002228
	cubic meters per hour	0.2268
	cubic meters per second	0.000063
	gallons (U.S.) per hour	60
	liters per minute	3.7853
	liters per second	0.06308
liters per minute	cubic feet per minute	0.0353
	cubic feet per second	0.000588
	gallons per minute	0.26418
	gallons per second	0.004403
liters per second	cubic feet per minute	2.1189
	cubic feet per second	0.0353
	cubic yards per minute	0.07848
liters per second-square meter	gallons per minute-square foot	1.4726
millions of gallons per day	acre feet per day	3.0689
	acre inches per day	36.8266
	acre inches per hour	1.53444
	cubic feet per hour	5,570.023
	cubic feet per minute	92.834
	cubic feet per second	1.547
	gallons per hour	41,666.667
	gallons per minute	694.4444
pounds of water per minute	cubic feet per second	.000267
LENGTH		
centimeters	feet	0.03281
	inches	0.3937
	meters	0.01
	microns	10,000

Convert From	Into	Multiply By
LENGTH *(continued)*		
centimeters	miles (statute)	6.2137×10^{-6}
	millimeters	10
	mils	393.7
	picas (printers)	2.371
	points (printers)	28.4528
	yards	0.01094
feet	centimeters	30.48
	inches	12
	kilometers	3.048×10^{-4}
	meters	0.3048
	microns	304,800
	miles (statute)	0.000189
	millimeters	304.8
	yards	0.333333
inches	centimeters	2.54
	feet	0.08333
	meters	0.0254
	microns	25,400
	miles	1.578×10^{-5}
	millimeters	25.4
	mils	1,000
	yards	0.0278
kilometers	centimeters	100,000
	feet	3,280.84
	inches	39,370
	miles	0.62137
	millimeters	10^{6}
	yards	1,093.61
meters	centimeters	100
	fathoms	0.54681
	feet	3.28084
	furlongs	0.00497
	inches	39.3701
	kilometers	0.001
	miles	0.000621
	millimeters	1,000
	mils	39,370.08
	yards	1.0936
microns	centimeters	0.0001
	feet	3.2808×10^{-6}
	inches	3.937×10^{-5}
	meters	1×10^{-6}
	millimeters	0.001

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
LENGTH *(continued)*		
miles (statute)	centimeters	160,934
	feet	5,280
	furlongs	8
	inches	63,360
	kilometers	1.609344
	light years	1.701×10^{-12}
	meters	1,609.344
	yards	1,760
millimeters	centimeters	0.1
	feet	0.00328
	inches	0.03937
	meters	0.001
	mils	39.37
	yards	1.094×10^{-3}
mils	centimeters	2.54×10^{-3}
	feet	8.333×10^{-5}
	inches	0.001
	kilometer	2.54×10^{-8}
	yards	2.778×10^{-5}
yards	centimeters	91.44
	cubits	2
	fathoms	0.5
	feet	3
	furlongs	0.004545
	inches	36
	kilometers	9.144×10^{-4}
	meters	0.9144
	miles	5.682×10^{-4}
	millimeters	914.4
LIGHT INTENSITY		
foot-candles	foot-lamberts	1
	lumens per square foot	1
	lumens per square meter	10.7639
	lux	10.7639
lumens	candle power	0.07958
	watt	0.0015
lumens per square foot	foot-candles	1
	foot-lamberts	1
	lumens per square meter	10.7639
lumens per square meter	foot-candles	0.0929
	lumens per square foot	0.0929
lux	foot-candles	0.0929
	lumens per square meter	1

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
POWER		
BTU	foot-pounds	777.649
	horsepower-hours	0.00039
	kilowatt-hours	0.00029287
	kilowatt-hours (international)	0.00029283
	joules	1,054.35
	joules (international)	1,054.18
	therms	0.00001
BTU per hour	horsepower per hours	0.00039
	kilowatts	0.00029
	watts	0.29287
BTU per minute	foot-pounds per second	12.96
	horsepower	0.02356
	kilowatts	0.01757
	watts	17.5725
foot-pounds	horsepower-hours	5.05×10^{-7}
	kilowatt-hours	3.766×10^{-7}
horsepower (mechanical)	Btu per minute	42.436
	feet-pounds per min	33,000
	feet-pounds per second	550
	horsepower (electric)	0.9996
	horsepower (metric)	1.0139
	horsepower (water)	0.99954
	kilograms-calories per minute	10.68
	kilowatts	0.7457
	watts	745.7
kilowatts	Btu per hour	3414.4
	foot-pounds per hour	2,655,000
	horsepower	1.341
	horsepower (boiler)	0.1019
	horsepower (electric)	1.34
	horsepower (metric)	1.3596
	kilowatts (international)	0.99983
kilowatt-hours	Btu	3414.4
	horsepower-hours	1.341
	foot-pounds	2,655,000
	kilogram-meters	367,098
watts	Btu per hour	3.4144
	horsepower	0.00134
	horsepower (electric)	0.00134
	horsepower (metric)	0.0013596
	kilowatts	0.001
	watts (international)	0.9998

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
PRESSURE		
atmosphere	bars	1.01325
	centimeter of mercury at 0°C	76
	centimeter of water at 4°C	1,033.26
	dynes per square centimeter	1,013,250
	feet of water at 39.2°F	33.8995
	inches of mercury at 32°F	29.9213
	kilograms per square centimeter	1.0332
	kilograms per square meter	10,332
	meters of water at 4°C	10.3326
	mm of mercury at 0°C	760
	pounds per square inch	14.696
bars	atmospheres	0.98692
	centimeter of mercury at 0°C	75.0062
	dynes per square centimeter	1,000,000
	feet water at 60°F	33.4883
	inches of mercury at 32°F	29.53
	pounds per square foot	2,089
	pounds per square in	14.5038
dynes per square centimeter	atmospheres	9.869×10^{-7}
	bars	1×10^{-6}
	centimeters of mercury at 0°C	7.500617×10^{-5}
	centimeters of water at 4°C	0.00101975
	inches of mercury at 32°F	2.953×10^{-5}
	inches of water at 4°C	0.000401
	pounds per square inch	1.45×10^{-5}
feet of water at 4°C	atmospheres	0.0295
	centimeter of mercury at 0°C	2.2419
	dynes per square centimeter	29,889.80
	grams per square centimeter	30.479
	inches of mercury at 32°F	0.8826
	kilograms per square meter	304.79
	pounds per square inch	0.433501
inches of mercury at 32°F	atmospheres	0.03342
	bars	0.03386
	dynes per square centimeter	33,864
	feet of air at 1 atm, 60°F	926.2
	feet of water at 39.2°F	1.1329
	grams per square centimeter	34.532
	kilograms per square meter	345.32
	millimeters of mercury at 60°F	25.4
	ounces per square inch	7.858
	pounds per square inch	70.7264

Convert From	Into	Multiply By
PRESSURE *(continued)*		
inches of water at 4°C	atmospheres	0.002458
	dynes per square centimeter	2,490.80
	inches of mercury at 32°F	0.07355
	kilograms per square centimeter	0.00254
	kilograms per square meter	25.399
	ounces per square foot	83.235
	ounces per square inch	0.57802
	pounds per square foot	5.20218
	pounds per square inch	0.03613
kilograms per cubic meter	grams per cubic centimeter	0.001
	pounds per cubic foot	0.0624
kilograms per square centimeter	atmospheres	0.967
	bars	0.98066
	centimeters of mercury at 0°C	73.556
	dynes per square centimeter	98,066
	feet of water at 39.2°F	32.809
	inches of mercury at 32°F	28.959
	pounds per square foot	2,048
	pounds per square inch	14.22
kilograms per square meter	atmospheres	9.678×10^{-5}
	bars	9.8066×10^{-5}
	dynes per square centimeter	98.066
	feet of water at 39.2°F	0.00328
	inches of mercury at 32°F	0.0029
	kilopascals	9.80665×10^{-3}
	millimeters of mercury at 0°C	0.07356
	pascals	9.8066
	pounds per square foot	0.20482
	pounds per square inch	0.00142
	pounds per square yard	1.8433
kiloPascals (kPa)	bars	0.01
	feet of water	0.33458
	kilograms per square centimeter	0.0102
	kilograms per square meter	101.97
	meters of head	0.1021
	pounds per square inch	0.14503
	centimeters of mercury at 0°C	0.75
	centimeters of water at 4°C	10.197
	dynes per square centimeter	10,000
	grams per square centimeter	10.197
	inches of mercury at 32°F	0.2953
	inches of water at 39.2°F	4.014788
	pounds per square foot	20.88
	millimeter of mercury at 0°C	7.5

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
PRESSURE *(continued)*		
millibars	atmospheres	0.000987
	bars	0.001
	dynes per square centimeter	1,000
	inches of mercury at 32°F	0.0295
	pounds per square foot	2.0885
Newtons	dynes	100,000
	pounds	0.2248089
Pascal	Newton per square meter	1
	pounds per square inch	0.000145
pounds per square inch	atmospheres	0.06805
	bars	0.06895
	centimeters of mercury at 0°C	5.17149
	centimeters of water at 4°C	70.3089
	dynes per square centimeter	68,947
	feet of water	2.307
	grams per square centimeter	70.307
	inches of mercury at 32°F	2.036
	inches of water at 39.2°F	27.681
	kilograms per square centimeter	0.07031
	kilopascals (kPa)	6.895
	pounds per square foot	144
	millimeters of mercury at 0°C	51.715
PRESSURE LOSS		
bars per 100 meters	kilopascals per 100 meters	100.004
	meters per 100 meters	10.211
	PSI per 100 feet	4.421
kilopascals (kPa) per 100 meters	bars per 100 meters	0.010
	meters per 100 meters	0.1021
	PSI per 100 feet	0.0442
meters per 100 meters	bars per 100 meters	0.0979
	kilopascals per 100 meters	9.79
	PSI per 100 feet	0.433
pounds per square inch (PSI) per 100 feet.	bars per 100 meters	0.226
	kilopascals per 100 meters	22.621
	meters per 100 meters	2.31
TEMPERATURE		
Centigrade	Fahrenheit	(°C x 1.8) + 32
Fahrenheit	Centigrade	(°F -32) / 1.8
VELOCITY		
cubic meters per minute	gallons (British) per minute	219.969
	gallons (U.S.) per minute	264.172
	liters per minute	1000

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
VELOCITY *(continued)*		
feet per minute	centimeters per second	0.508
	kilometers per hour	0.018288
	kilometers per minute	0.000348
	meters per minute	0.3048
	meters per second	0.00508
	miles per hour	0.011364
feet per second	centimeters per second	30.48
	kilometers per hour	1.09728
	kilometers per minute	0.01829
	meters per minute	18.288
	meters per second	0.3048
	miles per hour	0.681818
feet per (second x second)	centimeters per (second x second)	30.48
	kilometers per (hour x second)	1.0973
	meters per (second x second)	0.3048
gravity constant	centimeter per (second x second)	980.6
	feet per (second x second)	32.17
inches per hour	centimeters per hour	2.54
	feet per hour	0.0833
	miles per hour	1.5783×10^{-5}
inches per minute	centimeters per hour	152.4
	feet per hour	5
	feet per second	0.0013889
	miles per hour	0.000947
kilometers per hour	centimeters per second	27.778
	feet per hour	3,280.84
	feet per minute	54.6807
	meters per second	0.2778
	miles per hour	0.62137
meters per hour	feet per hour	3.2808
	feet per minute	0.05468
	knots	0.00054
	miles per hour	0.000621
meters per minute	centimeters per second	1.66667
	feet per minute	3.2808
	feet per second	0.05468
	kilometers per hour	0.06
	miles per hour	0.03728
meters per second	feet per minute	196.85
	feet per second	3.2818
	kilometers per hour	3.6
	miles per hour	2.2369
	miles per minute	0.03728

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
VELOCITY *(continued)*		
miles per hour	centimeters per second	44.704
	feet per hour	5,280
	feet per minute	88
	feet per second	1.4667
	kilometers per hour	1.6094
	kilometers per minute	0.0268
	knots (international)	0.86897
	meters per minute	26.822
	miles per minute	0.01667
VOLUME		
acre-feet	cubic feet	43,560
	cubic meters	1,233.482
	cubic yards	1,613.33
	gallons (U.S.)	325,900
	liters	1,233,455.5
acre inches	cubic feet	3,630
	cubic meters	102.79033
	gallons (U.S.)	27,154.29
bushels (British)	bushels (U.S.)	1.03206
	cubic feet	1.28435
	gallons (British)	8
	liters	36.3677
bushels (U.S.)	bushels (British)	0.96894
	cubic feet	1.24446
	gallons (U.S. dry)	8
	gallons (U.S. liquid)	9.30918
cubic centimeters	cubic feet	3.5315×10^{-5}
	cubic inches	0.06102
	cubic meters	1×10^{-6}
	gallons (British)	0.00022
	gallons (U.S. dry)	0.00023
	gallons (U.S. liquid)	0.00026
	liters	0.001
	ounces (British liquid)	0.03519
	ounces (U.S. liquid)	0.03381
cubic feet	acre-feet	2.296×10^{-5}
	cubic centimeters	28,316.8
	cubic inches	1,728
	cubic meters	0.02832
	gallons (U.S. dry)	6.42851
	gallons (U.S. liquid)	7.48052
	liters	28.316
	ounces (British fluid)	996.614
	ounces (U.S. fluid)	957.506

Convert From	Into	Multiply By
VOLUME *(continued)*		
cubic feet	pints (U.S. dry)	51.4281
	pints (U.S. liquid)	59.8442
	quarts (U.S. dry)	25.714
	quarts (U.S. liquid)	29.922
cubic feet of water at 60°F	pounds of water	63.367
cubic inches	cubic centimeters	16.3871
	cubic meters	1.639×10^{-5}
	cubic yards	2.143×10^{-5}
	gallons (U.S. dry)	0.00372
	gallons (U.S. liquid)	0.00433
	liters	0.01639
	milliliters	16.3866
	ounces (British liquid)	0.57674
	ounces (U.S. liquid)	0.55411
	quarts (U.S. dry)	0.01488
	quarts (U.S. liquid)	0.01732
cubic meters	acre-feet	0.00081
	cubic centimeters	1,000,000
	cubic feet	35.3147
	cubic inches	61,023.70
	cubic yards	1.30795
	gallons (British)	219.969
	gallons (U.S. liquid)	264.172
	liters	1,000
	quarts (U.S. liquid)	1,056.69
cubic yards	cubic feet	27
	cubic meters	0.76455
	gallons (British)	168.179
	gallons (U.S. dry)	173.569
	gallons (U.S. liquid)	201.974
	liters	764.533
cup	gallons	0.0625
	pints	0.5
	milliliters	284.13
	quarts	0.25
	tablespoons	16
	teaspoons	48
gallons (British)	barrels (British)	0.0277
	bushels	0.125
	cubic centimeters	4,546.09
	cubic feet	0.1605
	cubic inches	277.419
	gallons (U.S. liquid)	1.2009
	liters	4.546

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
VOLUME *(continued)*		
gallons (British)	ounces (British liquid)	160
	ounces (U.S. liquid)	153.721
	pounds of water at 62°F	10
gallons (U.S. dry)	barrels (U.S. dry)	0.038096
	barrels (U.S. liquid)	0.03694
	cubic centimeters	4,404.88
	cubic feet	0.15556
	gallons (U.S. liquid)	1.163647
	liters	4.4048
gallons (U.S. liquid)	acre-feet	3.0688×10^{-6}
	barrels (U.S. liquid)	0.031746
	barrels (U.S. petroleum)	0.023809
	cubic centimeters	3,785.41
	cubic feet	0.13368
	cubic inches	231
	cubic meters	0.00378
	cubic yards	0.00495
	gallons (British)	0.83267
	gallons (U.S. dry)	0.85937
	gallons (U.S. wine)	1
	liters	3.7853
	ounces (U.S. liquid)	128
	pints (U.S. liquid)	8
	quarts (U.S. liquid)	4
gallons (U.S.) of water at 4°C	pounds of water	8.34517
gallons (U.S.) of water at 60°F	pounds of water	8.32823
liters	bushels (British)	0.0275
	bushels (U.S.)	0.02838
	cubic centimeters	1,000
	cubic feet	0.03532
	cubic inches	61.002
	cubic meters	0.001
	cubic yards	0.001308
	gallons (British)	0.21998
	gallons (U.S. dry)	0.22703
	gallons (U.S. liquid)	0.26418
	ounces (British fluid)	35.196
	ounces (U.S. fluid)	33.81497
	pints (British)	1.7598
	pints (U.S. dry)	1.8162
	pints (U.S. liquid)	2.1134
	quarts (British)	0.8799
	quarts (U.S. dry)	0.9081
	quarts (U.S. liquid)	1.0567

Convert From	Into	Multiply By
VOLUME *(continued)*		
ounces (U.S. liquid)	cubic centimeters	29.5737
	cubic inches	1.80469
	cups	0.1698
	cubic meters	2.9574×10^{-5}
	drops	360.14
	gallons (U.S. liquid)	0.00781
	liters	0.02957
	milliliters	29.57
	quarts (U.S. liquid)	0.0312
	teaspoons	6
	tablespoons	2
pint (U.S. liquid)	cubic centimeters	473.176
	cubic feet	0.01671
	cubic inches	28.875
	cups	2
	fifths	0.625
	gallons (U.S. liquid)	0.125
	liters	0.473176
	millimeters	473.163
	ounces (U.S. liquid)	16
	quarts (U.S. liquid)	0.5
	teaspoons	96
	tablespoons	32
quarts (U.S. liquid)	cubic centimeters	946.353
	cubic feet	0.0334
	cubic inches	57.75
	cubic meters	0.464×10^{-4}
	cubic yards	0.001238
	fifth	1.25
	gallons (U.S. liquid)	.25
	liters	0.9463
	magnums	0.5
	ounces (U.S. liquid)	32
	pints (U.S. liquid)	2
	quarts (British)	0.859367
	shots	32
tablespoons	cups	0.0625
	drops	180
	ounces (U.S. liquid)	0.5
	quarts	0.01562
	teaspoons	3
teaspoons	cups	0.02083
	drops	60
	ounces (U.S. liquid)	0.1666

CONVERSION TABLE *(continued)*

Convert From	Into	Multiply By
VOLUME *(continued)*		
teaspoons	pinch	3 to 4
	pints	0.01042
	quarts	0.00521
	tablespoons	0.3333
WEIGHT		
dynes	kilograms	1.02×10^{-6}
	pounds	2.248×10^{-6}
grams	dynes	980.66
	ounces	0.03527
	pounds	0.0022046
kilograms	drams	564.38
	dynes	980,665
	grams	1,000
	ounces	35.27396
	pounds	2.20462
	tons (short)	0.001102
milligrams	grams	0.001
	ounces	3.527×10^{-5}
	pounds	2.205×10^{-6}
ounces	grams	28.349
	kilograms	0.02835
	pounds	0.0625
	tons (metric)	2.835×10^{-5}
	tons (short)	3.125×10^{-5}
pounds	drams	256
	dynes	444,800
	grains	7,000
	grams	453.59
	kilograms	0.4536
	ounces	16
	tons (long)	0.0004464
	tons (metric)	0.0004536
	tons (short)	0.0005
pounds of water	cubic feet	0.01602
	cubic inches	27.68
	gallons	0.1198
	liters	0.4545
tons (metric)	dynes	9.807×10^{8}
	kilograms	1,000
	ounces	35,273.95
	pounds	2,204.62
	tons (short)	8.8964×10^{8}

Convert From	Into	Multiply By
WEIGHT *(continued)*		
tons (short)	dynes	1.1023
	kilograms	907.18
	ounces	32,000
	pounds	2,000
	tons (long)	0.89286
	tons (metric)	0.90718

DECIMAL AND METRIC EQUIVALENTS OF COMMON FRACTIONS

Fractions of an Inch	Decimals of an Inch	Millimeters	Fractions of an Inch	Decimals of an Inch	Millimeters
1/64	0.015625	0.397	33/64	0.515625	13.097
1/32	0.03125	0.794	17/32	0.523125	13.494
3/64	0.046875	1.191	35/64	0.546875	13.891
1/16	0.0625	1.588	9/16	0.5625	14.288
5/64	0.078125	1.984	37/64	0.578125	14.684
3/32	0.09375	2.381	19/32	0.59375	15.081
7/64	0.109375	2.778	39/64	0.609375	15.478
1/8	0.125	3.175	5/8	0.625	15.875
9/64	0.140625	3.572	41/64	0.640625	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.171875	4.366	43/64	0.671875	17.066
3/16	0.1875	4.763	11/16	0.6875	17.463
13/64	0.203125	5.159	45/64	0.703125	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.234375	5.953	47/64	0.734375	18.653
1/4	0.250	6.350	3/4	0.750	19.050
17/64	0.265625	6.747	49/64	0.765625	19.447
9/32	0.28125	7.144	15/32	0.78125	19.844
19/64	0.296875	7.541	51/64	0.796875	20.241
5/16	0.3125	7.938	13/16	0.8125	20.638
21/64	0.328125	8.334	53/64	0.828125	21.034
11/32	0.34375	8.731	17/32	0.84375	21.431
23/64	0.359375	9.128	55/64	0.859375	21.828
3/8	0.375	9.525	7/8	0.875	22.225
25/64	0.390625	9.922	57/64	0.890625	22.622
13/32	0.40625	10.319	29/32	.090625	23.019
27/64	0.421875	10.716	59/64	0.921875	23.416
7/16	0.4375	11.113	15/16	0.9375	23.813
29/64	0.453125	11.509	61/64	0.953125	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.484375	12.303	63/64	0.984375	25.003
1/2	0.500	12.700	1	1.000	25.400

TABLES

SLOPE COMPARISON

Amount of Rise in 100' of Run	Percent Slope	Slope Ratio	Slope Angle Degrees		Plan to Slope Factor*
5	5	20:1	2°	52'	1.001
10	10	10:1	5°	43'	1.005
14	14		7°	58'	1.010
15	15		8°	32'	1.011
17	17		9°	39'	1.014
20	20	5:1	11°	19'	1.020
25	25	4:1	14°	2'	1.031
30	30		16°	42'	1.044
33	33	3:1	18°	16'	1.053
35	35		19°	17'	1.059
40	40	2.5:1	21°	48'	1.077
45	45		24°	14'	1.097
50	50	2:1	26°	34'	1.118
55	55		28°	49'	1.141
60	60		30°	58'	1.166
65	65	1.5:1	33°	1'	1.193
70	70		35°	0'	1.221
75	75		36°	52'	1.250
80	80		38°	40'	1.281
85	85		40°	22'	1.312
90	90		41°	59'	1.345
95	95		43°	32'	1.379
100	100	1:1	45°	0'	1.414
105	105		46°	24'	1.450
110	110		47°	44'	1.487
115	115		48°	59'	1.524
120	120		50°	12'	1.562
125	125	0.8:1	51°	20'	1.601
130	130		52°	26'	1.640
135	135		53°	28'	1.680
140	140		54°	28'	1.720
145	145		55°	24'	1.761
150	150	0.67:1	56°	19'	1.803

* Plan to Slope Factor: to convert from a plan dimension (horizontal measure) to actual slope distance, multiply by this factor. For example: plan indicates a 2:1 (50%) slope measuring 100 feet from the top to the toe of the slope on the plan. The actual distance from the top to the toe of the slope is 100 feet x 1.118 = 111.8 feet.

Plan to Slope Factor: to convert from an actual soil measurement, divide by this factor. For example: soil measurement is 12 feet, and the slope ratio is 1.5:1, the actual distance on the plan will be 12 ÷ 1.193 = 10 feet.

SLOPE REFERENCE CHART: PERCENT, ANGLE, AND RATIO

%	Angle	Ratio
0	0˚	
10	5˚ 43'	10 : 1
20	11˚ 19'	5 : 1
30	16˚ 42'	
33	18˚ 16'	3 : 1
40	21˚ 48'	
50	26˚ 34'	2 : 1
60	30˚ 58'	
67	33˚ 50'	1.5 : 1
70	35˚ 0'	
80	38˚ 40'	
90	42˚ 0'	
100	45˚ 0'	1 : 1

200	63˚ 27'
190	62˚ 15'
180	60˚ 57'
170	59˚ 32'
160	58˚ 0'
150	56˚ 19'
140	54˚ 28'
130	52˚ 26'
120	50˚ 42'
110	47˚ 44'

**Horizontal Distance
See Column No. 1**

h = vertical rise in feet

Percent of grade or slope: Equals vertical rise in feet per 100' of horizontal distance

= Angle of slope: Angle of inclination with respect to horizontal plane (ie) tan = h/horizontal distance

Ratio of slope = $\frac{\text{horizontal distance}}{h}$

MAXIMUM PRECIPITATION RATES FOR SLOPES

The maximum precipitation values listed below are those suggested by the United States Department of Agriculture. The values are average and may vary with respect to actual soil condition and condition of ground cover.

Maximum Precipitation Rates: Inches per Hour

Soil Texture	0 to 5% slope		5 to 8% slope		8 to 12% slope		12% + slope	
	Cover	Bare	Cover	Bare	Cover	Bare	Cover	Bare
Coarse sandy soils	2.00	2.00	2.00	1.50	1.50	1.00	1.00	0.50
Coarse sandy soils over compact subsoils	1.75	1.50	1.25	1.00	1.00	0.75	0.75	0.40
Light sandy loams uniform	1.75	1.00	1.25	0.80	1.00	0.60	0.75	0.40
Light sandy loams over compact subsoils	1.25	0.75	1.00	0.50	0.75	0.40	0.50	0.30
Uniform silt loams	1.00	0.50	0.80	0.40	0.60	0.30	0.40	0.20
Silt loams over compact subsoil	0.60	0.30	0.50	0.25	0.40	0.15	0.30	0.10
Heavy clay or clay loam	0.20	0.15	0.15	0.10	0.12	0.08	0.10	0.06

USING THE WATER SUPPLY REQUIREMENTS TABLE

The Water Supply Requirements table (page 49) provides a quick estimate of the gallons per minute (GPM) required to irrigate one acre at 70% efficiency for a variety of potential evapotranspiration (PET) rates for varying hours of operation. This can be used to estimate the water needs of large areas for water service meter size or pump station requirement.

How to Use the Table

1) Determine the approximate PET for the project. This should be the peak ETo and should include a crop coefficient. For example if the peak ETo were 0.34 in./day and the irrigated area was a warm season turf grass with a crop coefficient of 60% (0.60) the PET would be 0.20 in./day (0.34 x 0.60 = 0.20).

    Find the PET Average in in./day in the second column from the left.

    Example: 0.20 inches/day

2) Read across to the column under the "Average Hours of Operation/Day"

    Example: 12

3) Under the column for 12 Average Hours of Operation/Day, the "Minimum GPM per Acre" represents the minimum number of gallons per minute required to deliver 0.20 inches of water per day for one acre using an irrigation system with 70% efficiency.

    Example: 0.8 GPM minimum per acre required at peak demand.

4) Multiply the minimum GPM per acre times the number of acres in the project, if the project being designed had a total of 20 acres.

    Example: 20 x 10.8 = 216 GPM

WATER SUPPLY REQUIREMENTS

PET Average			Available Hours of Operation per Day						
			24	20	16	12	10	8	6
Inches per Month	Inches per Day	Gallons per Acre/Day	Minimum GPM per Acre	Minimum GPM per Acre	Minimum GPM per Acre	Minimum GPM per Acre	Minimum GPM per Acre	Minimum GPM per Acre	Minimum GPM per Acre
0.30	0.01	388	0.3	0.3	0.4	0.5	0.6	0.8	1.1
0.60	0.02	776	0.5	0.6	0.8	1.1	1.3	1.6	2.2
0.90	0.03	1164	0.8	1.0	1.2	1.6	1.9	2.4	3.2
1.20	0.04	1552	1.1	1.3	1.6	2.2	2.6	3.2	4.3
1.50	0.05	1940	1.3	1.6	2.0	2.7	3.2	4.0	5.4
1.80	0.06	2328	1.6	1.9	2.4	3.2	3.9	4.8	6.5
2.10	0.07	2715	1.9	2.3	2.8	3.8	4.5	5.7	7.5
2.40	0.08	3103	2.2	2.6	3.2	4.3	5.2	6.5	8.6
2.70	0.09	3491	2.4	2.9	3.6	4.8	5.8	7.3	9.7
3.00	0.10	3879	2.7	3.2	4.0	5.4	6.5	8.1	10.8
3.30	0.11	4267	3.0	3.6	4.4	5.9	7.1	8.9	11.9
3.60	0.12	4655	3.2	3.9	4.8	6.5	7.8	9.7	12.9
3.90	0.13	5043	3.5	4.2	5.3	7.0	8.4	10.5	14.0
4.20	0.14	5431	3.8	4.5	5.7	7.5	9.1	11.3	15.1
4.50	0.15	5819	4.0	4.8	6.1	8.1	9.7	12.1	16.2
4.80	0.16	6207	4.3	5.2	6.5	8.6	10.3	12.9	17.2
5.10	0.17	6595	4.6	5.5	6.9	9.2	11.0	13.7	18.3
5.40	0.18	6983	4.8	5.8	7.3	9.7	11.6	14.5	19.4
5.70	0.19	7370	5.1	6.1	7.7	10.2	12.3	15.4	20.5
6.00	0.20	7758	5.4	6.5	8.1	10.8	12.9	16.2	21.6
6.30	0.21	8146	5.7	6.8	8.5	11.3	13.6	17.0	22.6
6.60	0.22	8534	5.9	7.1	8.9	11.9	14.2	17.8	23.7
6.90	0.23	8922	6.2	7.4	9.3	12.4	14.9	18.6	24.8
7.20	0.24	9310	6.5	7.8	9.7	12.9	15.5	19.4	25.9
7.50	0.25	9698	6.7	8.1	10.1	13.5	16.2	20.2	26.9
7.80	0.26	10086	7.0	8.4	10.5	14.0	16.8	21.0	28.0
8.40	0.28	10862	7.5	9.1	11.3	15.1	18.1	22.6	30.2
9.00	0.30	11638	8.1	9.7	12.1	16.2	19.4	24.2	32.3
9.60	0.32	12413	8.6	10.3	12.9	17.2	20.7	25.9	34.5
10.20	0.34	13189	9.2	11.0	13.7	18.3	22.0	27.5	36.6
10.80	0.36	13965	9.7	11.6	14.5	19.4	23.3	29.1	38.8
11.40	0.38	14741	10.2	12.3	15.4	20.5	24.6	30.7	40.9
12.00	0.40	15517	10.8	12.9	16.2	21.6	25.9	32.3	43.1
12.60	0.42	16293	11.3	13.6	17.0	22.6	27.2	33.9	45.3
13.20	0.44	17068	11.9	14.2	17.8	23.7	28.4	35.6	47.4

*Note: Required GPM assumes a 70% system efficiency.

FRICTION FACTOR SHORTCUTS

The Friction Factor Method of sizing lateral line pipe is based on the premise that the operating pressure of all heads on a circuit should not vary by more than 10% to 20% of their designed operating pressure. This will provide the most uniform application of water.

The following is a simplified way to determine the maximum flow (GPM) allowed in lateral lines using the Friction Factor pipe sizing method. The example is based on lateral lines of Class 315 PVC for ½" and Class 200 PVC for ¾" to 3". Additional charts for lateral lines of Class 160 PVC and Polethylene are on page 54 and page 56.

Determination of appropriate pipe size is dependent upon three factors: the sprinkler operating pressure (PSI), the acceptable pressure variation between sprinklers on the circuit 10% to 20%, and the distance from the valve to the farthest sprinkler head on the circuit (note: in some cases this distance can be the distance between the first and last sprinklers on a circuit).

The Friction Factor is the allowable PSI loss per 100 feet of pipe. With the Friction Factor, pipe can be sized to avoid excessive pressure losses. The friction factor is calculated by the following formula:

$$Friction\ Factor = \frac{Sprinkler\ Operating\ Pressure \times Allowable\ \%\ of\ PSI\ Variation}{Critical\ Length\ (from\ valve\ to\ farthest\ head)\ in\ 100s\ of\ feet}$$

$$F_f = \frac{P_o \times P_v}{L_c/100'}$$

1) Determine the Friction Factor

Example:

⊗ **Electric Remote Control Valve**

● **Full Circle Sprinkler 2.0 GPM at 35 PSI**
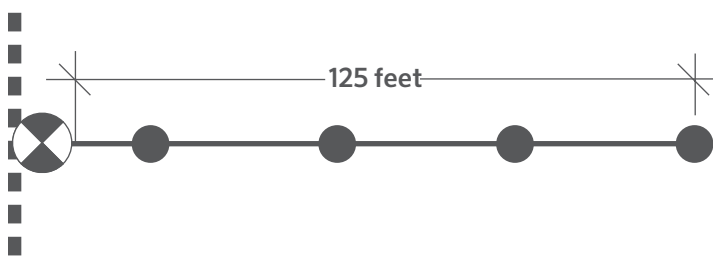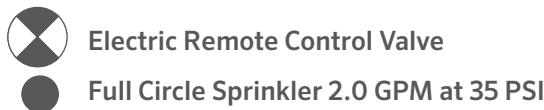
Sprinkler operating pressure = 35 PSI

Allowable pressure loss = 10%

Critical Length = 125 feet

$$Friction\ Factor = \frac{35 \times 0.10}{125/100}$$

$$Friction\ Factor = \frac{3.5}{1.25}$$

$$Friction\ Factor = 2.8\ allowable\ PSI\ loss\ from\ valve\ to\ farthest\ head$$

Round off the Friction Factor to the nearest ¼ PSI.

Example: 2.8 is rounded off to 2.75

This represents an allowable rate of PSI loss from the valve to the farthest head of 2.75 PSI per 100 feet of pipe.

FRICTION FACTOR SHORTCUTS *(continued)*

2) Find the Short Cut chart on the following pages that matches the Friction Factor above (2.75 PSI loss per 100 feet).

Example:

Friction Factor	2.75
	Max. GPM
½" CL 315 PVC	3.9
¾" CL 200 PVC	7.8
1" CL 200 PVC	15.0
1¼" CL 200 PVC	27.6
1½" CL 200 PVC	39.5
2" CL 200 PVC	70.9
2½" CL 200 PVC	117.0
3" CL 200 PVC	196.1

The "Max. GPM" represents the maximum GPM that can flow through the various sizes of lateral line pipe without exceeding the 2.75 PSI allowable loss per 100 feet.

3) Starting with the pipe sections farthest from the valve determine the flow in each section and find the smallest pipe that can carry that flow.

Example:
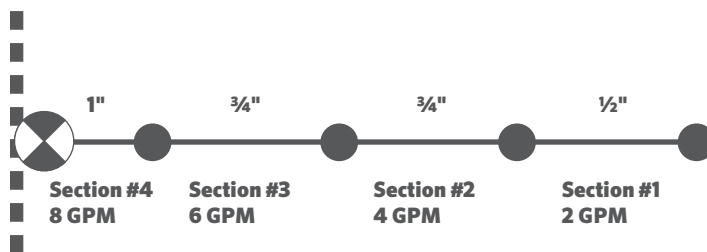
Pipe section #1 = 2 GPM, lateral line pipe should be ½" CL 315 PVC

Pipe section #2 = 4 GPM, lateral line pipe should be ¾" CL 200 PVC

Pipe section #3 = 6 GPM, lateral line pipe should be ¾" CL 200 PVC

Pipe section #4 = 8 GPM, lateral line pipe should be 1" CL 200 PVC

FRICTION FACTOR SHORTCUTS FOR CLASS 200 PVC*

Maximum GPM for Various Friction Factors

Friction Factor	0.25 Max. GPM	0.50 Max. GPM	0.75 Max. GPM	1 Max. GPM	1.25 Max. GPM	1.50 Max. GPM	1.75 Max. GPM	2 Max. GPM
½" CL 315 PVC	1.1	1.6	2.0	2.3	2.6	2.8	3.1	3.3
¾" CL 200 PVC	2.1	3.1	3.9	4.5	5.1	5.7	6.1	6.6
1" CL 200 PVC	4.1	6.0	7.4	8.7	9.8	10.8	11.7	12.6
1¼" CL 200 PVC	7.6	11.0	13.7	16.0	18.1	19.9	21.7	23.3
1½" CL 200 PVC	10.8	15.7	19.6	22.9	25.8	28.5	30.9	33.2
2" CL 200 PVC	19.4	28.2	35.1	41.0	46.3	51.1	55.5	59.7
2½" CL 200 PVC	32.1	46.6	58.0	67.8	76.4	84.3	91.7	98.5
3" CL 200 PVC	53.7	78.1	97.2	113.6	128.1	141.4	153.7	165.1

Friction Factor	2.25 Max. GPM	2.50 Max. GPM	2.75 Max. GPM	3 Max. GPM	3.25 Max. GPM	3.50 Max. GPM	3.75 Max. GPM	4 Max. GPM
½" CL 315 PVC	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.8
¾" CL 200 PVC	7.0	7.5	7.8	8.2	8.6	8.9	9.3	9.6
1" CL 200 PVC	13.4	14.2	15.0	15.7	16.4	17.0	17.7	18.3
1¼" CL 200 PVC	24.8	26.3	27.6	29.0	30.3	31.5	32.7	33.8
1½" CL 200 PVC	35.4	37.5	39.5	41.4	43.2	45.0	46.7	48.3
2" CL 200 PVC	63.6	67.3	70.9	74.3	77.5	80.7	83.8	86.7
2½" CL 200 PVC	105.0	111.1	117.0	122.6	128.1	133.3	138.3	143.2
3" CL 200 PVC	176.0	186.3	196.1	205.6	214.6	223.4	231.9	240.1

Friction Factor	4.25 Max. GPM	4.50 Max. GPM	4.75 Max. GPM	5 Max. GPM	5.25 Max. GPM	5.50 Max. GPM	5.75 Max. GPM	6 Max. GPM
½" CL 315 PVC	5.0	5.1	5.3	5.5	5.6	5.7	5.9	6.0
¾" CL 200 PVC	9.9	10.2	10.5	10.8	11.1	11.4	11.7	12.0
1" CL 200 PVC	18.9	19.5	20.1	20.7	21.2	21.8	22.3	22.8
1¼" CL 200 PVC	35.0	36.1	37.1	38.2	39.2	40.2	41.2	42.1
1½" CL 200 PVC	49.9	51.5	53.0	54.5	56.0	57.4	58.8	60.2
2" CL 200 PVC	89.6	92.4	95.2	97.9	100.5	103.0	105.5	108.0
2½" CL 200 PVC	148.0	152.7	157.2	161.6	165.9	170.1	174.3	178.3
3" CL 200 PVC	248.1	255.9	263.4	270.8	278.1	285.1	292.1	298.9

Friction Factor	6.25 Max. GPM	6.50 Max. GPM	6.75 Max. GPM	7 Max. GPM	7.25 Max. GPM	7.50 Max. GPM	7.75 Max. GPM	8 Max. GPM
½" CL 315 PVC	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.0
¾" CL 200 PVC	12.2	12.5	12.7	13.0	13.2	13.5	13.7	14.0
1" CL 200 PVC	23.3	23.8	24.3	24.8	25.3	25.7	26.2	26.6
1¼" CL 200 PVC	43.1	44.0	44.9	45.8	46.7	47.5	48.4	49.2
1½" CL 200 PVC	61.5	62.8	64.1	65.4	66.6	67.9	69.1	70.3
2" CL 200 PVC	110.4	112.7	115.1	117.4	119.6	121.8	124.0	126.1
2½" CL 200 PVC	182.3	186.2	190.0	193.8	197.5	201.1	204.7	208.3
3" CL 200 PVC	305.5	312.1	318.5	324.8	331.0	337.1	343.2	349.1

*Note: ½" pipe is Class 315 PVC because wall thickness must be at least 0.060" and Class 200 has a SDR of 21 which would result in a wall thickness in ½" pipe of less than 0.060".

Maximum GPM for Various Friction Factors

Friction Factor	8.25 Max. GPM	8.50 Max. GPM	8.75 Max. GPM	9 Max. GPM	9.25 Max. GPM	9.50 Max. GPM	9.75 Max. GPM	10 Max. GPM
½" CL 315 PVC	7.1	7.3	7.4	7.5	7.6	7.7	7.8	7.9
¾" CL 200 PVC	14.2	14.4	14.7	14.9	15.1	15.3	15.5	15.8
1" CL 200 PVC	27.1	27.5	28.0	28.4	28.8	29.2	29.6	30.0
1¼" CL 200 PVC	50.0	50.8	51.7	52.4	53.2	54.0	54.8	55.5
1½" CL 200 PVC	71.4	72.6	73.7	74.9	76.0	77.1	78.2	79.3
2" CL 200 PVC	128.2	130.3	132.4	134.4	136.4	138.4	140.3	142.3
2½" CL 200 PVC	211.8	215.2	218.6	221.9	225.3	228.5	231.8	234.9
3" CL 200 PVC	354.9	360.7	366.4	372.0	377.6	383.0	388.4	393.8

Friction Factor	10.25 Max. GPM	10.50 Max. GPM	10.75 Max. GPM	11 Max. GPM	11.25 Max. GPM	11.50 Max. GPM	11.75 Max. GPM	12 Max. GPM
½" CL 315 PVC	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
¾" CL 200 PVC	16.0	16.2	16.4	16.6	16.8	17.0	17.2	17.4
1" CL 200 PVC	30.4	30.8	31.2	31.6	32.0	32.4	32.8	33.2
1¼" CL 200 PVC	56.3	57.0	57.7	58.4	59.2	59.9	60.6	61.3
1½" CL 200 PVC	80.3	81.4	82.4	83.4	84.5	85.5	86.5	87.5
2" CL 200 PVC	144.2	146.1	147.9	149.8	151.6	153.4	155.2	157.0
2½" CL 200 PVC	238.1	241.2	244.3	247.3	250.4	253.4	256.3	259.2
3" CL 200 PVC	399.1	404.3	409.5	414.6	419.6	424.7	429.6	434.5

Friction Factor	12.25 Max. GPM	12.50 Max. GPM	12.75 Max. GPM	13 Max. GPM	13.25 Max. GPM	13.50 Max. GPM	13.75 Max. GPM	14 Max. GPM
½" CL 315 PVC	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5
¾" CL 200 PVC	17.6	17.8	18.0	18.2	18.3	18.5	18.7	18.9
1" CL 200 PVC	33.5	33.9	34.3	34.6	35.0	35.3	35.7	36.0
1¼" CL 200 PVC	61.9	62.6	63.3	64.0	64.6	65.3	65.9	66.6
1½" CL 200 PVC	88.4	89.4	90.4	91.3	92.3	93.2	94.1	95.0
2" CL 200 PVC	158.8	160.5	162.2	163.9	165.6	167.3	169.0	170.6
2½" CL 200 PVC	262.1	265.0	267.9	270.7	273.5	276.3	279.0	281.7
3" CL 200 PVC	439.4	444.2	449.0	453.7	458.4	463.1	467.7	472.2

Friction Factor	14.25 Max. GPM	14.50 Max. GPM	14.75 Max. GPM	15 Max. GPM	15.25 Max. GPM	15.50 Max. GPM	15.75 Max. GPM	16 Max. GPM
½" CL 315 PVC	9.6	9.7	9.8	9.9	10.0	10.0	10.1	10.2
¾" CL 200 PVC	19.1	19.3	19.4	19.6	19.8	20.0	20.1	20.3
1" CL 200 PVC	36.4	36.7	37.1	37.4	37.7	38.1	38.4	38.7
1¼" CL 200 PVC	67.2	67.8	68.5	69.1	69.7	70.3	70.9	71.6
1½" CL 200 PVC	96.0	96.9	97.8	98.7	99.5	100.4	101.3	102.2
2" CL 200 PVC	172.3	173.9	175.5	177.1	178.7	180.3	181.8	183.4
2½" CL 200 PVC	284.5	287.1	289.8	292.4	295.1	297.7	300.2	302.8
3" CL 200 PVC	476.8	481.3	485.7	490.2	494.6	498.9	503.3	507.6

*Note: ½" pipe is Class 315 PVC because wall thickness must be at least 0.060" and Class 200 has a SDR of 21 which would result in a wall thickness in ½" pipe of less than 0.060".

FRICTION FACTOR SHORTCUTS FOR CLASS 160 PVC*

Maximum GPM for Various Friction Factors

Friction Factor	0.25	0.50	0.75	1	1.25	1.50	1.75	2
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" CL 315 PVC	1.1	1.6	2.0	2.3	2.6	2.8	3.1	3.3
¾" CL 200 PVC	2.1	3.1	3.9	4.5	5.1	5.7	6.1	6.6
1" CL 160 PVC	4.2	6.0	7.5	8.8	9.9	10.9	11.9	12.8
1¼" CL 160 PVC	8.0	11.6	14.4	16.9	19.0	21.0	22.8	24.5
1½" CL 160 PVC	11.4	16.6	20.6	24.1	27.1	30.0	32.6	35.0
2" CL 160 PVC	20.5	29.8	37.1	43.3	48.8	53.9	58.6	62.9
2½" CL 160 PVC	33.8	49.2	61.2	71.5	80.7	89.0	96.8	104.0
3" CL 160 PVC	56.6	82.3	102.5	119.7	135.0	149.0	161.9	174.1

Friction Factor	2.25	2.50	2.75	3	3.25	3.50	3.75	4
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" CL 315 PVC	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.8
¾" CL 200 PVC	7.0	7.5	7.8	8.2	8.6	8.9	9.3	9.6
1" CL 160 PVC	13.6	14.4	15.2	15.9	16.6	17.3	17.9	18.6
1¼" CL 160 PVC	26.1	27.7	29.1	30.5	31.9	33.2	34.4	35.7
1½" CL 160 PVC	37.3	39.5	41.6	43.6	45.5	47.3	49.1	50.9
2" CL 160 PVC	67.1	71.0	74.7	78.3	81.8	85.1	88.4	91.5
2½" CL 160 PVC	110.8	117.3	123.5	129.4	135.2	140.7	146.0	151.2
3" CL 160 PVC	185.5	196.3	206.7	216.7	226.2	235.5	244.4	253.1

Friction Factor	4.25	4.50	4.75	5	5.25	5.50	5.75	6
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" CL 315 PVC	5.0	5.1	5.3	5.5	5.6	5.7	5.9	6.0
¾" CL 200 PVC	9.9	10.2	10.5	10.8	11.1	11.4	11.7	12.0
1" CL 160 PVC	19.2	19.8	20.4	20.9	21.5	22.0	22.6	23.1
1¼" CL 160 PVC	36.8	38.0	39.1	40.2	41.3	42.3	43.4	44.4
1½" CL 160 PVC	52.6	54.2	55.8	57.4	58.9	60.4	61.9	63.3
2" CL 160 PVC	94.5	97.5	100.4	103.2	106.0	108.7	111.3	113.9
2½" CL 160 PVC	156.2	161.1	165.9	170.6	175.1	179.6	183.9	188.2
3" CL 160 PVC	261.5	269.7	277.7	285.5	293.1	300.5	307.8	315.0

Friction Factor	6.25	6.50	6.75	7	7.25	7.50	7.75	8
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" CL 315 PVC	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.0
¾" CL 200 PVC	12.2	12.5	12.7	13.0	13.2	13.5	13.7	14.0
1" CL 160 PVC	23.6	24.1	24.6	25.1	25.6	26.1	26.5	27.0
1¼" CL 160 PVC	45.4	46.3	47.3	48.2	49.2	50.1	51.0	51.8
1½" CL 160 PVC	64.7	66.1	67.5	68.8	70.1	71.4	72.7	74.0
2" CL 160 PVC	116.4	118.9	121.4	123.8	126.1	128.5	130.8	133.0
2½" CL 160 PVC	182.4	196.5	200.6	204.5	208.4	212.3	216.1	219.8
3" CL 160 PVC	322.0	328.9	335.7	342.3	348.9	355.3	361.7	367.9

*Note: ½" pipe is Class 315 PVC and ¾" pipe is CL 200 PVC because wall thickness must be at least 0.060" and Class 160 has a SDR of 26 which would result in a wall thicknesses in ½" an ¾" pipe of less than 0.060".

Maximum GPM for Various Friction Factors

Friction Factor	8.25 Max. GPM	8.50 Max. GPM	8.75 Max. GPM	9 Max. GPM	9.25 Max. GPM	9.50 Max. GPM	9.75 Max. GPM	10 Max. GPM
½" CL 315 PVC	7.1	7.3	7.4	7.5	7.6	7.7	7.8	7.9
¾" CL 200 PVC	14.2	14.4	14.7	14.9	15.1	15.3	15.5	15.8
1" CL 160 PVC	27.4	27.9	28.3	28.8	29.2	29.6	30.0	30.4
1¼" CL 160 PVC	52.7	53.6	54.4	55.2	56.1	56.9	57.7	58.5
1½" CL 160 PVC	75.2	76.4	77.6	78.8	80.0	81.2	82.3	83.4
2" CL 160 PVC	135.3	137.5	139.6	141.8	143.9	146.0	148.0	150.1
2½" CL 160 PVC	223.5	227.1	230.7	234.3	237.8	241.2	244.6	248.0
3" CL 160 PVC	374.1	380.2	386.2	392.1	397.9	403.7	409.4	415.1

Friction Factor	10.25 Max. GPM	10.50 Max. GPM	10.75 Max. GPM	11 Max. GPM	11.25 Max. GPM	11.50 Max. GPM	11.75 Max. GPM	12 Max. GPM
½" CL 315 PVC	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
¾" CL 200 PVC	16.0	16.2	16.4	16.6	16.8	17.0	17.2	17.4
1" CL 160 PVC	30.9	31.3	31.7	32.1	32.4	32.8	33.2	33.6
1¼" CL 160 PVC	59.3	60.0	60.8	61.6	62.3	63.1	63.8	64.5
1½" CL 160 PVC	84.6	85.7	86.8	87.8	88.9	90.0	91.0	92.1
2" CL 160 PVC	152.1	154.1	156.0	158.0	159.9	161.8	163.7	165.6
2½" CL 160 PVC	251.3	254.6	257.8	261.1	264.3	267.4	270.5	273.6
3" CL 160 PVC	420.6	426.1	431.6	437.0	442.3	447.6	452.8	458.0

Friction Factor	12.25 Max. GPM	12.50 Max. GPM	12.75 Max. GPM	13 Max. GPM	13.25 Max. GPM	13.50 Max. GPM	13.75 Max. GPM	14 Max. GPM
½" CL 315 PVC	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5
¾" CL 200 PVC	17.6	17.8	18.0	18.2	18.3	18.5	18.7	18.9
1" CL 160 PVC	34.0	34.3	34.7	35.1	35.4	35.8	36.2	36.5
1¼" CL 160 PVC	65.2	66.0	66.7	67.4	68.1	68.8	69.4	70.1
1½" CL 160 PVC	93.1	94.1	95.1	96.1	97.1	98.1	99.1	100.1
2" CL 160 PVC	167.4	169.3	171.1	172.9	174.7	176.5	178.2	180.0
2½" CL 160 PVC	276.7	279.7	282.7	285.7	288.7	291.6	294.5	297.4
3" CL 160 PVC	463.1	468.2	473.2	478.2	483.2	488.1	492.9	497.7

Friction Factor	14.25 Max. GPM	14.50 Max. GPM	14.75 Max. GPM	15 Max. GPM	15.25 Max. GPM	15.50 Max. GPM	15.75 Max. GPM	16 Max. GPM
½" CL 315 PVC	9.6	9.7	9.8	9.9	10.0	10.0	10.1	10.2
¾" CL 200 PVC	19.1	19.3	19.4	19.6	19.8	20.0	20.1	20.3
1" CL 160 PVC	36.9	37.2	37.6	37.9	38.2	38.6	38.9	39.2
1¼" CL 160 PVC	70.8	71.5	72.1	72.8	73.4	74.1	74.7	75.4
1½" CL 160 PVC	101.0	102.0	102.9	103.9	104.8	105.7	106.6	107.5
2" CL 160 PVC	181.7	183.4	185.1	186.8	188.5	190.1	191.8	193.4
2½" CL 160 PVC	300.2	303.1	305.9	308.7	311.4	314.2	316.9	319.6
3" CL 160 PVC	502.5	507.3	512.0	516.6	521.3	525.9	530.4	535.0

*Note: ½" pipe is Class 315 PVC and ¾" pipe is CL 200 PVC because wall thickness must be at least 0.060" and Class 160 has a SDR of 26 which would result in a wall thickness in ½" an ¾" pipe of less than 0.060".

FRICTION FACTOR SHORT CUTS FOR POLYETHYLENE (PE) – SDR-7 (IPS) PRESSURE RATED TUBE

Maximum GPM for Various Friction Factors

Friction Factor	0.25	0.50	0.75	1	1.25	1.50	1.75	2
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" SDR-Poly	0.7	1.0	1.3	1.5	1.7	1.8	2.0	2.1
¾" SDR-Poly	1.5	2.1	2.6	3.1	3.5	3.8	4.2	4.5
1" SDR-Poly	2.8	4.0	5.0	5.8	6.6	7.2	7.9	8.5
1¼" SDR-Poly	5.7	8.2	10.2	12.0	13.5	14.9	16.2	17.4
1½" SDR-Poly	8.5	12.3	15.4	17.9	20.2	22.3	24.3	26.1
2" SDR-Poly	16.4	23.8	29.6	34.6	39.0	43.0	46.8	50.3
2½" SDR-Poly	26.1	37.9	47.2	55.2	62.2	68.7	74.6	80.2
3" SDR-Poly	46.2	67.1	83.6	97.6	110.1	121.5	132.0	141.9

Friction Factor	2.25	2.50	2.75	3	3.25	3.50	3.75	4
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" SDR-Poly	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.1
¾" SDR-Poly	4.8	5.1	5.3	5.6	5.8	6.1	6.3	6.5
1" SDR-Poly	9.0	9.5	10.0	10.5	11.0	11.4	11.9	12.3
1¼" SDR-Poly	18.5	19.6	20.7	21.6	22.6	23.5	24.4	25.3
1½" SDR-Poly	27.8	29.4	31.0	32.5	33.9	35.3	36.6	37.9
2" SDR-Poly	53.6	56.7	59.7	62.6	65.3	68.0	70.6	73.1
2½" SDR-Poly	85.5	90.5	95.2	99.8	104.2	108.5	112.6	116.6
3" SDR-Poly	151.2	160.1	168.5	176.6	185.5	192.0	199.3	206.3

Friction Factor	4.25	4.50	4.75	5	5.25	5.50	5.75	6
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" SDR-Poly	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
¾" SDR-Poly	6.7	7.0	7.2	7.4	7.6	7.7	7.9	8.1
1" SDR-Poly	12.7	13.1	13.5	13.9	14.2	14.6	15.0	15.3
1¼" SDR-Poly	26.1	26.9	27.7	28.5	29.3	30.0	30.8	31.5
1½" SDR-Poly	39.2	40.4	41.6	42.8	43.9	45.0	46.1	47.2
2" SDR-Poly	75.5	77.9	80.2	82.5	84.7	86.8	88.9	91.0
2½" SDR-Poly	120.5	124.3	127.9	131.6	135.0	138.5	141.8	145.1
3" SDR-Poly	213.2	219.9	226.4	232.7	239.0	245.0	251.0	256.8

Friction Factor	6.25	6.50	6.75	7	7.25	7.50	7.75	8
	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM	Max. GPM
½" SDR-Poly	4.0	4.0	4.1	4.2	4.3	4.4	4.5	4.5
¾" SDR-Poly	8.3	8.5	8.7	8.8	9.0	9.2	9.3	9.5
1" SDR-Poly	15.7	16.0	16.3	16.6	17.0	17.3	17.6	17.9
1¼" SDR-Poly	32.2	32.9	33.5	34.2	34.9	35.5	36.1	36.8
1½" SDR-Poly	48.2	49.3	50.3	51.3	52.3	53.2	54.2	55.1
2" SDR-Poly	93.0	95.0	97.0	98.9	100.8	102.6	104.5	106.3
2½" SDR-Poly	148.4	151.5	154.7	157.7	160.8	163.7	166.6	169.5
3" SDR-Poly	262.5	268.2	273.7	279.1	284.5	289.7	294.9	300.0

FRICTION FACTOR SHORT CUTS FOR POLYETHYLENE (PE) – SDR-7 (IPS) PRESSURE RATED TUBE *(continued)*

Maximum GPM for Various Friction Factors

Friction Factor	8.25 Max. GPM	8.50 Max. GPM	8.75 Max. GPM	9 Max. GPM	9.25 Max. GPM	9.50 Max. GPM	9.75 Max. GPM	10 Max. GPM
½" SDR-Poly	4.6	4.7	4.8	4.8	4.9	5.0	5.0	5.1
¾" SDR-Poly	9.6	9.8	10.0	10.1	10.3	10.4	10.6	10.7
1" SDR-Poly	18.2	18.5	18.8	19.1	19.3	19.6	19.9	20.2
1 ¼" SDR-Poly	37.4	38.0	38.6	39.2	39.8	40.3	40.9	41.5
1 ½ " SDR-Poly	56.0	57.0	57.9	58.7	59.6	60.5	61.3	62.2
2" SDR-Poly	108.1	109.8	111.5	113.3	114.9	116.6	118.3	119.9
2 ½ " SDR-Poly	172.4	175.2	177.9	180.7	183.4	186.0	188.6	191.2
3" SDR-Poly	305.0	310.0	314.9	319.7	324.4	329.1	333.8	338.4

Friction Factor	10.25 Max. GPM	10.50 Max. GPM	10.75 Max. GPM	11 Max. GPM	11.25 Max. GPM	11.50 Max. GPM	11.75 Max. GPM	12 Max. GPM
½" SDR-Poly	5.2	5.2	5.3	5.4	5.4	5.5	5.6	5.6
¾" SDR-Poly	10.8	11.0	11.1	11.3	11.4	11.5	11.7	11.8
1" SDR-Poly	20.4	20.7	21.0	21.2	21.5	21.8	22.0	22.3
1 ½" SDR-Poly	42.0	42.6	43.1	43.7	44.2	44.7	45.2	45.8
1 ½ " SDR-Poly	63.0	63.8	64.7	65.5	66.3	67.1	67.8	68.6
2" SDR-Poly	121.5	123.1	124.7	126.2	127.8	129.3	130.8	132.3
2 ½ " SDR-Poly	193.8	196.3	198.8	201.3	203.8	206.2	208.6	211.0
3" SDR-Poly	342.9	347.4	351.9	356.3	360.6	364.9	369.2	373.4

Friction Factor	12.25 Max. GPM	12.50 Max. GPM	12.75 Max. GPM	13 Max. GPM	13.25 Max. GPM	13.50 Max. GPM	13.75 Max. GPM	14 Max. GPM
½ " SDR-Poly	5.7	5.8	5.8	5.9	5.9	6.0	6.1	9.5
½" SDR-Poly	11.9	12.1	12.2	12.3	12.5	12.6	12.7	18.9
1" SDR-Poly	22.5	22.8	23.0	23.2	23.5	23.7	24.0	36.5
1 ½ " SDR-Poly	46.3	46.8	47.3	47.8	48.3	48.8	49.3	70.1
1 ½ " SDR-Poly	69.4	70.1	70.9	71.6	72.4	73.1	73.8	100.1
2" SDR-Poly	133.8	135.2	136.7	138.1	139.6	141.0	142.4	180.0
2 ½ " SDR-Poly	213.4	215.7	218.0	220.3	222.6	224.9	227.1	297.4
3" SDR-Poly	377.6	381.7	385.8	389.9	393.9	397.9	401.9	497.7

Friction Factor	14.25 Max. GPM	14.50 Max. GPM	14.75 Max. GPM	15 Max. GPM	15.25 Max. GPM	15.50 Max. GPM	15.75 Max. GPM	16 Max. GPM
½" SDR-Poly	6.2	6.2	6.3	6.4	6.4	6.5	6.5	6.6
½ " SDR-Poly	13.0	13.1	13.2	13.3	13.4	13.6	13.7	13.8
1" SDR-Poly	24.4	24.7	24.9	25.1	25.3	25.6	25.8	26.0
1 ½ " SDR-Poly	50.2	50.7	51.2	51.6	52.1	52.5	53.0	53.5
1 ½ " SDR-Poly	75.3	76.0	76.7	77.4	78.1	78.8	79.5	80.1
2" SDR-Poly	145.2	146.5	147.9	149.2	150.6	151.9	153.2	154.5
2 ½" SDR-Poly	231.5	233.7	235.9	238.0	240.2	242.3	244.4	246.5
3" SDR-Poly	409.7	413.6	417.4	421.2	425.0	428.7	432.5	436.2

APPROXIMATE FLOW RATES IN SIMPLE LOOPED MAIN LINES *

Length Ratio † Long to Short	Flow Rate Short Leg	Flow Rate Long Leg
1 to 1	50.0%	50.0%
2 to 1	59.4%	40.6%
3 to 1	64.4%	35.6%
4 to 1	67.8%	32.2%
5 to 1	70.4%	29.6%
6 to 1	72.4%	27.6%
7 to 1	74.0%	26.0%
8 to 1	75.4%	24.6%
9 to 1	76.6%	23.4%
10 to 1	77.6%	22.4%
12 to 1	79.2%	20.8%
15 to 1	81.2%	18.8%
20 to 1	83.4%	16.6%
25 to 1	85.0%	15.0%
30 to 1	86.2%	13.8%
35 to 1	87.2%	12.8%
40 to 1	88.0%	12.0%
45 to 1	88.6%	11.4%
50 to 1	89.2%	10.8%

* A simple looped main line would have one inlet and one outlet, and all pipe would be the same size. The type of pipe does not affect the flow percentages as long as pipe type and size remain constant.

† The Length Ratio is the ratio of the short leg of the loop to the long leg of the loop. To find the Length Ratio, divide the length of the long leg by the length of the short leg.

Example:
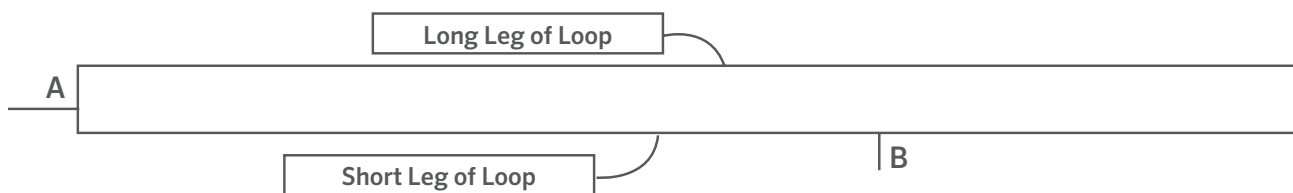
Example:
The entrance to the loop is at point "A" and the outlet is at point "B". Point "B" could be thought of as the location of a remote control valve. In the loop above, the longer side of the loop is about twice as long as the shorter side. In using the chart above, the ratio of 2:1 would indicate the flow in the short leg to be approximately 59.4% and the flow in the long leg to be approximately 40.6% of the total flow in the loop. If the total flow to point "B" is 50 gallons, the flow in the short leg would be approximately 29.7 GPM while the flow in the long leg would be approximately 20.3 GPM. Unequal flow rates occur because the pressure losses in each leg of the loop must be equal.

AVERAGE NUMBER OF SPRINKLERS PER ACRE

Square and/or Rectangular Spacing

Spacing in Feet	Heads Per Acre	Spacing In Feet	Heads Per Acre
10 x 10	435.6	30 x 60	24.2
11 x 11	360.0	40 x 40	27.2
12 x 12	302.4	40 x 50	21.8
13 x 13	257.6	40 x 60	18.2
14 x 14	222.3	40 x 80	13.6
15 x 15	193.5	50 x 50	17.4
16 x 16	170.0	50 x 60	14.5
17 x 17	150.8	50 x 70	12.4
18 x 18	134.3	50 x 80	10.9
19 x 19	120.6	60 x 60	12.1
20 x 20	109.0	60 x 70	10.4
20 x 30	72.7	60 x 80	9.1
20 x 40	54.5	70 x 70	8.9
20 x 50	43.5	70 x 80	7.8
20 x 60	36.3	70 x 90	6.9
25 x 25	69.7	80 x 80	6.8
30 x 30	48.4	80 x 90	6.1
30 x 40	36.3	80 x 100	5.5
30 x 50	29.0	100 x 100	4.4

AVERAGE NUMBER OF SPRINKLERS PER ACRE

Equilateral Triangular Spacing

Spacing In Feet	Heads Per Acre	Spacing In Feet	Heads Per Acre
10	504	66	11.5
11	418	68	10.9
12	348	70	10.3
13	296	72	9.7
14	256	74	9.2
15	224	76	8.7
16	196	78	8.3
17	175	80	7.9
18	155	82	7.5
19	140	84	7.1
20	125	86	6.8
21	114	88	6.5
22	105	90	6.2
23	96	92	5.9
24	87	94	5.7
25	80	96	5.5
26	74	98	5.2
27	69	100	5.0
28	64	102	4.8
29	60	104	4.6
30	56	106	4.5
32	49	108	4.3
34	44	110	4.2
36	39	112	4.0
38	35	114	3.9
40	31	116	3.7
42	28.5	118	3.6
44	26.0	120	3.5
46	23.7	122	3.4
48	21.8	124	3.3
50	20.0	126	3.2
52	18.6	128	3.1
54	17.2	130	3.0
56	16.0	132	2.9
58	15.0	134	2.8
60	14.0	136	2.7
62	13.1	138	2.6
64	12.3	140	2.5

The theoretical figures above represent the minimum number of sprinklers required to cover a square acre (208.7' x 208.7') with the most economical placement of sprinklers possible. Actual layouts to match individual field conditions may require additional sprinklers. This table should only be used for estimating purposes.

SCREEN FILTER MESH EQUIVALENTS

Mesh Size	Microns	Inches	mm
4	5205	0.2030	5.16
6	3175	0.125	3.18
8	2487	0.0970	2.46
10	1923	0.0750	1.90
11	1778	0.070	1.78
14	1307	0.0510	1.30
18	1000	0.0394	1.00
20	840	0.0331	0.84
24	813	0.032	0.81
25	710	0.0280	0.71
30	590	0.025	0.59
35	500	0.0197	0.50
40	420	0.0165	0.42
45	350	0.0138	0.35
50	297	0.0117	0.30
60	250	0.0098	0.25
70	210	0.0083	0.21
80	177	0.0070	0.18
100	149	0.0059	0.15
120	125	0.0049	0.12
140	105	0.0041	0.10
170	88	0.0035	0.08
200	74	0.0029	0.07
230	62	0.0024	0.06
270	53	0.0021	0.05
325	44	0.0017	0.04
400	37	0.0015	0.04
550	25	0.0009	0.02
800	15	0.0006	0.01
1250	10	0.0004	0.01

Screen Mesh Sizes Compared to 0.020 Inch Orifice

0.020" Orifice

```
200
150
100
 80
```

80 Mesh = 177 Microns
100 Mesh = 149 Microns
150 Mesh = 104 Microns
200 Mesh = 74 Microns
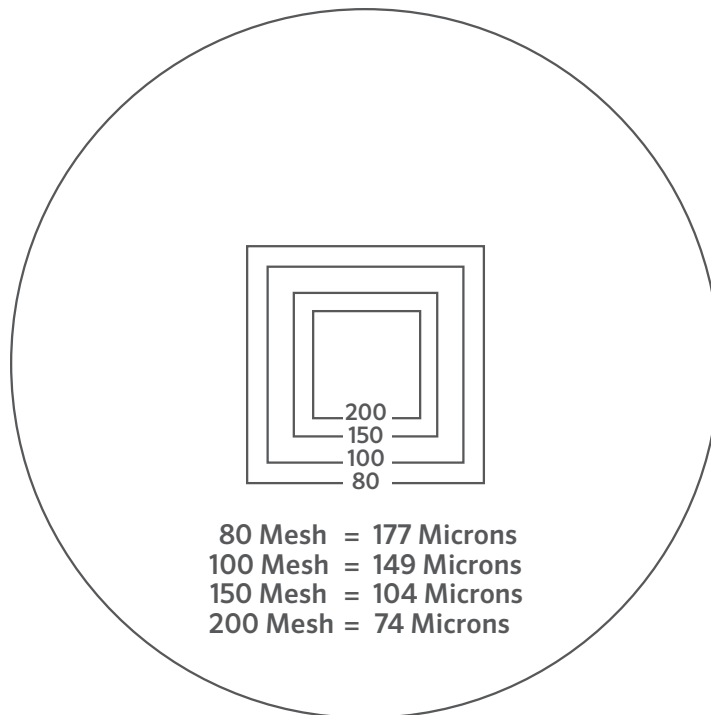
APPROXIMATE COST OF PUMP OPERATION

| Pump Horse Power | Average Kilowatt Hour Input | | Approximate Cost of Operation per Hour at Kilowatt Hr. Rate of: | | | | | | | | | | | | | | | |
| | | | $.0150 | | $.0200 | | $ .0250 | | $ .0400 | | $.0500 | | $.0600 | | $.0800 | | $.1000 | | $.1200 | |
	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase
¼	0.305		0.0046		0.0062		0.0078		0.0122		0.0153		0.0183		0.0244		0.0305		0.0366	
⅓	0.408		0.0062		0.0082		0.0103		0.0163		0.0204		0.0245		0.0326		0.0408		0.0490	
½	0.535	0.520	0.0081	0.0078	0.0108	0.0104	0.0135	0.0130	0.0214	0.0208	0.0268	0.0260	0.0321	0.0312	0.0428	0.0416	0.0535	0.0520	0.0642	0.0642
¾	0.760	0.768	0.0114	0.0116	0.0152	0.0154	0.0190	0.0193	0.0304	0.0307	0.0380	0.0384	0.0456	0.0461	0.0608	0.0614	0.0760	0.0768	0.0912	0.0922
1	1.000	0.960	0.0150	0.0144	0.0200	0.0192	0.0250	0.0240	0.0400	0.0384	0.0500	0.0480	0.0600	0.0576	0.0800	0.0768	0.1000	0.0960	0.1200	0.1152
1½	1.500	1.42	0.0225	0.0213	0.0300	0.0284	0.0375	0.0335	0.0600	0.0568	0.0750	0.0710	0.0900	0.0852	0.1200	0.1136	0.1500	0.1420	0.1800	0.1704
2	1.980	1.83	0.0297	0.0275	0.0396	0.0366	0.0495	0.0458	0.0792	0.0732	0.0990	0.0915	0.1188	0.1098	0.1584	0.1464	0.1980	0.1830	0.2376	0.2196
3	2.95	2.70	0.0443	0.0405	0.0590	0.0540	0.0738	0.0675	0.1180	0.1080	0.1475	0.1350	0.1770	0.1620	0.2360	0.2160	0.2950	0.2700	0.3540	0.3240
5	4.65	4.50	0.0698	0.0675	0.0930	0.0900	0.1163	0.1125	0.1860	0.1800	0.2325	0.2250	0.2790	0.2700	0.3720	0.3600	0.4650	0.4500	0.5580	0.5400
7½	6.9	6.75	0.1035	0.1013	0.1380	0.1350	0.1725	0.1688	0.2760	0.2700	0.3450	0.3375	0.4140	0.4050	0.5520	0.5400	0.6900	0.6750	0.8280	0.8100
10	9.3	9.0	0.1395	0.1350	0.1860	0.1800	0.2325	0.2250	0.3720	0.3600	0.4650	0.4500	0.5580	0.5400	0.7440	0.7200	0.9300	0.9000	1.1160	1.0800
15		12.8		0.1920		0.2560		0.3200		0.5120		0.6400		0.7680		1.0240		1.2800		1.5360
20		16.9		0.2535		0.3380		0.4225		0.6760		0.8450		1.0140		1.3520		1.6900		2.0280
25		20.8		0.3120		0.4160		0.5200		0.8320		1.0400		1.2480		1.6640		2.0800		2.4960
30		25.0		0.3750		0.5000		0.6250		1.0000		1.2500		1.5000		2.0000		2.5000		3.0000
40		33.2		0.4980		0.6640		0.8300		1.3280		1.6600		1.9920		2.6560		3.3200		3.9840
50		41.3		0.6195		0.8260		1.0325		1.6520		2.0650		2.4780		3.3040		4.1300		4.9560
60		49.5		0.7425		0.9900		1.2375		1.9800		2.4750		2.9700		3.9600		4.9500		5.9400
75		61.5		0.9225		1.2300		1.5375		2.4600		3.0750		3.6900		4.9200		6.1500		7.3800
100		81.5		1.225		1.6300		2.0375		3.2600		4.0750		4.8900		6.5200		8.1500		9.7800

Note: To calculate approximate cost of operation at a cost factor not listed above, multiply the second column rate of $0.02 per KWH by the actual rate in effect, and then divide by 2.

Example:
The cost of operating a 3 hp single phase pump at a rate of $0.07 per KWH would be
0.0590 x 7 ÷ 2 = $0.2065 per hour

These charts are based upon 100% motor efficiencies.

To determine actual cost factors, divide by actual pump and motor efficiency, as indicated above.

TABLE OF PUMP HORSEPOWER REQUIREMENTS (WHP)
(at 100% Pump Efficiency)

Head (Feet)	Pressure (PSI)	Flow – GPM										
		25	50	75	100	150	200	250	300	350	400	500
10	4.33	0.063	0.126	0.189	0.253	0.379	0.505	0.631	0.758	0.884	1.01	1.26
15	6.50	0.095	0.189	0.284	0.379	0.568	0.758	0.947	1.136	1.326	1.52	1.89
20	8.66	0.126	0.253	0.379	0.505	0.758	1.010	1.26	1.52	1.77	2.02	2.53
25	10.83	0.158	0.316	0.473	0.631	0.947	1.26	1.58	1.89	2.21	2.53	3.16
30	12.99	0.189	0.379	0.57	0.76	1.14	1.52	1.89	2.27	2.65	3.03	3.79
35	15.16	0.22	0.44	0.66	0.88	1.33	1.77	2.21	2.65	3.09	3.54	4.42
40	17.32	0.25	0.51	0.76	1.01	1.52	2.02	2.53	3.03	3.54	4.04	5.05
45	19.49	0.28	0.57	0.85	1.14	1.70	2.27	2.84	3.41	3.98	4.55	5.68
50	21.65	0.32	0.63	0.95	1.26	1.89	2.53	3.16	3.79	4.42	5.05	6.31
60	25.98	0.38	0.76	1.14	1.52	2.27	3.03	3.79	4.55	5.30	6.06	7.58
70	30.31	0.44	0.88	1.33	1.77	2.65	3.54	4.42	5.30	6.19	7.07	8.84
80	34.64	0.51	1.01	1.52	2.02	3.03	4.04	5.05	6.06	7.07	8.08	10.10
90	38.97	0.57	1.14	1.70	2.27	3.41	4.55	5.68	6.82	7.95	9.09	11.36
100	43.30	0.63	1.26	1.89	2.53	3.79	5.05	6.31	7.58	8.84	10.10	12.63
120	51.96	0.76	1.52	2.27	3.03	4.55	6.06	7.58	9.09	10.61	12.12	15.15
140	60.62	0.88	1.77	2.65	3.54	5.30	7.07	8.84	10.61	12.37	14.14	17.68
160	69.28	1.01	2.02	3.03	4.04	6.06	8.08	10.10	12.12	14.14	16.16	20.20
180	77.94	1.14	2.27	3.41	4.55	6.82	9.09	11.36	13.64	15.91	18.18	22.73
200	86.60	1.26	2.53	3.79	5.05	7.58	10.10	12.63	15.15	17.68	20.20	25.25
220	95.26	1.39	2.78	4.17	5.56	8.33	11.11	13.89	16.67	19.44	22.22	27.78
240	103.92	1.52	3.03	4.55	6.06	9.09	12.12	15.15	18.18	21.21	24.24	30.30
260	112.58	1.64	3.28	4.92	6.57	9.85	13.13	16.41	19.70	22.98	26.26	32.83
280	121.24	1.77	3.54	5.30	7.07	10.61	14.14	17.68	21.21	24.75	28.28	35.35
300	129.90	1.89	3.79	5.68	7.58	11.36	15.15	18.94	22.73	26.52	30.30	37.88
325	140.73	2.05	4.10	6.16	8.21	12.31	16.41	20.52	24.62	28.72	32.83	41.04
350	151.55	2.21	4.42	6.63	8.84	13.26	17.68	22.10	26.52	30.93	35.35	44.19
375	162.38	2.37	4.73	7.10	9.47	14.20	18.94	23.67	28.41	33.14	37.88	47.35
400	173.20	2.53	5.05	7.58	10.10	15.15	20.20	25.25	30.30	35.35	40.40	50.51
425	184.03	2.68	5.37	8.05	10.73	16.10	21.46	26.83	32.20	37.56	42.93	53.66
450	194.85	2.84	5.68	8.52	11.36	17.05	22.73	28.41	34.09	39.77	45.45	56.82
475	205.68	3.00	6.00	9.00	11.99	17.99	23.99	29.99	35.98	41.98	47.98	59.97
500	216.50	3.16	6.31	9.47	12.63	18.94	25.25	31.57	37.88	44.19	50.50	63.13

Notes:

1. The (WHP) water horsepower requirements charted above have been calculated by either of the following formulas.

$$WHP = \frac{GPM \times HEAD\,(feet)}{3960}$$

$$WHP = \frac{GPM \times Pressure\,(PSI)}{1714}$$

2. The specific brake horsepower requirement is calculated by dividing the WHP above by the actual pump efficiency.

$$BHP = \frac{WHP}{efficiency}$$

Example:

100 GPM at 90 feet of head requires 2.27 horsepower at 100% efficiency. If the pump is 70% efficient, the actual (BHP) required is:

$$\frac{2.27}{0.70} = 3.25\,BHP$$

WIRE DATA: STANDARD ANNEALED COPPER AT 20°C

American Wire Gauge	Metric Wire Gauge	Diameter Mils	Diameter mm	Resistance Per mft Ohms	Resistance Per km Ohms
1		289.3	7.348	0.9239	0.4065
	7.0		7.000		0.4480
2		257.6	6.543	0.1563	0.5128
	6.0		6.000		0.6098
3		229.4	5.827	0.1971	0.6466
4		204.3	5.189	0.2485	0.8152
	5.0		5.000		0.08781
5		181.9	4.620	0.3134	1.028
	4.5		4.500		1.084
6		162.0	4.115	0.3952	1.297
	4.0		4.000		1.372
7		144.3	3.665	0.4981	1.634
	3.5		3.500		1.792
8		128.5	3.264	0.6281	2.061
	3.0		3.000		2.439
9		114.4	2.906	0.7925	2.600
10		101.9	2.588	0.9988	3.277
	2.5		2.500		3.512
11		90.7	2.30	1.26	4.14
12		80.8	2.05	1.59	5.21
	2.0		2.00		5.49
13		72.0	1.83	2.00	6.56
	1.8		1.80		6.78
14		64.1	1.63	2.52	8.28
	1.6		1.60		8.58
15		57.1	1.45	3.18	10.4
	1.4		1.40		11.2
16		50.8	1.29	4.02	13.2
	1.2		1.20		15.2
17		45.3	1.15	5.05	16.6
18		40.3	1.02	6.39	21.0
	1.0		1.000		22.0
19		35.9	0.912	8.05	26.4
	0.9		0.900		27.1
20		32.0	0.813	10.1	33.2

TABLE OF VOLTAGE LOSSES FOR ANNEALED COPPER WIRE 25°C (77°F) (Loss per 1000 feet of wire)

AMPERES	18	16	14	12	10	8	6	4	2
0.1	0.65	0.41	0.26	0.16	0.10	0.06	0.04	0.03	0.02
0.15	0.98	0.61	0.39	0.24	0.15	0.10	0.06	0.04	0.02
0.2	1.30	0.82	0.52	0.32	0.20	0.13	0.08	0.05	0.03
0.25	1.63	1.02	0.65	0.41	0.26	0.16	0.10	0.06	0.04
0.3	1.95	1.23	0.77	0.49	0.31	0.19	0.12	0.08	0.05
0.35	2.28	1.43	0.90	0.57	0.36	0.22	0.14	0.09	0.06
0.4	2.60	1.64	1.03	0.65	0.41	0.26	0.16	0.10	0.06
0.45	2.93	1.84	1.16	0.73	0.46	0.29	0.18	0.11	0.07
0.5	3.26	2.05	1.29	0.81	0.51	0.32	0.20	0.13	0.08
0.6	3.91	2.45	1.55	0.97	0.61	0.38	0.24	0.15	0.10
0.7	4.56	2.86	1.81	1.13	0.71	0.45	0.28	0.18	0.11
0.8	5.21	3.27	2.06	1.30	0.82	0.51	0.32	0.20	0.13
0.9	5.86	3.68	2.32	1.46	0.92	0.58	0.36	0.23	0.14
1.0	6.51	4.09	2.58	1.62	1.02	0.64	0.40	0.25	0.16
1.1	7.16	4.50	2.84	1.78	1.12	0.71	0.44	0.28	0.17
1.2	7.81	4.91	3.10	1.94	1.22	0.77	0.48	0.30	0.19
1.3	8.46	5.32	3.35	2.11	1.33	0.83	0.52	0.33	0.21
1.4	9.11	5.73	3.61	2.27	1.43	0.90	0.56	0.35	0.22
1.5	9.77	6.14	3.87	2.43	1.53	0.96	0.60	0.38	0.24
1.6	10.42	6.54	4.13	2.59	1.63	1.03	0.77	0.40	0.25
1.7	11.07	6.95	4.39	2.75	1.73	1.09	0.69	0.43	0.27
1.8	11.72	7.36	4.64	2.92	1.84	1.15	0.73	0.46	0.29
1.9	12.37	7.77	4.90	3.08	1.94	1.22	0.77	0.48	0.30
2.0	13.02	8.18	5.16	3.24	2.04	1.28	0.81	0.51	0.32
2.1	13.67	8.59	5.42	3.40	2.14	1.35	0.85	0.53	0.33
2.2	14.32	9.00	5.68	3.56	2.24	1.41	0.89	0.56	0.35
2.3	14.97	9.41	5.93	3.73	2.35	1.47	0.93	0.58	0.37
2.4	15.62	9.82	6.19	3.89	2.45	1.54	0.97	0.61	0.38
2.5	16.28	10.23	6.45	4.05	2.55	1.60	1.01	0.63	0.40
2.6	16.93	10.63	6.71	4.21	2.65	1.67	1.05	0.66	0.41
2.7	17.58	11.04	6.97	4.37	2.75	1.73	1.09	0.68	0.43
2.8	18.23	11.45	7.22	4.54	2.86	1.79	1.13	0.71	0.45
2.9	18.88	11.86	7.48	4.70	2.96	1.86	1.17	0.73	0.46
3.0	19.53	12.27	7.74	4.86	3.06	1.92	1.21	0.76	0.48
3.2	20.83	13.09	8.26	5.18	3.26	2.05	1.29	0.81	0.51
3.4	22.13	13.91	8.77	5.51	3.47	2.18	1.37	0.86	0.54
3.6	23.44	14.72	9.29	5.83	3.67	2.31	1.45	0.91	0.57
3.8	24.74	15.54	9.80	6.16	3.88	2.44	1.53	0.96	0.60
4.0	26.04	16.36	10.32	6.48	4.08	2.56	1.61	1.01	0.64
4.2	27.34	17.18	10.84	6.80	4.28	2.69	1.69	1.06	0.67
4.4	28.64	18.00	11.35	7.13	4.49	2.82	1.77	1.11	0.70
4.6	29.95	18.81	11.87	7.45	4.69	2.95	1.85	1.16	0.73
4.8	31.25	19.63	12.38	7.78	4.90	3.08	1.93	1.21	0.76
5.0	32.55	20.45	12.90	8.10	5.10	3.21	2.02	1.27	0.80
5.2	33.85	21.27	13.42	8.42	5.30	3.33	2.10	1.32	0.83
5.4	35.15	22.09	13.93	8.75	5.51	3.46	2.18	1.37	0.86
5.6	36.46	22.90	14.45	9.07	5.71	3.59	2.26	1.42	0.89
5.8	37.76	23.72	14.96	9.40	5.92	3.72	2.34	1.47	0.92
6.0	39.06	24.54	15.48	9.72	6.12	3.85	2.42	1.52	0.95
6.2	40.36	25.36	16.00	10.04	6.32	3.97	2.50	1.57	0.99
6.4	41.66	26.18	16.51	10.37	6.53	4.10	2.58	1.62	1.02
6.6	42.97	26.99	17.03	10.69	6.73	4.23	2.66	1.67	1.05
6.8	44.27	27.81	17.54	11.02	6.94	4.36	2.74	1.72	1.08
7.0	45.57	28.63	18.06	11.34	7.14	4.49	2.82	1.77	1.11

To find the voltage loss for a two wire circuit, multiply the loss per 1000 feet figure above by **twice** the actual wire length expressed in thousands. For a single wire, multiply the loss per 1000 feet value, above by the actual wire length in thousands.

Note: Remember, amperages are additive along a wire where current is demanded by more than one appliance.

Note: Voltage losses are calculated from the formula:

Where: $V = IR$ I = current in amperes   R = resistance in ohms per 1000 feet   V = voltage

APPROXIMATE NUMBER OF WIRES TO BE INSTALLED IN CONDUIT OR TUBING

Maximum Number of Wires in Conduit or Sleeving

WIRE SIZE (AWG)	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	WIRE SIZE (AWG)
18	6	12	20	35	49	80	110	175					18
16	5	10	16	30	42	67	97	150					16
14	4	6	10	18	25	40	56	88	120	150			14
12	3	5	7	15	20	33	50	75	102	130	205		12
10	1	3	6	13	16	27	40	63	85	110	170		10
8	1	2	4	6	9	16	25	35	50	65	105	150	8
6	1	1	3	3	5	10	15	22	32	40	63	92	6
4		1	1	2	4	7	10	16	24	30	48	70	4
2		1	1	2	2	5	9	12	18	22	36	54	2
0			1	1	2	3	5	8	12	15	24	36	0
00			1	1	1	2	4	7	10	14	21	31	00
000				1	1	2	3	6	8	11	18	26	000
0000				1	1	1	2	5	7	10	15	22	0000

ESTIMATING PIPE SIZE

Nominal Pipe Size	Approximate String Length in Inches		
	Copper Pipe	Galvanized (Sch. 40 Steel)	PVC Pipe
½"	2"	$2^5/_8$"	$2^5/_8$"
$^5/_8$"	$2^3/_8$"		
$^3/_4$"	2¾"	$3^5/_{16}$"	$3^5/_{16}$"
1"	3½"	$4^1/_8$"	$4^1/_8$"
$1^1/_4$"	$4^5/_{16}$"	$5^3/_{16}$"	$5^3/_{16}$"
1½"	$5^1/_8$"	6"	6"
2"	$6^3/_4$"	$7^7/_{16}$"	$7^7/_{16}$"

To determine the nominal size of a pipe, wrap a string around the pipe and compare its length to the chart above.

OPERATING PRESSURES FOR PVC, POLYETHYLENE PIPE AND COPPER TUBE Pressure Rating (PSI) at 73.4°F (23°C)

Nominal Size	Sch 80 PVC*	Sch 40 PVC*	(SDR 13.5) CL 315	(SDR 21) CL 200	(SDR 26) CL 160	(SDR 32.5) CL 125	Sch 40 PE
½"	850	600	315	***	***	***	190
¾"	690	480	315	200	***	***	150
1"	630	450	315	200	160	***	140
1 ¼"	520	370	315	200	160	***	120
1 ½"	470	330	315	200	160	***	100
2"	400	280	315	200	160	***	90
2 ½"	420	300	315	200	160	***	100
3"	370	260	315	200	160	125	80
4"	320	220	315	200	160	125	70
6"	280	180	315	200	160	125	60
8"	250	160	315	200	160	125	++
10"	230	140	315	200	160	125	++
12"	230	130	315	200	160	125	++

Note:
1) Pressure ratings are the maximum that should be applied. Surge pressures should be included.
2) Pressure ratings must be reduced for temperatures over 23°C (73.4°F)
3) These ratings do not apply for threaded pipe. Do not thread Sch 40 pipe
4) "***" indicates pipe not listed because wall thickness less than 0.060 minimum
5) Burst pressures are generally about 2.5 to 2.8 times the maximum pressure rating
6) PVC 1120, 1220 code designations
7) Non-threaded pipe
8) "*"Sch 80 and Sch 40 pipe rounded to the nearest ten.

COPPER TUBE

Nominal Size	Type M		Type L		Type K	
	Annealed	Hard Drawn	Annealed	Hard Drawn	Annealed	Hard Drawn
½"	430	760	625	1105	780	1375
¾"	350	610	495	875	750	1315
1"	295	515	440	770	575	1010
1 ¼"	295	515	385	680	465	820
1 ½"	290	510	355	630	435	765
2"	300	450	315	555	380	665
2 ½"	235	410	295	520	355	520
3"	220	385	275	490	340	605
4"	215	380	255	450	315	555
6"	190	335	215	385	305	540
8"	200	350	240	420	325	580
10"	205	355	240	425	330	585
12"	205	360	225	395	330	585

Rated Internal Working Pressure for Copper Tube for Service Temperatures up to 150°F, PSI

PVC SCHEDULE 40 AND SCHEDULE 80 PIPE AND INJECTION MOLDED FITTINGS SUGGESTED MAXIMUM INTERNAL PRESSURE RATINGS Pressure Rating (PSI) at 73.4°F (23°C)

	Suggested PVC Pipe and Injection Molded Fittings Internal Pressure Ratings						
	Schedule 40				Schedule 80		
Nominal Size	Pipe	Solvent Cemented Joint	Threaded Joint		Pipe	Solvent Cemented Joint	Threaded Joint
½"	596	358	179		848	509	254
¾"	482	289	144		688	413	206
1"	450	270	135		630	378	189
1¼"	368	221	110		520	312	156
1½"	330	198	99		471	282	141
2"	277	166	83		404	243	121
2½"	304	182	91		425	255	127
3"	263	158	79		375	225	112
3½"	240	144	72		345	207	103
4"	222	133	66		324	194	97
6"	177	106	53		279	167	83
8"	155	93	46		246	148	
10"	141	150			234	200	
12"	132	150			228	200	

This table is for use as a general guide only. Actual Internal Pressure Ratings may vary widely with field conditions. Elevated operating temperatures will necessitate a devaluation of the above ratings.

Note: Historically, manufactures have assumed that fittings have the same internal pressure rating as pipe. An engineering study* by Keller-Bleisner Engineering of Logan, Utah, indicates that while the fittings do meet the minimum burst requirements of pipe, actual operating conditions may require a devaluation of the internal pressure rating for fittings. The devaluation is due to the applied stress loads to the fitting caused by the operating parameters of the system. The maximum internal pressure ratings are admittedly based on limited data but it is the most resent study pertaining to fitting internal pressure ratings.

*The above study was funded by Dura, Eslon, LCP, Lasco, Nibco, R&G Sloane, and Spears.

THE AFFINITY LAWS

The total dynamic head (TDH) discharge capacity (flow) and brake horsepower (BHP) from a pump are a function of the impeller diameter and rotational speed (RPM). When selecting a pump model it is uncommon to find the exact match of TDH and capacity. The Affinity Laws can be used to determine the appropriate RPM, impeller diameter or brake horsepower (BHP) for a given flow and TDH requirement.

The relationship between pump capacity, TDH, BHP and horsepower for different RPMs and impeller diameters are as follows: the flow varies directly with speed (or impeller diameter), pressure varies as the square of speed (or impeller diameter), and power varies as the square of speed (or impeller diameter), and power varies as the cube of speed (or impeller diameter). A mathematical representation of the Affinity Laws is shown below:

$$\frac{Q_1}{Q_2} = \left[\frac{N_1}{N_2}\right] \qquad \frac{H_1}{H_2} = \left[\frac{N_1}{N_2}\right]^2 \qquad \frac{BHP_1}{BHP_2} = \left[\frac{N_1}{N_2}\right]^3$$

$$\frac{Q_1}{Q_2} = \left[\frac{D_1}{D_2}\right] \qquad \frac{H_1}{H_2} = \left[\frac{D_1}{D_2}\right]^2 \qquad \frac{BHP_1}{BHP_2} = \left[\frac{H_1}{H_2}\right]^3$$

Where:

Q = Pump Capacity (GPM)

H = Total Dynamic Head (feet)

BHP = Brake Horsepower (feet-pound/second)

N = Impeller Rotational Velocity (rpm)

D = Impeller Diameter (inches)

FRICTION LOSS CHARTS

IRRIGATION ASSOCIATION FRICTION LOSS AND VELOCITY CHARTS 2008

Tables are based upon the following:

Hazen-Williams Equation:

$$H_f = (0.2083)(100/C)^{1.852}(Q^{1.852}/D^{4.866})$$

The result is multiplied by 0.433 to give PSI loss for 100 feet of pipe.

The velocity values were derived using the following equation:

$$V = \left(\frac{0.408 \times Q_{GPM}}{d^2} \right)$$

The average inside diameter of OD controlled pipe was based upon subtracting two times the minium wall thickness plue one-half of the wall thickness from the outside diameter.

Resources of information for pipe diameters and wall thickness came from:

- ASABE Standards 2007, ANSI/ASAE S376.2 Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipes

- Uni-Bell Handbook of PVC Pipe,Uni-Bell PVC Pipe Association

- Appropriate ASTM standards for non-plastic pipes

Pressure ratings for plastic pipes are based on 23° C or 73.4° F

Head loss decreases (increases) approximately 1% for ever 3 degrees F above (below) the reference temparature (73.4° F).

CLASS 160 PVC IPS PLASTIC PIPE

ASTM D2241   (1120, 1220)   SDR 26   C=150

PSI Loss per 100 Feet of Pipe

	Shown for convenience																			
Nominal Size	Class 315 1/2"		Class 200 3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Avg. ID	0.696		0.910		1.175		1.512		1.734		2.173		2.635		3.21		4.134		6.084	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg. Wall	0.072		0.070		0.070		0.074		0.083		0.101		0.120		0.145		0.183		0.271	
Min. Wall	0.062		0.060		0.060		0.064		0.073		0.091		0.110		0.135		0.173		0.255	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
1	0.84	0.25	0.49	0.07	0.30	0.02	0.18	0.01	0.14	0.00										
2	1.68	0.90	0.99	0.24	0.59	0.07	0.36	0.02	0.27	0.01	0.17	0.00								
3	2.53	1.90	1.48	0.52	0.89	0.15	0.54	0.04	0.41	0.02	0.26	0.01								
4	3.37	3.24	1.97	0.88	1.18	0.25	0.71	0.07	0.54	0.04	0.35	0.01	0.24	0.00						
5	4.21	4.89	2.46	1.33	1.48	0.38	0.89	0.11	0.68	0.06	0.43	0.02	0.29	0.01						
6	5.05	6.86	2.96	1.86	1.77	0.54	1.07	0.16	0.81	0.08	0.52	0.03	0.35	0.01	0.24	0.00				
7	5.90	9.12	3.45	2.47	2.07	0.71	1.25	0.21	0.95	0.11	0.60	0.04	0.41	0.01	0.28	0.01				
8	6.74	11.68	3.94	3.17	2.36	0.91	1.43	0.27	1.09	0.14	0.69	0.05	0.47	0.02	0.32	0.01				
9	7.58	14.53	4.43	3.94	2.66	1.14	1.61	0.33	1.22	0.17	0.78	0.06	0.53	0.02	0.36	0.01				
10	8.42	17.66	4.93	4.79	2.96	1.38	1.78	0.40	1.36	0.21	0.86	0.07	0.59	0.03	0.40	0.01				
12	10.11	24.75	5.91	6.71	3.55	1.94	2.14	0.57	1.63	0.29	1.04	0.10	0.71	0.04	0.48	0.01				
14	11.79	32.93	6.90	8.93	4.14	2.58	2.50	0.76	1.90	0.39	1.21	0.13	0.82	0.05	0.55	0.02				
16	13.48	42.16	7.88	11.44	4.73	3.30	2.86	0.97	2.17	0.50	1.38	0.17	0.94	0.06	0.63	0.02	0.38	0.01		
18	15.16	52.44	8.87	14.23	5.32	4.10	3.21	1.20	2.44	0.62	1.56	0.21	1.06	0.08	0.71	0.03	0.43	0.01		
20			9.85	17.29	5.91	4.99	3.57	1.46	2.71	0.75	1.73	0.25	1.18	0.10	0.79	0.04	0.48	0.01		
22			10.84	20.63	6.50	5.95	3.93	1.74	2.99	0.90	1.90	0.30	1.29	0.12	0.87	0.04	0.53	0.01		
24			11.82	24.24	7.09	6.99	4.28	2.05	3.26	1.05	2.07	0.35	1.41	0.14	0.95	0.05	0.57	0.02		
26			12.81	28.11	7.68	8.11	4.64	2.38	3.53	1.22	2.25	0.41	1.53	0.16	1.03	0.06	0.62	0.02		
28			13.80	32.25	8.27	9.30	5.00	2.73	3.80	1.40	2.42	0.47	1.65	0.18	1.11	0.07	0.67	0.02		
30			14.78	36.64	8.87	10.57	5.35	3.10	4.07	1.59	2.59	0.53	1.76	0.21	1.19	0.08	0.72	0.02		
32					9.46	11.91	5.71	3.49	4.34	1.79	2.76	0.60	1.88	0.23	1.27	0.09	0.76	0.03	0.35	0.00
34					10.05	13.32	6.07	3.91	4.61	2.01	2.94	0.67	2.00	0.26	1.35	0.10	0.81	0.03	0.37	0.00
36					10.64	14.81	6.42	4.34	4.88	2.23	3.11	0.74	2.12	0.29	1.43	0.11	0.86	0.03	0.40	0.00
38					11.23	16.37	6.78	4.80	5.16	2.46	3.28	0.82	2.23	0.32	1.50	0.12	0.91	0.04	0.42	0.01
40					11.82	18.00	7.14	5.28	5.43	2.71	3.46	0.90	2.35	0.35	1.58	0.14	0.95	0.04	0.44	0.01
42					12.41	19.70	7.50	5.78	5.70	2.97	3.63	0.99	2.47	0.39	1.66	0.15	1.00	0.04	0.46	0.01
44					13.00	21.47	7.85	6.30	5.97	3.23	3.80	1.08	2.59	0.42	1.74	0.16	1.05	0.05	0.48	0.01
46					13.59	23.32	8.21	6.84	6.24	3.51	3.97	1.17	2.70	0.46	1.82	0.18	1.10	0.05	0.51	0.01
48					14.18	25.23	8.57	7.40	6.51	3.80	4.15	1.27	2.82	0.50	1.90	0.19	1.15	0.06	0.53	0.01
50					14.78	27.21	8.92	7.98	6.78	4.10	4.32	1.37	2.94	0.53	1.98	0.20	1.19	0.06	0.55	0.01
55							9.82	9.52	7.46	4.89	4.75	1.63	3.23	0.64	2.18	0.24	1.31	0.07	0.61	0.01
60							10.71	11.18	8.14	5.74	5.18	1.91	3.53	0.75	2.38	0.29	1.43	0.08	0.66	0.01
65							11.60	12.97	8.82	6.66	5.62	2.22	3.82	0.87	2.57	0.33	1.55	0.10	0.72	0.01
70							12.49	14.88	9.50	7.64	6.05	2.55	4.11	1.00	2.77	0.38	1.67	0.11	0.77	0.02
75							13.38	16.90	10.18	8.68	6.48	2.89	4.41	1.13	2.97	0.43	1.79	0.13	0.83	0.02
80							14.28	19.05	10.86	9.78	6.91	3.26	4.70	1.28	3.17	0.49	1.91	0.14	0.88	0.02
85									11.53	10.94	7.34	3.65	4.99	1.43	3.37	0.55	2.03	0.16	0.94	0.02
90									12.21	12.16	7.78	4.06	5.29	1.59	3.56	0.61	2.15	0.18	0.99	0.03
95									12.89	13.45	8.21	4.48	5.58	1.76	3.76	0.67	2.27	0.20	1.05	0.03
100									13.57	14.79	8.64	4.93	5.88	1.93	3.96	0.74	2.39	0.22	1.10	0.03
110									14.93	17.64	9.50	5.88	6.46	2.30	4.36	0.88	2.63	0.26	1.21	0.04
120											10.37	6.91	7.05	2.71	4.75	1.04	2.86	0.30	1.32	0.05
130											11.23	8.02	7.64	3.14	5.15	1.20	3.10	0.35	1.43	0.05
140											12.10	9.20	8.23	3.60	5.54	1.38	3.34	0.40	1.54	0.06
150											12.96	10.45	8.81	4.09	5.94	1.46	3.58	0.46	1.65	0.07
160											13.82	11.77	9.40	4.61	6.34	1.76	3.82	0.52	1.76	0.08
170											14.69	13.17	9.99	5.16	6.73	1.97	4.06	0.58	1.87	0.09
180													10.58	5.73	7.13	2.19	4.30	0.64	1.98	0.10
190													11.16	6.34	7.52	2.42	4.54	0.71	2.09	0.11
200													11.75	6.97	7.92	2.67	4.77	0.78	2.20	0.12
220													12.93	8.31	8.71	3.18	5.25	0.93	2.42	0.14
240													14.10	9.77	9.50	3.74	5.73	1.09	2.65	0.17
260															10.29	4.33	6.21	1.27	2.87	0.19
280															11.09	4.97	6.68	1.45	3.09	0.22
300															11.88	5.65	7.16	1.65	3.31	0.25
320															12.67	6.37	7.64	1.86	3.53	0.28
340															13.46	7.12	8.12	2.08	3.75	0.32
360															14.25	7.92	8.59	2.31	3.97	0.35
380																	9.07	2.56	4.19	0.39
400																	9.55	2.81	4.41	0.43
420																	10.03	3.08	4.63	0.47
440																	10.50	3.35	4.85	0.51
460																	10.98	3.64	5.07	0.56
480																	11.46	3.94	5.29	0.60
500																	11.94	4.25	5.51	0.65

Shaded area represents velocities over 5 fps.
Use with caution.

CLASS 160 PVC IPS PLASTIC PIPE

ANSI/ASAE S376.2   ASTM 2241   SDR 26   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		14"		16"		18"	
Avg. ID	6.084		7.921		9.874		11.710		12.860		14.696		16.532	
Pipe OD	6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.271		0.352		0.438		0.520		0.570		0.652		0.734	
Min. Wall	0.255		0.332		0.413		0.490		0.538		0.615		0.692	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
20	0.22	0.00	0.13	0.00	0.08	0.00	0.06	0.00	0.05	0.00	0.04	0.00	0.03	0.00
40	0.44	0.01	0.26	0.00	0.17	0.00	0.12	0.00	0.10	0.00	0.08	0.00	0.06	0.00
60	0.66	0.01	0.39	0.00	0.25	0.00	0.18	0.00	0.15	0.00	0.11	0.00	0.09	0.00
80	0.88	0.02	0.52	0.01	0.33	0.00	0.24	0.00	0.20	0.00	0.15	0.00	0.12	0.00
100	1.10	0.03	0.65	0.01	0.42	0.00	0.30	0.00	0.25	0.00	0.19	0.00	0.15	0.00
150	1.65	0.07	0.98	0.02	0.63	0.01	0.45	0.00	0.37	0.00	0.28	0.00	0.22	0.00
200	2.20	0.12	1.30	0.03	0.84	0.01	0.60	0.00	0.49	0.00	0.38	0.00	0.30	0.00
250	2.76	0.18	1.63	0.05	1.05	0.02	0.74	0.01	0.62	0.00	0.47	0.00	0.37	0.00
300	3.31	0.25	1.95	0.07	1.26	0.02	0.89	0.01	0.74	0.01	0.57	0.00	0.45	0.00
350	3.86	0.33	2.28	0.09	1.46	0.03	1.04	0.01	0.86	0.01	0.66	0.00	0.52	0.00
400	4.41	0.43	2.60	0.12	1.67	0.04	1.19	0.02	0.99	0.01	0.76	0.01	0.60	0.00
450	4.96	0.53	2.93	0.15	1.88	0.05	1.34	0.02	1.11	0.01	0.85	0.01	0.67	0.00
500	5.51	0.65	3.25	0.18	2.09	0.06	1.49	0.03	1.23	0.02	0.94	0.01	0.75	0.01
550	6.06	0.77	3.58	0.21	2.30	0.07	1.64	0.03	1.36	0.02	1.04	0.01	0.82	0.01
600	6.61	0.91	3.90	0.25	2.51	0.09	1.79	0.04	1.48	0.02	1.13	0.01	0.90	0.01
650	7.16	1.05	4.23	0.29	2.72	0.10	1.93	0.04	1.60	0.03	1.23	0.01	0.97	0.01
700	7.72	1.21	4.55	0.33	2.93	0.11	2.08	0.05	1.73	0.03	1.32	0.02	1.04	0.01
750	8.27	1.37	4.88	0.38	3.14	0.13	2.23	0.06	1.85	0.04	1.42	0.02	1.12	0.01
800	8.82	1.55	5.20	0.43	3.35	0.15	2.38	0.06	1.97	0.04	1.51	0.02	1.19	0.01
850	9.37	1.73	5.53	0.48	3.56	0.16	2.53	0.07	2.10	0.05	1.61	0.02	1.27	0.01
900			5.85	0.53	3.77	0.18	2.68	0.08	2.22	0.05	1.70	0.03	1.34	0.01
950			6.18	0.59	3.98	0.20	2.83	0.09	2.34	0.06	1.79	0.03	1.42	0.02
1000			6.50	0.65	4.18	0.22	2.98	0.10	2.47	0.06	1.89	0.03	1.49	0.02
1050			6.83	0.71	4.39	0.24	3.12	0.11	2.59	0.07	1.98	0.04	1.57	0.02
1100			7.15	0.77	4.60	0.26	3.27	0.12	2.71	0.07	2.08	0.04	1.64	0.02
1150					4.81	0.29	3.42	0.13	2.84	0.08	2.17	0.04	1.72	0.02
1200					5.02	0.31	3.57	0.14	2.96	0.09	2.27	0.04	1.79	0.03
1250					5.23	0.34	3.72	0.15	3.08	0.09	2.36	0.05	1.87	0.03
1300					5.44	0.36	3.87	0.16	3.21	0.10	2.46	0.05	1.94	0.03
1350					5.65	0.39	4.02	0.17	3.33	0.11	2.55	0.06	2.02	0.03
1400					5.86	0.41	4.17	0.18	3.45	0.11	2.64	0.06	2.09	0.03
1450					6.07	0.44	4.31	0.19	3.58	0.12	2.74	0.06	2.16	0.04
1500					6.28	0.47	4.46	0.20	3.70	0.13	2.83	0.07	2.24	0.04
1600					6.70	0.53	4.76	0.23	3.95	0.15	3.02	0.08	2.39	0.04
1700					7.11	0.59	5.06	0.26	4.19	0.16	3.21	0.09	2.54	0.05
1800							5.36	0.29	4.44	0.18	3.40	0.10	2.69	0.05
1900							5.65	0.32	4.69	0.20	3.59	0.11	2.84	0.06
2000							5.95	0.35	4.93	0.22	3.78	0.12	2.99	0.07
2100							6.25	0.38	5.18	0.24	3.97	0.13	3.13	0.07
2200							6.55	0.42	5.43	0.26	4.16	0.14	3.28	0.08
2300							6.84	0.45	5.67	0.29	4.34	0.15	3.43	0.08
2400							7.14	0.49	5.92	0.31	4.53	0.16	3.58	0.09
2500							7.44	0.53	6.17	0.33	4.72	0.17	3.73	0.10
2600							7.74	0.57	6.41	0.36	4.91	0.19	3.88	0.11
2700							8.03	0.61	6.66	0.39	5.10	0.20	4.03	0.11
2800							8.33	0.65	6.91	0.41	5.29	0.22	4.18	0.12
2900							8.63	0.69	7.15	0.44	5.48	0.23	4.33	0.13
3000							8.93	0.74	7.40	0.47	5.67	0.24	4.48	0.14
3100							9.22	0.79	7.65	0.50	5.86	0.26	4.63	0.15
3200							9.52	0.83	7.89	0.53	6.05	0.28	4.78	0.16
3300									8.14	0.56	6.23	0.29	4.93	0.16
3400									8.39	0.59	6.42	0.31	5.08	0.17
3500									8.63	0.62	6.61	0.33	5.22	0.18
3600									8.88	0.66	6.80	0.34	5.37	0.19
3700									9.13	0.69	6.99	0.36	5.52	0.20
3800											7.18	0.38	5.67	0.21
3900											7.37	0.40	5.82	0.22
4000											7.56	0.42	5.97	0.24
4100											7.75	0.44	6.12	0.25
4200											7.93	0.46	6.27	0.26
4300													6.42	0.27
4400													6.57	0.28
4500													6.72	0.29
4600													6.87	0.30
4700													7.02	0.32

Shaded area represents velocities over 5 fps.
Use with caution.

CLASS 200 PVC IPS PLASTIC PIPE

ASTM D2241   (1120, 1220)   SDR 21   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	Class 315 1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Avg. ID	0.696		0.910		1.169		1.482		1.700		2.129		2.581		3.146		4.046		5.955	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg.Wall	0.072		0.070		0.073		0.089		0.100		0.123		0.147		0.177		0.227		0.335	
Min. Wall	0.062		0.060		0.063		0.079		0.090		0.113		0.137		0.167		0.214		0.316	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	0.84	0.25	0.49	0.07	0.30	0.02	0.19	0.01	0.14	0.00										
2	1.68	0.90	0.99	0.24	0.60	0.07	0.37	0.02	0.28	0.01	0.18	0.00								
3	2.53	1.90	1.48	0.52	0.90	0.15	0.56	0.05	0.42	0.02	0.27	0.01								
4	3.37	3.24	1.97	0.88	1.19	0.26	0.74	0.08	0.56	0.04	0.36	0.01	0.24	0.01						
5	4.21	4.89	2.46	1.33	1.49	0.39	0.93	0.12	0.71	0.06	0.45	0.02	0.31	0.01						
6	5.05	6.86	2.96	1.86	1.79	0.55	1.11	0.17	0.85	0.09	0.54	0.03	0.37	0.01	0.25	0.00				
7	5.90	9.12	3.45	2.47	2.09	0.73	1.30	0.23	0.99	0.12	0.63	0.04	0.43	0.02	0.29	0.01				
8	6.74	11.68	3.94	3.17	2.39	0.94	1.49	0.30	1.13	0.15	0.72	0.05	0.49	0.02	0.33	0.01				
9	7.58	14.53	4.43	3.94	2.69	1.17	1.67	0.37	1.27	0.19	0.81	0.06	0.55	0.02	0.37	0.01				
10	8.42	17.66	4.93	4.79	2.99	1.42	1.86	0.45	1.41	0.23	0.90	0.08	0.61	0.03	0.41	0.01				
12	10.11	24.75	5.91	6.71	3.58	1.98	2.23	0.63	1.69	0.32	1.08	0.11	0.73	0.04	0.49	0.02				
14	11.79	32.93	6.90	8.93	4.18	2.64	2.60	0.83	1.98	0.43	1.26	0.14	0.86	0.06	0.58	0.02				
16	13.48	42.16	7.88	11.44	4.78	3.38	2.97	1.07	2.26	0.55	1.44	0.18	0.98	0.07	0.66	0.03	0.40	0.01		
18	15.16	52.44	8.87	14.23	5.37	4.21	3.34	1.33	2.54	0.68	1.62	0.23	1.10	0.09	0.74	0.03	0.45	0.01		
20			9.85	17.29	5.97	5.11	3.72	1.61	2.82	0.83	1.80	0.28	1.22	0.11	0.82	0.04	0.50	0.01		
22			10.84	20.63	6.57	6.10	4.09	1.92	3.11	0.99	1.98	0.33	1.35	0.13	0.91	0.05	0.55	0.01		
24			11.82	24.24	7.17	7.17	4.46	2.26	3.39	1.16	2.16	0.39	1.47	0.15	0.99	0.06	0.60	0.02		
26			12.81	28.11	7.76	8.31	4.83	2.62	3.67	1.34	2.34	0.45	1.59	0.18	1.07	0.07	0.65	0.02		
28			13.80	32.25	8.36	9.53	5.20	3.01	3.95	1.54	2.52	0.52	1.71	0.20	1.15	0.08	0.70	0.02		
30			14.78	36.64	8.96	10.83	5.57	3.41	4.24	1.75	2.70	0.59	1.84	0.23	1.24	0.09	0.75	0.03		
32					9.55	12.21	5.94	3.85	4.52	1.97	2.88	0.66	1.96	0.26	1.32	0.10	0.80	0.03	0.37	0.00
34					10.15	13.66	6.32	4.31	4.80	2.21	3.06	0.74	2.08	0.29	1.40	0.11	0.85	0.03	0.39	0.00
36					10.75	15.18	6.69	4.79	5.08	2.45	3.24	0.82	2.20	0.32	1.48	0.12	0.90	0.04	0.41	0.01
38					11.35	16.78	7.06	5.29	5.36	2.71	3.42	0.91	2.33	0.36	1.57	0.14	0.95	0.04	0.44	0.01
40					11.94	18.45	7.43	5.82	5.65	2.98	3.60	1.00	2.45	0.39	1.65	0.15	1.00	0.04	0.46	0.01
42					12.54	20.20	7.80	6.37	5.93	3.27	3.78	1.09	2.57	0.43	1.73	0.16	1.05	0.05	0.48	0.01
44					13.14	22.02	8.17	6.94	6.21	3.56	3.96	1.19	2.69	0.47	1.81	0.18	1.10	0.05	0.51	0.01
46					13.73	23.91	8.55	7.54	6.49	3.86	4.14	1.29	2.82	0.51	1.90	0.19	1.15	0.06	0.53	0.01
48					14.33	25.87	8.92	8.15	6.78	4.18	4.32	1.40	2.94	0.55	1.98	0.21	1.20	0.06	0.55	0.01
50					14.93	27.90	9.29	8.79	7.06	4.51	4.50	1.51	3.06	0.59	2.06	0.23	1.25	0.07	0.58	0.01
55							10.22	10.49	7.76	5.38	4.95	1.80	3.37	0.71	2.27	0.27	1.37	0.08	0.63	0.01
60							11.15	12.33	8.47	6.32	5.40	2.11	3.67	0.83	2.47	0.32	1.50	0.09	0.69	0.01
65							12.07	14.30	9.18	7.33	5.85	2.45	3.98	0.96	2.68	0.37	1.62	0.11	0.75	0.02
70							13.00	16.40	9.88	8.41	6.30	2.81	4.29	1.10	2.89	0.42	1.74	0.12	0.81	0.02
75							13.93	18.63	10.59	9.56	6.75	3.20	4.59	1.25	3.09	0.48	1.87	0.14	0.86	0.02
80							14.86	21.00	11.29	10.77	7.20	3.60	4.90	1.41	3.30	0.54	1.99	0.16	0.92	0.02
85									12.00	12.05	7.65	4.03	5.21	1.58	3.50	0.60	2.12	0.18	0.98	0.03
90									12.71	13.40	8.10	4.48	5.51	1.76	3.71	0.67	2.24	0.20	1.04	0.03
95									13.41	14.81	8.55	4.95	5.82	1.94	3.92	0.74	2.37	0.22	1.09	0.03
100									14.12	16.28	9.00	5.45	6.12	2.13	4.12	0.81	2.49	0.24	1.15	0.04
110											9.90	6.50	6.74	2.55	4.53	0.97	2.74	0.29	1.27	0.04
120											10.80	7.63	7.35	2.99	4.95	1.14	2.99	0.34	1.38	0.05
130											11.70	8.85	7.96	3.47	5.36	1.32	3.24	0.39	1.50	0.06
140											12.60	10.16	8.57	3.98	5.77	1.52	3.49	0.45	1.61	0.07
150											13.50	11.54	9.19	4.52	6.18	1.73	3.74	0.51	1.73	0.08
160											14.40	13.01	9.80	5.10	6.60	1.95	3.99	0.57	1.84	0.09
170													10.41	5.70	7.01	2.18	4.24	0.64	1.96	0.10
180													11.02	6.34	7.42	2.42	4.49	0.71	2.07	0.11
190													11.64	7.01	7.83	2.67	4.74	0.79	2.19	0.12
200													12.25	7.71	8.24	2.94	4.98	0.86	2.30	0.13
220													13.47	9.19	9.07	3.51	5.48	1.03	2.53	0.16
240													14.70	10.80	9.89	4.12	5.98	1.21	2.76	0.18
260															10.72	4.78	6.48	1.41	2.99	0.21
280															11.54	5.48	6.98	1.61	3.22	0.25
300															12.37	6.23	7.48	1.83	3.45	0.28
320															13.19	7.02	7.98	2.06	3.68	0.31
340															14.02	7.86	8.47	2.31	3.91	0.35
360															14.84	8.73	8.97	2.57	4.14	0.39
380																	9.47	2.84	4.37	0.43
400																	9.97	3.12	4.60	0.48
420																	10.47	3.42	4.83	0.52
440																	10.97	3.72	5.06	0.57
460																	11.46	4.04	5.29	0.62
480																	11.96	4.37	5.52	0.67
500																	12.46	4.72	5.75	0.72

Shaded area represents velocities over 5 fps.
Use with caution.

CLASS 200 PVC IPS PLASTIC PIPE

ANSI/ASAE S376.2   ASTM 2241   SDR 21   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		14"		16"		18"	
Avg. ID	5.955		7.755		9.666		11.464		12.588		14.384		15.246	
Pipe OD	6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.335		0.435		0.542		0.643		0.706		0.808		1.377	
Min. Wall	0.316		0.410		0.511		0.606		0.666		0.762		0.857	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
20	0.23	0.00	0.14	0.00	0.09	0.00	0.06	0.00	0.05	0.00	0.04	0.00	0.04	0.00
40	0.46	0.01	0.27	0.00	0.17	0.00	0.12	0.00	0.10	0.00	0.08	0.00	0.07	0.00
60	0.69	0.01	0.41	0.00	0.26	0.00	0.19	0.00	0.15	0.00	0.12	0.00	0.11	0.00
80	0.92	0.02	0.54	0.01	0.35	0.00	0.25	0.00	0.21	0.00	0.16	0.00	0.14	0.00
100	1.15	0.04	0.68	0.01	0.44	0.00	0.31	0.00	0.26	0.00	0.20	0.00	0.18	0.00
150	1.73	0.08	1.02	0.02	0.66	0.01	0.47	0.00	0.39	0.00	0.30	0.00	0.26	0.00
200	2.30	0.13	1.36	0.04	0.87	0.01	0.62	0.01	0.51	0.00	0.39	0.00	0.35	0.00
250	2.88	0.20	1.70	0.06	1.09	0.02	0.78	0.01	0.64	0.01	0.49	0.00	0.44	0.00
300	3.45	0.28	2.04	0.08	1.31	0.03	0.93	0.01	0.77	0.01	0.59	0.00	0.53	0.00
350	4.03	0.37	2.37	0.10	1.53	0.04	1.09	0.02	0.90	0.01	0.69	0.01	0.61	0.00
400	4.60	0.48	2.71	0.13	1.75	0.05	1.24	0.02	1.03	0.01	0.79	0.01	0.70	0.00
450	5.18	0.59	3.05	0.16	1.97	0.06	1.40	0.02	1.16	0.02	0.89	0.01	0.79	0.01
500	5.75	0.72	3.39	0.20	2.18	0.07	1.55	0.03	1.29	0.02	0.99	0.01	0.88	0.01
550	6.33	0.86	3.73	0.24	2.40	0.08	1.71	0.04	1.42	0.02	1.08	0.01	0.97	0.01
600	6.90	1.01	4.07	0.28	2.62	0.10	1.86	0.04	1.54	0.03	1.18	0.01	1.05	0.01
650	7.48	1.17	4.41	0.32	2.84	0.11	2.02	0.05	1.67	0.03	1.28	0.02	1.14	0.01
700	8.05	1.34	4.75	0.37	3.06	0.13	2.17	0.06	1.80	0.04	1.38	0.02	1.23	0.01
750	8.63	1.52	5.09	0.42	3.28	0.14	2.33	0.06	1.93	0.04	1.48	0.02	1.32	0.02
800	9.20	1.72	5.43	0.48	3.49	0.16	2.48	0.07	2.06	0.04	1.58	0.02	1.40	0.02
850	9.78	1.92	5.77	0.53	3.71	0.18	2.64	0.08	2.19	0.05	1.68	0.03	1.49	0.02
900			6.11	0.59	3.93	0.20	2.79	0.09	2.32	0.06	1.77	0.03	1.58	0.02
950			6.44	0.65	4.15	0.22	2.95	0.10	2.45	0.06	1.87	0.03	1.67	0.02
1000			6.78	0.72	4.37	0.25	3.10	0.11	2.57	0.07	1.97	0.04	1.76	0.03
1050			7.12	0.79	4.59	0.27	3.26	0.12	2.70	0.07	2.07	0.04	1.84	0.03
1100			7.46	0.86	4.80	0.29	3.41	0.13	2.83	0.08	2.17	0.04	1.93	0.03
1150					5.02	0.32	3.57	0.14	2.96	0.09	2.27	0.05	2.02	0.03
1200					5.24	0.34	3.73	0.15	3.09	0.10	2.37	0.05	2.11	0.04
1250					5.46	0.37	3.88	0.16	3.22	0.10	2.46	0.05	2.19	0.04
1300					5.68	0.40	4.04	0.17	3.35	0.11	2.56	0.06	2.28	0.04
1350					5.90	0.43	4.19	0.19	3.48	0.12	2.66	0.06	2.37	0.05
1400					6.11	0.46	4.35	0.20	3.60	0.13	2.76	0.07	2.46	0.05
1450					6.33	0.49	4.50	0.21	3.73	0.14	2.86	0.07	2.55	0.05
1500					6.55	0.52	4.66	0.23	3.86	0.14	2.96	0.08	2.63	0.06
1600					6.99	0.59	4.97	0.26	4.12	0.16	3.16	0.08	2.81	0.06
1700					7.42	0.66	5.28	0.29	4.38	0.18	3.35	0.09	2.98	0.07
1800							5.59	0.32	4.63	0.20	3.55	0.11	3.16	0.08
1900							5.90	0.35	4.89	0.22	3.75	0.12	3.34	0.09
2000							6.21	0.39	5.15	0.25	3.94	0.13	3.51	0.10
2100							6.52	0.42	5.41	0.27	4.14	0.14	3.69	0.11
2200							6.83	0.46	5.66	0.29	4.34	0.15	3.86	0.12
2300							7.14	0.50	5.92	0.32	4.54	0.17	4.04	0.13
2400							7.45	0.54	6.18	0.34	4.73	0.18	4.21	0.14
2500							7.76	0.59	6.44	0.37	4.93	0.19	4.39	0.15
2600							8.07	0.63	6.69	0.40	5.13	0.21	4.56	0.16
2700							8.38	0.67	6.95	0.43	5.32	0.22	4.74	0.17
2800							8.69	0.72	7.21	0.46	5.52	0.24	4.91	0.18
2900							9.00	0.77	7.47	0.49	5.72	0.26	5.09	0.19
3000							9.31	0.82	7.72	0.52	5.92	0.27	5.27	0.20
3100							9.62	0.87	7.98	0.55	6.11	0.29	5.44	0.22
3200							9.93	0.92	8.24	0.59	6.31	0.31	5.62	0.23
3300									8.50	0.62	6.51	0.32	5.79	0.24
3400									8.75	0.66	6.70	0.34	5.97	0.26
3500									9.01	0.69	6.90	0.36	6.14	0.27
3600									9.27	0.73	7.10	0.38	6.32	0.29
3700									9.53	0.77	7.30	0.40	6.49	0.30
3800											7.49	0.42	6.67	0.32
3900											7.69	0.44	6.85	0.33
4000											7.89	0.46	7.02	0.35
4100											8.09	0.48	7.20	0.37
4200											8.28	0.51	7.37	0.38
4300													7.55	0.40
4400													7.72	0.42
4500													7.90	0.43
4600													8.07	0.45
4700													8.25	0.47

Shaded area represents velocities over 5 fps. Use with caution.

CLASS 315 PVC IPS PLASTIC PIPE

ASTM D2241   (1120, 1220)   SDR 13.5   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Avg. ID	0.696		0.874		1.101		1.394		1.598		1.983		2.423		2.948		3.794		5.583	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg. Wall	0.072		0.088		0.107		0.133		0.151		0.196		0.226		0.274		0.353		0.521	
Min. Wall	0.062		0.078		0.097		0.123		0.141		0.176		0.213		0.259		0.333		0.491	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	0.84	0.25	0.53	0.08	0.34	0.03	0.21	0.01	0.16	0.00										
2	1.68	0.90	1.07	0.30	0.67	0.10	0.42	0.03	0.32	0.02	0.21	0.01								
3	2.53	1.90	1.60	0.63	1.01	0.20	0.63	0.06	0.48	0.03	0.31	0.01								
4	3.37	3.24	2.14	1.07	1.35	0.35	0.84	0.11	0.64	0.06	0.42	0.02	0.28	0.01						
5	4.21	4.89	2.67	1.61	1.68	0.53	1.05	0.17	0.80	0.09	0.52	0.03	0.35	0.01						
6	5.05	6.86	3.20	2.26	2.02	0.74	1.26	0.23	0.96	0.12	0.62	0.04	0.42	0.02	0.28	0.01				
7	5.90	9.12	3.74	3.01	2.36	0.98	1.47	0.31	1.12	0.16	0.73	0.06	0.49	0.02	0.33	0.01				
8	6.74	11.68	4.27	3.86	2.69	1.25	1.68	0.40	1.28	0.20	0.83	0.07	0.56	0.03	0.38	0.01				
9	7.58	14.53	4.81	4.80	3.03	1.56	1.89	0.49	1.44	0.25	0.93	0.09	0.63	0.03	0.42	0.01				
10	8.42	17.66	5.34	5.83	3.37	1.90	2.10	0.60	1.60	0.31	1.04	0.11	0.69	0.04	0.47	0.02				
12	10.11	24.75	6.41	8.17	4.04	2.66	2.52	0.84	1.92	0.43	1.25	0.15	0.83	0.06	0.56	0.02				
14	11.79	32.93	7.48	10.87	4.71	3.53	2.94	1.12	2.24	0.58	1.45	0.20	0.97	0.08	0.66	0.03				
16	13.48	42.16	8.55	13.92	5.39	4.53	3.36	1.44	2.56	0.74	1.66	0.26	1.11	0.10	0.75	0.04	0.45	0.01		
18	15.16	52.44	9.61	17.32	6.06	5.63	3.78	1.79	2.88	0.92	1.87	0.32	1.25	0.12	0.85	0.05	0.51	0.01		
20			10.68	21.05	6.73	6.84	4.20	2.17	3.20	1.12	2.08	0.39	1.39	0.15	0.94	0.06	0.57	0.02		
22			11.75	25.11	7.40	8.16	4.62	2.59	3.52	1.33	2.28	0.47	1.53	0.18	1.03	0.07	0.62	0.02		
24			12.82	29.50	8.08	9.59	5.04	3.04	3.83	1.57	2.49	0.55	1.67	0.21	1.13	0.08	0.68	0.02		
26			13.89	34.21	8.75	11.12	5.46	3.53	4.15	1.82	2.70	0.64	1.81	0.24	1.22	0.09	0.74	0.03		
28			14.96	39.25	9.42	12.76	5.88	4.05	4.47	2.08	2.91	0.73	1.95	0.27	1.31	0.11	0.79	0.03		
30			16.02	44.60	10.10	14.50	6.30	4.60	4.79	2.37	3.11	0.83	2.08	0.31	1.41	0.12	0.85	0.04		
32					10.77	16.34	6.72	5.18	5.11	2.67	3.32	0.93	2.22	0.35	1.50	0.14	0.91	0.04	0.42	0.01
34					11.44	18.28	7.14	5.80	5.43	2.98	3.53	1.04	2.36	0.39	1.60	0.15	0.96	0.04	0.45	0.01
36					12.12	20.32	7.56	6.45	5.75	3.32	3.74	1.16	2.50	0.44	1.69	0.17	1.02	0.05	0.47	0.01
38					12.79	22.46	7.98	7.13	6.07	3.67	3.94	1.28	2.64	0.48	1.78	0.19	1.08	0.05	0.50	0.01
40					13.46	24.70	8.40	7.84	6.39	4.03	4.15	1.41	2.78	0.53	1.88	0.20	1.13	0.06	0.52	0.01
42					14.14	27.04	8.82	8.58	6.71	4.41	4.36	1.54	2.92	0.58	1.97	0.22	1.19	0.07	0.55	0.01
44					14.81	29.47	9.24	9.35	7.03	4.81	4.57	1.68	3.06	0.63	2.07	0.24	1.25	0.07	0.58	0.01
46					15.48	32.00	9.66	10.15	7.35	5.22	4.77	1.83	3.20	0.69	2.16	0.27	1.30	0.08	0.60	0.01
48					16.16	34.62	10.08	10.98	7.67	5.65	4.98	1.98	3.34	0.75	2.25	0.29	1.36	0.08	0.63	0.01
50					16.83	37.34	10.50	11.85	7.99	6.09	5.19	2.13	3.47	0.80	2.35	0.31	1.42	0.09	0.65	0.01
55							11.55	14.13	8.79	7.27	5.71	2.54	3.82	0.96	2.58	0.37	1.56	0.11	0.72	0.02
60							12.60	16.60	9.59	8.54	6.23	2.99	4.17	1.13	2.82	0.43	1.70	0.13	0.79	0.02
65							13.65	19.26	10.39	9.91	6.74	3.47	4.52	1.31	3.05	0.50	1.84	0.15	0.85	0.02
70							14.70	22.09	11.18	11.37	7.26	3.98	4.86	1.50	3.29	0.58	1.98	0.17	0.92	0.03
75							15.75	25.10	11.98	12.91	7.78	4.52	5.21	1.70	3.52	0.66	2.13	0.19	0.98	0.03
80							16.80	28.29	12.78	14.55	8.30	5.09	5.56	1.92	3.76	0.74	2.27	0.22	1.05	0.03
85									13.58	16.28	8.82	5.70	5.91	2.15	3.99	0.83	2.41	0.24	1.11	0.04
90									14.38	18.10	9.34	6.33	6.25	2.39	4.23	0.92	2.55	0.27	1.18	0.04
95									15.18	20.01	9.86	7.00	6.60	2.64	4.46	1.02	2.69	0.30	1.24	0.05
100									15.98	22.00	10.38	7.70	6.95	2.90	4.69	1.12	2.83	0.33	1.31	0.05
110											11.41	9.18	7.64	3.46	5.16	1.33	3.12	0.39	1.44	0.06
120											12.45	10.79	8.34	4.07	5.63	1.57	3.40	0.46	1.57	0.07
130											13.49	12.51	9.03	4.72	6.10	1.82	3.68	0.53	1.70	0.08
140											14.53	14.35	9.73	5.41	6.57	2.08	3.97	0.61	1.83	0.09
150											15.56	16.31	10.42	6.15	7.04	2.37	4.25	0.69	1.96	0.11
160											16.60	18.38	11.12	6.93	7.51	2.67	4.54	0.78	2.09	0.12
170													11.81	7.76	7.98	2.99	4.82	0.87	2.23	0.13
180													12.51	8.62	8.45	3.32	5.10	0.97	2.36	0.15
190													13.20	9.53	8.92	3.67	5.39	1.08	2.49	0.16
200													13.90	10.48	9.39	4.03	5.67	1.18	2.62	0.18
220													15.29	12.50	10.33	4.81	6.24	1.41	2.88	0.22
240													16.68	14.69	11.27	5.66	6.80	1.66	3.14	0.25
260															12.21	6.56	7.37	1.92	3.40	0.29
280															13.15	7.52	7.94	2.20	3.67	0.34
300															14.08	8.55	8.50	2.50	3.93	0.38
320															15.02	9.64	9.07	2.82	4.19	0.43
340															15.96	10.78	9.64	3.16	4.45	0.48
360															16.90	11.98	10.20	3.51	4.71	0.54
380																	10.77	3.88	4.97	0.59
400																	11.34	4.27	5.24	0.65
420																	11.90	4.67	5.50	0.71
440																	12.47	5.09	5.76	0.78
460																	13.04	5.53	6.02	0.84
480																	13.61	5.98	6.28	0.91
500																	14.17	6.45	6.54	0.98

Shaded area represents velocities over 5 fps. Use with caution.

SCHEDULE 40 PVC IPS PLASTIC PIPE

ASTM D1785 (1120, 1220) C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Avg. ID	0.602		0.804		1.029		1.360		1.590		2.047		2.445		3.042		3.998		6.031	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg. Wall	0.119		0.123		0.143		0.150		0.155		0.164		0.215		0.229		0.251		0.297	
Min. Wall	0.109		0.113		0.133		0.140		0.145		0.154		0.203		0.216		0.237		0.280	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.13	0.50	0.63	0.12	0.39	0.04	0.22	0.01	0.16	0.00										
2	2.25	1.82	1.26	0.44	0.77	0.13	0.44	0.03	0.32	0.02	0.19	0.00								
3	3.38	3.85	1.89	0.94	1.16	0.28	0.66	0.07	0.48	0.03	0.29	0.01								
4	4.50	6.55	2.52	1.60	1.54	0.48	0.88	0.12	0.65	0.06	0.39	0.02	0.27	0.01						
5	5.63	9.91	3.16	2.42	1.93	0.73	1.10	0.19	0.81	0.09	0.49	0.03	0.34	0.01						
6	6.75	13.89	3.79	3.40	2.31	1.02	1.32	0.26	0.97	0.12	0.58	0.04	0.41	0.02	0.26	0.01				
7	7.88	18.48	4.42	4.52	2.70	1.36	1.54	0.35	1.13	0.16	0.68	0.05	0.48	0.02	0.31	0.01				
8	9.01	23.66	5.05	5.79	3.08	1.74	1.76	0.45	1.29	0.21	0.78	0.06	0.55	0.03	0.35	0.01				
9	10.13	29.43	5.68	7.20	3.47	2.17	1.99	0.56	1.45	0.26	0.88	0.08	0.61	0.03	0.40	0.01				
10	11.26	35.77	6.31	8.75	3.85	2.63	2.21	0.68	1.61	0.32	0.97	0.09	0.68	0.04	0.44	0.01				
12	13.51	50.14	7.57	12.27	4.62	3.69	2.65	0.95	1.94	0.44	1.17	0.13	0.82	0.05	0.53	0.02				
14	15.76	66.71	8.84	16.32	5.39	4.91	3.09	1.26	2.26	0.59	1.36	0.17	0.96	0.07	0.62	0.03				
16	18.01	85.42	10.10	20.90	6.17	6.29	3.53	1.62	2.58	0.76	1.56	0.22	1.09	0.09	0.71	0.03	0.41	0.01		
18	20.26	106.24	11.36	25.99	6.94	7.82	3.97	2.01	2.90	0.94	1.75	0.28	1.23	0.12	0.79	0.04	0.46	0.01		
20			12.62	31.59	7.71	9.51	4.41	2.45	3.23	1.14	1.95	0.33	1.36	0.14	0.88	0.05	0.51	0.01		
22			13.89	37.69	8.48	11.35	4.85	2.92	3.55	1.37	2.14	0.40	1.50	0.17	0.97	0.06	0.56	0.02		
24			15.15	44.28	9.25	13.33	5.29	3.43	3.87	1.60	2.34	0.47	1.64	0.20	1.06	0.07	0.61	0.02		
26			16.41	51.36	10.02	15.46	5.74	3.98	4.20	1.86	2.53	0.54	1.77	0.23	1.15	0.08	0.66	0.02		
28			17.67	58.91	10.79	17.73	6.18	4.56	4.52	2.13	2.73	0.62	1.91	0.26	1.23	0.09	0.71	0.02		
30			18.94	66.94	11.56	20.15	6.62	5.19	4.84	2.42	2.92	0.71	2.05	0.30	1.32	0.10	0.77	0.03		
32					12.33	22.71	7.06	5.85	5.16	2.73	3.12	0.80	2.18	0.34	1.41	0.12	0.82	0.03	0.36	0.00
34					13.10	25.41	7.50	6.54	5.49	3.06	3.31	0.89	2.32	0.38	1.50	0.13	0.87	0.03	0.38	0.00
36					13.87	28.24	7.94	7.27	5.81	3.40	3.51	0.99	2.46	0.42	1.59	0.14	0.92	0.04	0.40	0.01
38					14.64	31.22	8.38	8.04	6.13	3.76	3.70	1.10	2.59	0.46	1.68	0.16	0.97	0.04	0.43	0.01
40					15.41	34.33	8.82	8.84	6.46	4.13	3.89	1.21	2.73	0.51	1.76	0.18	1.02	0.05	0.45	0.01
42					16.18	37.58	9.26	9.67	6.78	4.52	4.09	1.32	2.87	0.56	1.85	0.19	1.07	0.05	0.47	0.01
44					16.95	40.96	9.71	10.54	7.10	4.93	4.28	1.44	3.00	0.61	1.94	0.21	1.12	0.06	0.49	0.01
46					17.73	44.47	10.15	11.45	7.42	5.35	4.48	1.57	3.14	0.66	2.03	0.23	1.17	0.06	0.52	0.01
48					18.50	48.12	10.59	12.39	7.75	5.79	4.67	1.69	3.28	0.71	2.12	0.25	1.23	0.07	0.54	0.01
50					19.27	51.90	11.03	13.36	8.07	6.25	4.87	1.83	3.41	0.77	2.20	0.27	1.28	0.07	0.56	0.01
55							12.13	15.94	8.88	7.45	5.36	2.18	3.75	0.92	2.42	0.32	1.40	0.08	0.62	0.01
60							13.24	18.72	9.68	8.75	5.84	2.56	4.09	1.08	2.65	0.37	1.53	0.10	0.67	0.01
65							14.34	21.72	10.49	10.15	6.33	2.97	4.44	1.25	2.87	0.43	1.66	0.11	0.73	0.02
70							15.44	24.91	11.30	11.65	6.82	3.41	4.78	1.43	3.09	0.50	1.79	0.13	0.79	0.02
75							16.54	28.31	12.10	13.23	7.30	3.87	5.12	1.63	3.31	0.56	1.91	0.15	0.84	0.02
80							17.65	31.90	12.91	14.91	7.79	4.36	5.46	1.84	3.53	0.63	2.04	0.17	0.90	0.02
85									13.72	16.69	8.28	4.88	5.80	2.06	3.75	0.71	2.17	0.19	0.95	0.03
90									14.52	18.55	8.76	5.43	6.14	2.29	3.97	0.79	2.30	0.21	1.01	0.03
95									15.33	20.50	9.25	6.00	6.48	2.53	4.19	0.87	2.42	0.23	1.07	0.03
100									16.14	22.55	9.74	6.59	6.82	2.78	4.41	0.96	2.55	0.25	1.12	0.03
110											10.71	7.87	7.51	3.31	4.85	1.14	2.81	0.30	1.23	0.04
120											11.68	9.24	8.19	3.89	5.29	1.34	3.06	0.36	1.35	0.05
130											12.66	10.72	8.87	4.52	5.73	1.56	3.32	0.41	1.46	0.06
140											13.63	12.30	9.55	5.18	6.17	1.79	3.57	0.47	1.57	0.06
150											14.61	13.97	10.24	5.89	6.61	2.03	3.83	0.54	1.68	0.07
160											15.58	15.75	10.92	6.63	7.05	2.29	4.08	0.61	1.79	0.08
170													11.60	7.42	7.50	2.56	4.34	0.68	1.91	0.09
180													12.28	8.25	7.94	2.85	4.59	0.75	2.02	0.10
190													12.97	9.12	8.38	3.15	4.85	0.83	2.13	0.11
200													13.65	10.03	8.82	3.46	5.11	0.92	2.24	0.12
220													15.01	11.96	9.70	4.13	5.62	1.09	2.47	0.15
240													16.38	14.06	10.58	4.85	6.13	1.28	2.69	0.17
260															11.46	5.63	6.64	1.49	2.92	0.20
280															12.35	6.46	7.15	1.71	3.14	0.23
300															13.23	7.34	7.66	1.94	3.37	0.26
320															14.11	8.27	8.17	2.19	3.59	0.30
340															14.99	9.25	8.68	2.45	3.81	0.33
360															15.87	10.29	9.19	2.72	4.04	0.37
380																	9.70	3.01	4.26	0.41
400																	10.21	3.31	4.49	0.45
420																	10.72	3.62	4.71	0.49
440																	11.23	3.95	4.94	0.53
460																	11.74	4.28	5.16	0.58
480																	12.25	4.64	5.38	0.63
500																	12.76	5.00	5.61	0.68
Working Pressure	600 PSI		480 PSI		450 PSI		370 PSI		330 PSI		280 PSI		300 PSI		260 PSI		220 PSI		180 PSI	

Shaded area represents velocities over 5 fps. Use with caution.

PVC SCHEDULE 40 IPS PLASTIC PIPE

ASTM D1785 C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"	
Avg. ID	3.998		6.031		7.942		9.976		11.889	
Pipe OD	4.500		6.625		8.625		10.750		12.750	
Avg. Wall	0.251		0.297		0.342		0.387		0.431	
Min. Wall	0.237		0.280		0.322		0.365		0.406	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
10	0.26	0.00	0.11	0.00	0.06	0.00	0.04	0.00	0.03	0.00
20	0.51	0.01	0.22	0.00	0.13	0.00	0.08	0.00	0.06	0.00
30	0.77	0.03	0.34	0.00	0.19	0.00	0.12	0.00	0.09	0.00
40	1.02	0.05	0.45	0.01	0.26	0.00	0.16	0.00	0.12	0.00
50	1.28	0.07	0.56	0.01	0.32	0.00	0.20	0.00	0.14	0.00
60	1.53	0.10	0.67	0.01	0.39	0.00	0.25	0.00	0.17	0.00
70	1.79	0.13	0.79	0.02	0.45	0.00	0.29	0.00	0.20	0.00
80	2.04	0.17	0.90	0.02	0.52	0.01	0.33	0.00	0.23	0.00
90	2.30	0.21	1.01	0.03	0.58	0.01	0.37	0.00	0.26	0.00
100	2.55	0.25	1.12	0.03	0.65	0.01	0.41	0.00	0.29	0.00
120	3.06	0.36	1.35	0.05	0.78	0.01	0.49	0.00	0.35	0.00
140	3.57	0.47	1.57	0.06	0.91	0.02	0.57	0.01	0.40	0.00
160	4.08	0.61	1.79	0.08	1.03	0.02	0.66	0.01	0.46	0.00
180	4.59	0.75	2.02	0.10	1.16	0.03	0.74	0.01	0.52	0.00
200	5.11	0.92	2.24	0.12	1.29	0.03	0.82	0.01	0.58	0.00
225	5.74	1.14	2.52	0.15	1.46	0.04	0.92	0.01	0.65	0.01
250	6.38	1.39	2.80	0.19	1.62	0.05	1.02	0.02	0.72	0.01
275	7.02	1.65	3.08	0.22	1.78	0.06	1.13	0.02	0.79	0.01
300	7.66	1.94	3.37	0.26	1.94	0.07	1.23	0.02	0.87	0.01
325	8.30	2.25	3.65	0.30	2.10	0.08	1.33	0.03	0.94	0.01
350	8.93	2.58	3.93	0.35	2.26	0.09	1.43	0.03	1.01	0.01
375			4.21	0.40	2.43	0.10	1.54	0.03	1.08	0.01
400			4.49	0.45	2.59	0.12	1.64	0.04	1.15	0.02
425			4.77	0.50	2.75	0.13	1.74	0.04	1.23	0.02
450			5.05	0.56	2.91	0.15	1.84	0.05	1.30	0.02
475			5.33	0.62	3.07	0.16	1.95	0.05	1.37	0.02
500			5.61	0.68	3.23	0.18	2.05	0.06	1.44	0.02
550			6.17	0.81	3.56	0.21	2.25	0.07	1.59	0.03
600			6.73	0.95	3.88	0.25	2.46	0.08	1.73	0.03
650			7.29	1.10	4.20	0.29	2.66	0.09	1.88	0.04
700			7.85	1.26	4.53	0.33	2.87	0.11	2.02	0.05
750					4.85	0.38	3.07	0.12	2.16	0.05
800					5.17	0.42	3.28	0.14	2.31	0.06
850					5.50	0.47	3.48	0.16	2.45	0.07
900					5.82	0.53	3.69	0.17	2.60	0.07
950					6.15	0.58	3.89	0.19	2.74	0.08
1000					6.47	0.64	4.10	0.21	2.89	0.09
1050					6.79	0.70	4.30	0.23	3.03	0.10
1150					7.44	0.83	4.71	0.27	3.32	0.12
1200					7.76	0.90	4.92	0.30	3.46	0.13
1250							5.12	0.32	3.61	0.14
1300							5.33	0.34	3.75	0.15
1350							5.53	0.37	3.90	0.16
1400							5.74	0.39	4.04	0.17
1500							6.15	0.45	4.33	0.19
1550							6.35	0.47	4.47	0.20
1600							6.56	0.50	4.62	0.21
1650							6.76	0.53	4.76	0.23
1700							6.97	0.56	4.91	0.24
1750							7.17	0.59	5.05	0.25
1800									5.20	0.27
1850									5.34	0.28
1900									5.48	0.29
1950									5.63	0.31
2000									5.77	0.32
2100									6.06	0.35
2200									6.35	0.39
2300									6.64	0.42
2400									6.93	0.45
2500									7.22	0.49
2600										
2700										
2800										
2900										
3000										

Shaded area represents velocities over 5 fps. Use with caution.

SCHEDULE 80 PVC IPS PLASTIC PIPE

ASTM D1785   (1120, 1220)   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
Avg. ID	0.526		0.722		0.935		1.254		1.476		1.913		2.289		2.864		3.786		5.709	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
Avg. Wall	0.157		0.164		0.190		0.203		0.212		0.231		0.293		0.318		0.357		0.458	
Min. Wall	0.147		0.154		0.179		0.191		0.200		0.218		0.276		0.300		0.337		0.432	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.47	0.97	0.78	0.21	0.47	0.06	0.26	0.01	0.19	0.01										
2	2.95	3.50	1.57	0.75	0.93	0.21	0.52	0.05	0.37	0.02	0.22	0.01								
3	4.42	7.42	2.35	1.59	1.40	0.45	0.78	0.11	0.56	0.05	0.33	0.01								
4	5.90	12.64	3.13	2.71	1.87	0.77	1.04	0.18	0.75	0.08	0.45	0.02	0.31	0.01						
5	7.37	19.11	3.91	4.09	2.33	1.16	1.30	0.28	0.94	0.13	0.56	0.04	0.39	0.01						
6	8.85	26.78	4.70	5.74	2.80	1.63	1.56	0.39	1.12	0.18	0.67	0.05	0.47	0.02	0.30	0.01				
7	10.32	35.63	5.48	7.63	3.27	2.17	1.82	0.52	1.31	0.24	0.78	0.07	0.55	0.03	0.35	0.01				
8	11.80	45.63	6.26	9.77	3.73	2.78	2.08	0.67	1.50	0.30	0.89	0.09	0.62	0.04	0.40	0.01				
9	13.27	56.75	7.04	12.15	4.20	3.45	2.34	0.83	1.69	0.37	1.00	0.11	0.70	0.04	0.45	0.01				
10	14.75	68.98	7.83	14.77	4.67	4.20	2.59	1.01	1.87	0.46	1.11	0.13	0.78	0.05	0.50	0.02				
12			9.39	20.70	5.60	5.88	3.11	1.41	2.25	0.64	1.34	0.18	0.93	0.08	0.60	0.03				
14			10.96	27.55	6.53	7.83	3.63	1.88	2.62	0.85	1.56	0.24	1.09	0.10	0.70	0.03				
16			12.52	35.27	7.47	10.03	4.15	2.40	3.00	1.09	1.78	0.31	1.25	0.13	0.80	0.04	0.46	0.01		
18			14.09	43.87	8.40	12.47	4.67	2.99	3.37	1.35	2.01	0.38	1.40	0.16	0.90	0.05	0.51	0.01		
20			15.65	53.32	9.33	15.16	5.19	3.63	3.75	1.64	2.23	0.47	1.56	0.19	0.99	0.07	0.57	0.02		
22					10.27	18.08	5.71	4.33	4.12	1.96	2.45	0.56	1.71	0.23	1.09	0.08	0.63	0.02		
24					11.20	21.24	6.23	5.09	4.49	2.30	2.68	0.65	1.87	0.27	1.19	0.09	0.68	0.02		
26					12.13	24.64	6.75	5.91	4.87	2.67	2.90	0.76	2.02	0.32	1.29	0.11	0.74	0.03		
28					13.07	28.26	7.26	6.77	5.24	3.06	3.12	0.87	2.18	0.36	1.39	0.12	0.80	0.03		
30					14.00	32.12	7.78	7.70	5.62	3.48	3.34	0.99	2.34	0.41	1.49	0.14	0.85	0.04		
32					14.93	36.19	8.30	8.68	5.99	3.92	3.57	1.11	2.49	0.46	1.59	0.16	0.91	0.04	0.40	0.01
34					15.87	40.49	8.82	9.71	6.37	4.39	3.79	1.24	2.65	0.52	1.69	0.17	0.97	0.04	0.43	0.01
36							9.34	10.79	6.74	4.88	4.01	1.38	2.80	0.58	1.79	0.19	1.02	0.05	0.45	0.01
38							9.86	11.93	7.12	5.40	4.24	1.53	2.96	0.64	1.89	0.21	1.08	0.06	0.48	0.01
40							10.38	13.11	7.49	5.93	4.46	1.68	3.11	0.70	1.99	0.24	1.14	0.06	0.50	0.01
42							10.90	14.35	7.87	6.49	4.68	1.84	3.27	0.77	2.09	0.26	1.20	0.07	0.53	0.01
44							11.42	15.65	8.24	7.08	4.91	2.00	3.43	0.84	2.19	0.28	1.25	0.07	0.55	0.01
46							11.94	16.99	8.61	7.69	5.13	2.18	3.58	0.91	2.29	0.31	1.31	0.08	0.58	0.01
48							12.45	18.38	8.99	8.32	5.35	2.35	3.74	0.98	2.39	0.33	1.37	0.08	0.60	0.01
50							12.97	19.83	9.36	8.97	5.57	2.54	3.89	1.06	2.49	0.36	1.42	0.09	0.63	0.01
55							14.27	23.65	10.30	10.70	6.13	3.03	4.28	1.27	2.74	0.43	1.57	0.11	0.69	0.01
60							15.57	27.79	11.24	12.57	6.69	3.56	4.67	1.49	2.98	0.50	1.71	0.13	0.75	0.02
65									12.17	14.58	7.25	4.13	5.06	1.72	3.23	0.58	1.85	0.15	0.81	0.02
70									13.11	16.73	7.80	4.74	5.45	1.98	3.48	0.66	1.99	0.17	0.88	0.02
75									14.05	19.01	8.36	5.38	5.84	2.25	3.73	0.76	2.13	0.19	0.94	0.03
80									14.98	21.42	8.92	6.06	6.23	2.53	3.98	0.85	2.28	0.22	1.00	0.03
85									15.92	23.96	9.48	6.78	6.62	2.83	4.23	0.95	2.42	0.24	1.06	0.03
90											10.03	7.54	7.01	3.15	4.48	1.06	2.56	0.27	1.13	0.04
95											10.59	8.34	7.40	3.48	4.73	1.17	2.70	0.30	1.19	0.04
100											11.15	9.17	7.79	3.83	4.97	1.29	2.85	0.33	1.25	0.04
110											12.26	10.94	8.57	4.57	5.47	1.53	3.13	0.39	1.38	0.05
120											13.38	12.85	9.34	5.37	5.97	1.80	3.42	0.46	1.50	0.06
130											14.49	14.90	10.12	6.22	6.47	2.09	3.70	0.54	1.63	0.07
140											15.61	17.09	10.90	7.14	6.96	2.40	3.98	0.62	1.75	0.08
150													11.68	8.11	7.46	2.73	4.27	0.70	1.88	0.10
160													12.46	9.14	7.96	3.07	4.55	0.79	2.00	0.11
170													13.24	10.23	8.46	3.44	4.84	0.88	2.13	0.12
180													14.02	11.37	8.95	3.82	5.12	0.98	2.25	0.13
190													14.80	12.57	9.45	4.22	5.41	1.09	2.38	0.15
200													15.57	13.82	9.95	4.64	5.69	1.19	2.50	0.16
220															10.94	5.54	6.26	1.42	2.75	0.19
240															11.94	6.51	6.83	1.67	3.00	0.23
260															12.93	7.55	7.40	1.94	3.25	0.26
280															13.93	8.66	7.97	2.23	3.51	0.30
300															14.92	9.84	8.54	2.53	3.76	0.34
320															15.92	11.09	9.11	2.85	4.01	0.39
340																	9.68	3.19	4.26	0.43
360																	10.25	3.55	4.51	0.48
380																	10.82	3.92	4.76	0.53
400																	11.39	4.31	5.01	0.58
420																	11.95	4.72	5.26	0.64
440																	12.52	5.14	5.51	0.70
460																	13.09	5.59	5.76	0.76
480																	13.66	6.04	6.01	0.82
500																	14.23	6.52	6.26	0.88
Working Pressure	850 PSI		690 PSI		630 PSI		520 PSI		470 PSI		400 PSI		420 PSI		370 PSI		320 PSI		280 PSI	

Shaded area represents velocities over 5 fps.
Use with caution.

PVC SCHEDULE 80 IPS PLASTIC PIPE

ASTM D1785   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"	
Avg. ID	3.786		5.709		7.565		9.493		11.294	
Pipe OD	4.500		6.625		8.625		10.750		12.750	
Avg. Wall	0.357		0.458		0.530		0.629		0.728	
Min. Wall	0.337		0.432		0.500		0.593		0.687	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
10	0.28	0.00	0.13	0.00	0.07	0.00	0.05	0.00	0.03	0.00
20	0.57	0.02	0.25	0.00	0.14	0.00	0.09	0.00	0.06	0.00
30	0.85	0.04	0.38	0.00	0.21	0.00	0.14	0.00	0.10	0.00
40	1.14	0.06	0.50	0.01	0.29	0.00	0.18	0.00	0.13	0.00
50	1.42	0.09	0.63	0.01	0.36	0.00	0.23	0.00	0.16	0.00
60	1.71	0.13	0.75	0.02	0.43	0.00	0.27	0.00	0.19	0.00
70	1.99	0.17	0.88	0.02	0.50	0.01	0.32	0.00	0.22	0.00
80	2.28	0.22	1.00	0.03	0.57	0.01	0.36	0.00	0.26	0.00
90	2.56	0.27	1.13	0.04	0.64	0.01	0.41	0.00	0.29	0.00
100	2.85	0.33	1.25	0.04	0.71	0.01	0.45	0.00	0.32	0.00
120	3.42	0.46	1.50	0.06	0.86	0.02	0.54	0.01	0.38	0.00
140	3.98	0.62	1.75	0.08	1.00	0.02	0.63	0.01	0.45	0.00
160	4.55	0.79	2.00	0.11	1.14	0.03	0.72	0.01	0.51	0.00
180	5.12	0.98	2.25	0.13	1.28	0.03	0.81	0.01	0.58	0.00
200	5.69	1.19	2.50	0.16	1.43	0.04	0.91	0.01	0.64	0.01
225	6.40	1.49	2.82	0.20	1.60	0.05	1.02	0.02	0.72	0.01
250	7.12	1.81	3.13	0.24	1.78	0.06	1.13	0.02	0.80	0.01
275	7.83	2.15	3.44	0.29	1.96	0.07	1.25	0.02	0.88	0.01
300	8.54	2.53	3.76	0.34	2.14	0.09	1.36	0.03	0.96	0.01
325	9.25	2.94	4.07	0.40	2.32	0.10	1.47	0.03	1.04	0.01
350	9.96	3.37	4.38	0.46	2.50	0.12	1.58	0.04	1.12	0.02
375			4.69	0.52	2.67	0.13	1.70	0.04	1.20	0.02
400			5.01	0.58	2.85	0.15	1.81	0.05	1.28	0.02
425			5.32	0.65	3.03	0.17	1.92	0.06	1.36	0.02
450			5.63	0.73	3.21	0.18	2.04	0.06	1.44	0.03
475			5.95	0.80	3.39	0.20	2.15	0.07	1.52	0.03
500			6.26	0.88	3.56	0.22	2.26	0.07	1.60	0.03
550			6.88	1.05	3.92	0.27	2.49	0.09	1.76	0.04
600			7.51	1.24	4.28	0.31	2.72	0.10	1.92	0.04
650			8.14	1.44	4.63	0.36	2.94	0.12	2.08	0.05
700			8.76	1.65	4.99	0.42	3.17	0.14	2.24	0.06
750					5.35	0.48	3.40	0.16	2.40	0.07
800					5.70	0.54	3.62	0.18	2.56	0.08
850					6.06	0.60	3.85	0.20	2.72	0.09
900					6.42	0.67	4.07	0.22	2.88	0.09
950					6.77	0.74	4.30	0.24	3.04	0.10
1000					7.13	0.81	4.53	0.27	3.20	0.12
1050					7.49	0.89	4.75	0.29	3.36	0.13
1150					8.20	1.05	5.21	0.35	3.68	0.15
1200					8.56	1.14	5.43	0.38	3.84	0.16
1250							5.66	0.41	4.00	0.17
1300							5.89	0.44	4.16	0.19
1350							6.11	0.47	4.32	0.20
1400							6.34	0.50	4.48	0.22
1500							6.79	0.57	4.80	0.24
1550							7.02	0.60	4.96	0.26
1600							7.24	0.64	5.12	0.28
1650							7.47	0.68	5.28	0.29
1700							7.70	0.72	5.44	0.31
1750							7.92	0.76	5.60	0.33
1800									5.76	0.34
1850									5.92	0.36
1900									6.08	0.38
1950									6.24	0.40
2000									6.40	0.42
2100									6.72	0.46
2200									7.04	0.50
2300									7.36	0.54
2400									7.68	0.58
2500									8.00	0.63
2600										
2700										
2800										
2900										
3000										

Shaded area represents velocities over 5 fps. Use with caution.

POLYETHYLENE PIPE—PEPCO PRODUCTS

C=140

Pressure Loss Per 100 Feet Of Pipe (PSI)   Sizes 1/16" Through 3/8"

Nominal Size	1/16"		1/8"		3/16"		7/32"		1/4"		5/16"*		3/8"		Nominal Size
Pipe ID	0.040		0.070		0.125		0.160		0.170		0.250		0.375		Pipe ID
Pipe O.D.	0.080		0.125		0.185		0.220		0.250		0.307		0.455		Pipe O.D.
Wall Thick	0.020		0.028		0.030		0.030		0.040		0.028		0.040		Wall Thick
Flow GPH	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPH
0.25	1.06	11.99	0.35	0.79	0.11	0.05	0.07	0.01	0.06	0.01	0.03	0.00			0.25
0.50	2.13	43.28	0.69	2.84	0.22	0.17	0.13	0.05	0.12	0.04	0.05	0.01			0.50
0.75	3.19	91.71	1.04	6.02	0.33	0.36	0.20	0.11	0.18	0.08	0.08	0.01			0.75
1.00	4.25	156.20	1.39	10.26	0.44	0.61	0.27	0.18	0.24	0.14	0.11	0.02			1.00
1.25	5.31	236.20	1.73	15.51	0.54	0.92	0.33	0.28	0.29	0.21	0.14	0.03	0.06	0.00	1.25
1.50	6.38	331.10	2.08	21.74	0.65	1.29	0.40	0.39	0.35	0.29	0.16	0.04	0.07	0.01	1.50
1.75	7.44	440.40	2.43	28.92	0.76	1.72	0.46	0.52	0.41	0.39	0.19	0.06	0.08	0.01	1.75
2.00	8.50	564.00	2.78	37.04	0.87	2.20	0.53	0.66	0.47	0.49	0.22	0.08	0.10	0.01	2.00
2.50	10.63	852.70	3.47	56.00	1.09	3.33	0.66	1.00	0.59	0.75	0.27	0.11	0.12	0.02	2.50
3.00			4.16	78.49	1.31	4.67	0.80	1.41	0.71	1.05	0.33	0.16	0.15	0.02	3.00
3.5			4.86	104.40	1.52	6.22	0.93	1.87	0.82	1.39	0.38	0.21	0.17	0.03	3.5
4.0			5.55	133.70	1.74	7.96	1.06	2.39	0.94	1.78	0.44	0.27	0.19	0.04	4.0
4.5			6.24	166.30	1.96	9.90	1.20	2.98	1.06	2.22	0.49	0.34	0.22	0.05	4.5
5.0			6.94	202.10	2.18	12.03	1.33	3.62	1.18	2.69	0.54	0.41	0.24	0.06	5.0
6.0			8.33	283.30	2.61	16.86	1.59	5.07	1.41	3.78	0.65	0.58	0.29	0.08	6.0
7			9.71	377.00	3.05	22.44	1.86	6.75	1.65	5.03	0.76	0.77	0.34	0.11	7
8			11.10	482.70	3.48	28.73	2.13	8.64	1.88	6.44	0.87	0.99	0.39	0.14	8
9			12.49	600.40	3.92	35.74	2.39	10.75	2.12	8.00	0.98	1.23	0.44	0.17	9
10			13.88	729.70	4.35	43.44	2.66	13.07	2.35	9.73	1.09	1.49	0.48	0.21	10
12					5.22	60.88	3.19	18.32	2.82	13.64	1.31	2.09	0.58	0.29	12
14					6.09	81.00	3.72	24.37	3.29	18.14	1.52	2.78	0.68	0.39	14
16					6.96	103.70	4.25	31.20	3.76	23.23	1.74	3.56	0.77	0.49	16
18					7.83	129.00	4.78	38.81	4.24	28.89	1.96	4.42	0.87	0.62	18
20					8.70	156.80	5.31	47.17	4.71	35.12	2.18	5.38	0.97	0.75	20
22					9.57	187.10	5.84	56.28	5.18	41.90	2.39	6.42	1.06	0.89	22
24					10.44	219.80	6.38	66.12	5.65	49.23	2.61	7.54	1.16	1.05	24
26					11.32	254.90	6.91	76.68	6.12	57.09	2.83	8.74	1.26	1.22	26
28					12.19	292.40	7.44	87.96	6.59	65.49	3.05	10.03	1.35	1.39	28
30					13.06	332.30	7.97	99.95	7.06	74.42	3.26	11.39	1.45	1.58	30
32					13.93	374.40	8.50	112.60	7.53	83.87	3.48	12.84	1.55	1.79	32
34					14.80	418.90	9.03	126.00	8.00	93.83	3.70	14.37	1.64	2.00	34
36					15.67	465.70	9.56	140.10	8.47	104.30	3.92	15.97	1.74	2.22	36
38					16.54	514.80	10.09	154.90	8.94	115.30	4.13	17.65	1.84	2.45	38
40					17.41	566.10	10.63	170.30	9.41	126.80	4.35	19.41	1.93	2.70	40
42					18.28	619.60	11.16	186.40	9.88	138.80	4.57	21.25	2.03	2.95	42
44					19.15	675.30	11.69	203.20	10.35	151.30	4.79	23.16	2.13	3.22	44
46							12.22	220.60	10.82	164.20	5.00	25.15	2.22	3.50	46
48							12.75	238.70	11.29	177.70	5.22	27.21	2.32	3.78	48
50							13.28	257.40	11.76	191.70	5.44	29.34	2.42	4.08	50
55							14.61	307.10	12.94	228.70	5.98	35.01	2.66	4.87	55
60							15.94	360.80	14.12	268.60	6.53	41.13	2.90	5.72	60
65							17.27	418.50	15.29	311.60	7.07	47.70	3.14	6.63	65
70							18.59	480.00	16.47	357.40	7.62	54.72	3.38	7.61	70
75							19.92	545.50	17.65	406.10	8.16	62.18	3.63	8.65	75
80									18.82	457.70	8.70	70.07	3.87	9.74	80
85											9.25	78.40	4.11	10.90	85
90											9.79	87.16	4.35	12.12	90
95											10.34	96.33	4.59	13.39	95
100											10.88	105.90	4.84	14.73	100
110											11.97	126.40	5.32	17.57	110
120											13.06	148.50	5.80	20.65	120
130											14.14	172.20	6.29	23.94	130
140											15.23	197.50	6.77	27.47	140
150											16.32	224.50	7.25	31.21	150
160											17.41	253.00	7.74	35.17	160
180											19.58	314.60	8.70	43.75	180
200													9.67	53.17	200
225													10.88	66.13	225
250													12.09	80.38	250
300													14.51	112.70	300
350													16.92	149.90	350
375													18.13	170.30	375
400													19.34	192.00	400

Note: Flows are GPH

* Note: 5/16" ID and PSI loss is the same as 11/32" ID.

POLYETHYLENE PIPE—PEPCO PRODUCTS

C=140

Pressure Loss Per 100 Feet Of Pipe (PSI)   Sizes ½" Through 1¼"

Nominal Size	½"*		½"*		½"*		⁵⁄₈"		¾"		1"		1¼"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	0.520 0.620 0.150		0.600 0.700(4) 0.050(2)		0.620 0.710 0.045		0.720 0.830 0.055		0.830 0.940 0.055		1.060 1.200 0.070		1.390 1.550 0.080		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
0.25	0.38	0.09	0.28	0.04	0.27	0.04	0.20	0.02	0.15	0.01	0.09	0.00			0.25
0.50	0.75	0.32	0.57	0.16	0.53	0.14	0.39	0.07	0.30	0.03	0.18	0.01	0.11	0.00	0.50
0.75	1.13	0.68	0.85	0.34	0.80	0.29	0.59	0.14	0.44	0.07	0.27	0.02	0.16	0.01	0.75
1.00	1.51	1.17	1.13	0.58	1.06	0.50	0.79	0.24	0.59	0.12	0.36	0.04	0.21	0.01	1.00
1.25	1.89	1.76	1.42	0.88	1.33	0.75	0.98	0.36	0.74	0.18	0.45	0.06	0.26	0.01	1.25
1.50	2.26	2.47	1.70	1.23	1.59	1.05	1.18	0.51	0.89	0.25	0.54	0.08	0.32	0.02	1.50
1.75	2.64	3.29	1.98	1.64	1.86	1.40	1.38	0.67	1.04	0.34	0.64	0.10	0.37	0.03	1.75
2.00	3.02	4.21	2.27	2.10	2.12	1.79	1.57	0.86	1.18	0.43	0.73	0.13	0.42	0.04	2.00
2.25	3.39	5.23	2.55	2.61	2.39	2.22	1.77	1.07	1.33	0.54	0.82	0.16	0.48	0.04	2.25
2.50	3.77	6.36	2.83	3.17	2.65	2.70	1.97	1.31	1.48	0.65	0.91	0.20	0.53	0.05	2.50
2.75	4.15	7.59	3.12	3.78	2.92	3.22	2.16	1.56	1.63	0.78	1.00	0.24	0.58	0.06	2.75
3.00	4.53	8.91	3.40	4.44	3.18	3.79	2.36	1.83	1.78	0.92	1.09	0.28	0.63	0.07	3.00
3.25	4.90	10.34	3.68	5.15	3.45	4.39	2.56	2.12	1.92	1.06	1.18	0.32	0.69	0.09	3.25
3.50	5.28	11.86	3.97	5.91	3.71	5.04	2.75	2.43	2.07	1.22	1.27	0.37	0.74	0.10	3.50
3.75	5.66	13.48	4.25	6.72	3.98	5.73	2.95	2.77	2.22	1.38	1.36	0.42	0.79	0.11	3.75
4.0	6.04	15.19	4.53	7.57	4.25	6.45	3.15	3.12	2.37	1.56	1.45	0.47	0.84	0.13	4.0
4.5	6.79	18.89	5.10	9.41	4.78	8.03	3.54	3.88	2.67	1.94	1.63	0.59	0.95	0.16	4.5
5.0	7.54	22.96	5.67	11.44	5.31	9.76	3.94	4.71	2.96	2.36	1.82	0.72	1.06	0.19	5.0
5.5	8.30	27.39	6.23	13.65	5.84	11.64	4.33	5.62	3.26	2.81	2.00	0.86	1.16	0.23	5.5
6.0	9.05	32.18	6.80	16.04	6.37	13.67	4.72	6.61	3.55	3.31	2.18	1.01	1.27	0.27	6.0
6.5	9.81	37.32	7.37	18.60	6.90	15.86	5.12	7.66	3.85	3.84	2.36	1.17	1.37	0.31	6.5
7.0	10.56	42.82	7.93	21.34	7.43	18.19	5.51	8.79	4.15	4.40	2.54	1.34	1.48	0.36	7.0
7.5	11.32	48.65	8.50	24.25	7.96	20.67	5.90	9.99	4.44	5.00	2.72	1.52	1.58	0.41	7.5
8.0	12.07	54.83	9.07	27.33	8.49	23.30	6.30	11.25	4.74	5.63	2.90	1.71	1.69	0.46	8.0
8.5	12.83	61.34	9.63	30.57	9.02	26.06	6.69	12.59	5.03	6.30	3.09	1.92	1.79	0.51	8.5
9.0	13.58	68.19	10.20	33.99	9.55	28.98	7.08	14.00	5.33	7.01	3.27	2.13	1.90	0.57	9.0
9.5	14.33	75.37	10.77	37.57	10.08	32.03	7.48	15.47	5.63	7.75	3.45	2.36	2.01	0.63	9.5
10	15.09	82.88	11.33	41.31	10.61	35.22	7.87	17.01	5.92	8.52	3.63	2.59	2.11	0.69	10
11	16.60	98.89	12.47	49.29	11.68	42.02	8.66	20.30	6.51	10.16	3.99	3.09	2.32	0.83	11
12	18.11	116.20	13.60	57.90	12.74	49.36	9.44	23.85	7.11	11.94	4.36	3.63	2.53	0.97	12
13	19.62	134.70	14.73	67.16	13.80	57.25	10.23	27.66	7.70	13.85	4.72	4.21	2.75	1.13	13
14			15.87	77.04	14.86	65.67	11.02	31.72	8.29	15.88	5.08	4.83	2.96	1.29	14
15			17.00	87.54	15.92	74.63	11.81	36.05	8.88	18.05	5.45	5.49	3.17	1.47	15
16			18.13	98.65	16.98	84.10	12.59	40.63	9.48	20.34	5.81	6.19	3.38	1.65	16
18					19.11	104.60	14.17	50.53	10.66	25.30	6.54	7.69	3.80	2.06	18
20							15.74	61.42	11.84	30.75	7.26	9.35	4.22	2.50	20
22							17.31	73.27	13.03	36.68	7.99	11.16	4.65	2.98	22
24							18.89	86.08	14.21	43.10	8.71	13.11	5.07	3.51	24
26									15.40	49.99	9.44	15.20	5.49	4.07	26
28									16.58	57.34	10.17	17.44	5.91	4.66	28
30									17.77	65.15	10.89	19.82	6.34	5.30	30
32									18.95	73.43	11.62	22.33	6.76	5.97	32
34											12.35	24.99	7.18	6.68	34
36											13.07	27.78	7.60	7.43	36
38											13.80	30.70	8.02	8.21	38
40											14.52	33.76	8.45	9.03	40
42											15.25	36.95	8.87	9.88	42
44											15.98	40.28	9.29	10.77	44
46											16.70	43.74	9.71	11.70	46
48											17.43	47.32	10.14	12.66	48
50											18.16	51.04	10.56	13.65	50
55											19.97	60.89	11.61	16.29	55
60													12.67	19.13	60
65													13.73	22.19	65
70													14.78	25.45	70
75													15.84	28.92	75
80													16.89	32.60	80
85													17.95	36.47	85
90													19.01	40.54	90

* Note: Pepco manufactures nominal ½" polyethylene pipe in three different IDs.

POLYETHYLENE PIPE—BOWSMITH, INC.

C=140

PRESSURE LOSS PER 100 FEET OF PIPE (PSI)   SIZES ⅜" THROUGH 1¼"

Nominal Size	3/8"*		3/8"*		1/2"*		1/2"*		1/2"*		1/2"*		1/2"*		Nominal Size
Pipe ID	0.375		0.390		0.525		0.530		0.590		0.600		0.605		Pipe ID
Pipe O.D.	0.455		0.490		0.625		0.625		0.700		0.700		0.700		Pipe O.D.
Wall Thick	0.040		0.050		0.050		0.0475		0.055		0.050		0.0475		Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	GPM
0.25	0.73	0.44	0.67	0.36	0.37	0.09	0.36	0.08	0.29	0.05	0.28	0.04	0.28	0.04	0.25
0.50	1.45	1.58	1.34	1.31	0.74	0.31	0.73	0.29	0.59	0.17	0.57	0.16	0.56	0.15	0.50
0.75	2.18	3.36	2.01	2.77	1.11	0.65	1.09	0.62	0.88	0.37	0.85	0.34	0.84	0.33	0.75
1.00	2.90	5.72	2.68	4.73	1.48	1.11	1.45	1.06	1.17	0.63	1.13	0.58	1.11	0.56	1.00
1.25	3.63	8.65	3.35	7.14	1.85	1.68	1.82	1.61	1.47	0.95	1.42	0.88	1.39	0.84	1.25
1.50	4.35	12.12	4.02	10.01	2.22	2.36	2.18	2.25	1.76	1.34	1.70	1.23	1.67	1.18	1.50
1.75	5.08	16.12	4.69	13.32	2.59	3.14	2.54	2.99	2.05	1.78	1.98	1.64	1.95	1.57	1.75
2.00	5.80	20.65	5.36	17.06	2.96	4.02	2.90	3.83	2.34	2.28	2.27	2.10	2.23	2.01	2.00
2.5	7.25	31.21	6.71	25.79	3.70	6.07	3.63	5.80	2.93	3.44	2.83	3.17	2.79	3.04	2.5
3.0	8.70	43.75	8.05	36.15	4.44	8.51	4.36	8.13	3.52	4.82	3.40	4.44	3.34	4.27	3.0
4	11.61	74.53	10.73	61.58	5.92	14.50	5.81	13.84	4.69	8.21	4.53	7.57	4.46	7.27	4
5	14.51	112.70	13.41	93.09	7.40	21.92	7.26	20.93	5.86	12.42	5.67	11.44	5.57	10.99	5
6	17.41	157.90	16.09	130.50	8.88	30.72	8.71	29.33	7.03	17.41	6.80	16.04	6.69	15.41	6
7			18.78	173.60	10.36	40.87	10.17	39.03	8.20	23.16	7.93	21.34	7.80	20.50	7
8					11.84	52.33	11.62	49.97	9.38	29.66	9.07	27.33	8.92	26.25	8
9					13.32	65.09	13.07	62.16	10.55	36.88	10.20	33.99	10.03	32.64	9
10					14.80	79.11	14.52	75.55	11.72	44.83	11.33	41.31	11.15	39.68	10
12					17.76	110.90	17.43	105.90	14.06	62.84	13.60	57.90	13.38	55.61	12
14									16.41	83.60	15.87	77.04	15.61	73.99	14
16									18.75	107.10	18.13	98.65	17.83	94.75	16

Nominal Size	5/8"*		5/8"*		3/4"*		3/4"*		1"*		1"*		1¼"		Nominal Size
Pipe ID	0.625		0.730		0.811		0.818		1.050		1.057		1.360		Pipe ID
Pipe O.D.	0.720		0.835		0.935		0.935		1.195		1.195		1.530		Pipe O.D.
Wall Thick	0.475		0.0525		0.0625		0.059		0.0725		0.069		0.085		Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
1	1.04	0.48	0.77	0.22	0.62	0.13	0.61	0.13	0.37	0.04	0.37	0.04	0.22	0.01	1
2	2.09	1.72	1.53	0.81	1.24	0.48	1.22	0.46	0.74	0.14	0.73	0.13	0.44	0.04	2
3	3.13	3.64	2.30	1.71	1.86	1.03	1.83	0.98	1.11	0.29	1.10	0.28	0.66	0.08	3
4	4.18	6.21	3.06	2.91	2.48	1.75	2.44	1.68	1.48	0.50	1.46	0.48	0.88	0.14	4
5	5.22	9.38	3.83	4.41	3.10	2.64	3.05	2.53	1.85	0.75	1.83	0.73	1.10	0.21	5
6	6.27	13.15	4.59	6.18	3.72	3.70	3.66	3.55	2.22	1.05	2.19	1.02	1.32	0.30	6
7	7.31	17.50	5.36	8.22	4.34	4.92	4.27	4.72	2.59	1.40	2.56	1.36	1.54	0.40	7
8	8.36	22.40	6.12	10.52	4.96	6.31	4.88	6.05	2.96	1.79	2.92	1.74	1.76	0.51	8
9	9.40	27.86	6.89	13.09	5.58	7.84	5.49	7.52	3.33	2.23	3.29	2.16	1.99	0.63	9
10	10.44	33.87	7.66	15.91	6.20	9.53	6.10	9.14	3.70	2.71	3.65	2.63	2.21	0.77	10
12	12.53	47.47	9.19	22.30	7.44	13.36	7.32	12.82	4.44	3.80	4.38	3.68	2.65	1.08	12
14	14.62	63.16	10.72	29.67	8.68	17.78	8.54	17.05	5.18	5.06	5.11	4.90	3.09	1.44	14
16	16.71	80.88	12.25	37.99	9.93	22.77	9.76	21.83	5.92	6.48	5.84	6.27	3.53	1.84	16
18	18.80	100.60	13.78	47.25	11.17	28.32	10.98	27.16	6.66	8.06	6.57	7.80	3.97	2.29	18
20			15.31	57.43	12.41	34.42	12.20	33.01	7.40	9.79	7.30	9.48	4.41	2.78	20
22			16.84	68.52	13.65	41.06	13.41	39.38	8.14	11.68	8.03	11.31	4.85	3.32	22
24			18.37	80.50	14.89	48.24	14.63	46.26	8.88	13.73	8.76	13.29	5.29	3.90	24
26			19.91	93.36	16.13	55.95	15.85	53.66	9.62	15.92	9.49	15.41	5.74	4.52	26
28					17.37	64.18	17.07	61.55	10.36	18.26	10.23	17.68	6.18	5.19	28
30					18.61	72.93	18.29	69.94	11.10	20.75	10.96	20.09	6.62	5.89	30
32					19.85	82.18	19.51	78.82	11.84	23.39	11.69	22.64	7.06	6.64	32
34									12.58	26.17	12.42	25.33	7.50	7.43	34
36									13.32	29.09	13.15	28.16	7.94	8.26	36
38									14.06	32.15	13.88	31.13	8.38	9.13	38
40									14.80	35.36	14.61	34.23	8.82	10.04	40
42									15.54	38.70	15.34	37.47	9.26	10.99	42
44									16.28	42.18	16.07	40.84	9.71	11.98	44
46									17.02	45.80	16.80	44.34	10.15	13.01	46
48									17.76	49.56	17.53	47.98	10.59	14.07	48
50									18.50	53.45	18.26	51.75	11.03	15.18	50
55													12.13	18.11	55
60													13.24	21.28	60
65													14.34	24.68	65
70													15.44	28.31	70
75													16.54	32.16	75
80													17.65	36.25	80
85													18.75	40.55	85
90													19.85	45.08	90

* Note: Bowsmith manufactures more than one pipe in similar nominal sizes but with different IDs.

# POLYETHYLENE PIPE—HARDIE & RAIN BIRD
C=140

PRESSURE LOSS PER 100 FEET OF PIPE (PSI)   SIZES ½" THROUGH ¾"

Nominal Size	¼"		½"		¾"		Vinyl Tubing ¼"		Xeri-Tube ™ 700 ½"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	0.170 0.250 0.040		0.613 0.709 0.048		0.810 0.936 0.063		0.160 0.280 0.060		0.580 0.700 0.060		Pipe ID Pipe O.D. Wall Thick
Flow GPH	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPH
1	0.24	0.14					0.27	0.18			1
2	0.47	0.49					0.53	0.66	0.07	0.00	2
3	0.71	1.05					0.80	1.41	0.11	0.01	3
4	0.94	1.78	0.07	0.00			1.06	2.39	0.14	0.02	4
5	1.18	2.69	0.09	0.01			1.33	3.62	0.18	0.03	5
6	1.41	3.78	0.11	0.01			1.59	5.07	0.21	0.04	6
8	1.88	6.44	0.14	0.01			2.13	8.64	0.28	0.06	8
10	2.35	9.73	0.18	0.02	0.10	0.00	2.66	13.07	0.35	0.10	10
12	2.82	13.64	0.22	0.03	0.12	0.01	3.19	18.32	0.42	0.13	12
14	3.29	18.14	0.25	0.04	0.15	0.01	3.72	24.37	0.49	0.18	14
15	3.53	20.61	0.27	0.04	0.16	0.01	3.98	27.69	0.53	0.20	15
20	4.71	35.12	0.36	0.07	0.21	0.02	5.31	47.17	0.70	0.34	20
30	7.06	74.42	0.54	0.14	0.31	0.04	7.97	99.95	0.61	0.19	30
40	9.41	126.80	0.72	0.25	0.41	0.06			1.40	1.24	40
50			0.90	0.37	0.52	0.10			1.76	1.87	50
60			1.09	0.52	0.62	0.13			1.21	0.69	60
70			1.27	0.70	0.73	0.18			2.46	3.50	70
80			1.45	0.89	0.83	0.23			2.81	4.48	80
90			1.63	1.11	0.93	0.29			1.82	1.45	90
100			1.81	1.35	1.04	0.35			3.51	6.77	100
110	Note: Flows are GPH		1.99	1.61	1.14	0.41			3.86	8.07	110
120			2.17	1.89	1.24	0.49			2.43	2.42	120
130			2.35	2.19	1.35	0.56			4.57	11.00	130
140			2.53	2.51	1.45	0.65			4.92	12.62	140
150			2.71	2.86	1.55	0.74			3.03	13.74	150
160			2.90	3.22	1.66	0.83			5.62	16.16	160
170			3.08	3.60	1.76	0.93			5.97	18.08	170
180			3.26	4.00	1.87	1.03			3.64	15.24	180
190			3.44	4.42	1.97	1.14			6.67	22.21	190
200			3.62	4.87	2.07	1.25			7.02	24.43	200
210			3.80	5.33	2.18	1.37			4.24	26.97	210
220			3.98	5.80	2.28	1.50			7.73	29.14	220
230			4.16	6.30	2.38	1.62			8.08	31.64	230
240			4.34	6.82	2.49	1.76			4.85	38.93	240
Flow GPM											Flow GPM
4.5			4.89	8.48	2.80	2.19			5.46	11.10	4.5
5.0			5.43	10.31	3.11	2.66			6.06	13.50	5.0
5.5			5.97	12.30	3.42	3.17			6.67	16.10	5.5
6.0			6.51	14.45	3.73	3.72			7.28	18.93	6.0
6.5			7.06	16.76	4.04	4.32			13.70	84.14	6.5
7.0			7.60	19.23	4.35	4.95					7.0
7.5	Note: Flows are GPH		8.14	21.85	4.66	5.63					7.5
8.0			8.69	24.62	4.97	6.34					8.0
8.5			9.23	27.55	5.29	7.10					8.5
9.0			9.77	30.62	5.60	7.89					9.0
9.5			10.31	33.85	5.91	8.72					9.5
10			10.86	37.22	6.22	9.59					10
11			11.94	44.40	6.84	11.44					11
12			13.03	52.17	7.46	13.44					12
13			14.12	60.50	8.08	15.59					13
14			15.20	69.41	8.71	17.89					14
15			16.29	78.87	9.33	20.32					15
16			17.37	88.88	9.95	22.90					16
17			18.46	99.44	10.57	25.62					17
18			19.54	110.50	11.19	28.49					18
19					11.82	31.49					19
20					12.44	34.62					20
22					13.68	41.31					22
24					14.92	48.53					24
26					16.17	56.28					26
28					17.41	64.56					28
30					18.66	73.36					30
32					19.90	82.68					32

# AGRICULTURAL PRODUCTS FLEXIBLE PVC
C=150

PRESSURE LOSS PER 100 FEET (PSI)   SIZES ½" THROUGH 1"

	Agriculture Products – IPS Hose						Agriculture Products – IRRIG Hose						
Nominal Size	½"		¾"		1"		½"		⁵/₈"		¾"		**Nominal Size**
Pipe ID **Pipe O.D.** **Wall Thick**	0.546 0.840 0.147		0.740 1.050 0.154		0.960 1.315 0.179		0.500 0.680 0.090		0.625 0.825 0.100		0.750 0.970 0.110		**Pipe ID** **Pipe O.D.** **Wall Thick**
Flow GPM	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Flow GPM**
0.5	0.68	0.22	0.37	0.05	0.22	0.01	0.82	0.34	0.52	0.12	0.36	0.05	0.5
1.0	1.37	0.81	0.75	0.18	0.44	0.05	1.63	1.24	1.04	0.42	0.73	0.17	1.0
1.5	2.05	1.71	1.12	0.39	0.66	0.11	2.45	2.63	1.57	0.89	1.09	0.37	1.5
2.0	2.74	2.92	1.49	0.67	0.89	0.19	3.26	4.48	2.09	1.51	1.45	0.62	2.0
2.5	3.42	4.41	1.86	1.01	1.11	0.28	4.08	6.77	2.61	2.29	1.81	0.94	2.5
3.0	4.11	6.19	2.24	1.41	1.33	0.40	4.90	9.50	3.13	3.21	2.18	1.32	3.0
3.5	4.79	8.23	2.61	1.87	1.55	0.53	5.71	12.63	3.66	4.26	2.54	1.76	3.5
4.0	5.47	10.54	2.98	2.40	1.77	0.68	6.53	16.18	4.18	5.46	2.90	2.25	4.0
4.5	6.16	13.11	3.35	2.99	1.99	0.84	7.34	20.12	4.70	6.79	3.26	2.80	4.5
5.0	6.84	15.94	3.73	3.63	2.21	1.02	8.16	24.45	5.22	8.26	3.63	3.40	5.0
5.5	7.53	19.01	4.10	4.33	2.43	1.22	8.98	29.18	5.74	9.85	3.99	4.06	5.5
6.0	8.21	22.34	4.47	5.09	2.66	1.43	9.79	34.28	6.27	11.57	4.35	4.77	6.0
6.5	8.90	25.91	4.84	5.90	2.88	1.66	10.61	39.75	6.79	13.42	4.71	5.53	6.5
7.0	9.58	29.72	5.22	6.77	3.10	1.91	11.42	45.60	7.31	15.40	5.08	6.34	7.0
7.5	10.26	33.77	5.59	7.69	3.32	2.17	12.24	51.82	7.83	17.50	5.44	7.20	7.5
8.0	10.95	38.05	5.96	8.67	3.54	2.44	13.06	58.40	8.36	19.72	5.80	8.12	8.0
8.5	11.63	42.58	6.33	9.70	3.76	2.73	13.87	65.34	8.88	22.06	6.17	9.08	8.5
9.0	12.32	47.33	6.71	10.78	3.98	3.04	14.69	72.63	9.40	24.52	6.53	10.10	9.0
9.5	13.00	52.31	7.08	11.92	4.21	3.36	15.50	80.28	9.92	27.10	6.89	11.16	9.5
10.0	13.69	57.53	7.45	13.10	4.43	3.69	16.32	88.28	10.44	29.81	7.25	12.27	10.0
11	15.05	68.63	8.20	15.63	4.87	4.41	17.95	105.30	11.49	35.56	7.98	14.64	11
12	16.42	80.63	8.94	18.37	5.31	5.18	19.58	123.70	12.53	41.78	8.70	17.20	12
13	17.79	93.52	9.69	21.30	5.76	6.00			13.58	48.45	9.43	19.95	13
14	19.16	107.30	10.43	24.43	6.20	6.89			14.62	55.58	10.15	22.89	14
15			11.18	27.76	6.64	7.82			15.67	63.16	10.88	26.01	15
16			11.92	31.29	7.08	8.82			16.71	71.18	11.61	29.31	16
17			12.67	35.01	7.53	9.87			17.76	79.63	12.33	32.79	17
18			13.41	38.92	7.97	10.97			18.80	88.53	13.06	36.46	18
19			14.16	43.02	8.41	12.12			19.85	97.85	13.78	40.30	19
20			14.90	47.30	8.85	13.33					14.51	44.31	20
21			15.65	51.78	9.30	14.59					15.23	48.50	21
22			16.39	56.43	9.74	15.90					15.96	52.87	22
23			17.14	61.28	10.18	17.27					16.68	57.40	23
24			17.88	66.30	10.63	18.68					17.41	62.11	24
25			18.63	71.51	11.07	20.15					18.13	66.99	25
26			19.37	76.90	11.51	21.67					18.86	72.03	26
27					11.95	23.24					19.58	77.25	27
28					12.40	24.86							28
29					12.84	26.53							29
30					13.28	28.25							30
31					13.72	30.01							31
32					14.17	31.83							32
33					14.61	33.70							33
34					15.05	35.61							34
35					15.49	37.58							35
36					15.94	39.59							36
37					16.38	41.65							37
38					16.82	43.76							38
39					17.27	45.92							39
40					17.71	48.12							40
41					18.15	50.37							41
42					18.59	52.67							42
43					19.04	55.02							43
44					19.48	57.41							44
45					19.92	59.85							45

PEPCO FLEXIBLE PVC

C=150

PRESSURE LOSS PER 100 FEET (PSI)   SIZES ½" THROUGH 1"

	Pepco Products – IPS Heavy Hose								Pepco Products – Flexible Irrigation Hose						
Nominal Size	½"		¾"		1"		1"		½"		⁵⁄₈"		¾"		Nominal Size
Pipe ID / Pipe O.D. / Wall Thick	0.546 / 0.840 / 0.147		0.740 / 1.050 / 0.154		0.960 / 1.315 / 0.179		1.000 / 1.315 / 0.158		0.500 / 0.680 / 0.090		0.625 / 0.825 / 0.100		0.750 / 0.970 / 0.110		Pipe ID / Pipe O.D. / Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
0.5	0.68	0.22	0.37	0.05	0.22	0.01	0.20	0.01	0.82	0.34	0.52	0.12	0.36	0.05	0.5
1.0	1.37	0.81	0.75	0.18	0.44	0.05	0.41	0.04	1.63	1.24	1.04	0.42	0.73	0.17	1.0
1.5	2.05	1.71	1.12	0.39	0.66	0.11	0.61	0.09	2.45	2.63	1.57	0.89	1.09	0.37	1.5
2.0	2.74	2.92	1.49	0.67	0.89	0.19	0.82	0.15	3.26	4.48	2.09	1.51	1.45	0.62	2.0
2.5	3.42	4.41	1.86	1.01	1.11	0.28	1.02	0.23	4.08	6.77	2.61	2.29	1.81	0.94	2.5
3.0	4.11	6.19	2.24	1.41	1.33	0.40	1.22	0.33	4.90	9.50	3.13	3.21	2.18	1.32	3.0
3.5	4.79	8.23	2.61	1.87	1.55	0.53	1.43	0.43	5.71	12.63	3.66	4.26	2.54	1.76	3.5
4.0	5.47	10.54	2.98	2.40	1.77	0.68	1.63	0.55	6.53	16.18	4.18	5.46	2.90	2.25	4.0
4.5	6.16	13.11	3.35	2.99	1.99	0.84	1.84	0.69	7.34	20.12	4.70	6.79	3.26	2.80	4.5
5.0	6.84	15.94	3.73	3.63	2.21	1.02	2.04	0.84	8.16	24.45	5.22	8.26	3.63	3.40	5.0
5.5	7.53	19.01	4.10	4.33	2.43	1.22	2.24	1.00	8.98	29.18	5.74	9.85	3.99	4.06	5.5
6.0	8.21	22.34	4.47	5.09	2.66	1.43	2.45	1.18	9.79	34.28	6.27	11.57	4.35	4.77	6.0
6.5	8.90	25.91	4.84	5.90	2.88	1.66	2.65	1.36	10.61	39.75	6.79	13.42	4.71	5.53	6.5
7.0	9.58	29.72	5.22	6.77	3.10	1.91	2.86	1.56	11.42	45.60	7.31	15.40	5.08	6.34	7.0
7.5	10.26	33.77	5.59	7.69	3.32	2.17	3.06	1.78	12.24	51.82	7.83	17.50	5.44	7.20	7.5
8.0	10.95	38.05	5.96	8.67	3.54	2.44	3.26	2.00	13.06	58.40	8.36	19.72	5.80	8.12	8.0
8.5	11.63	42.58	6.33	9.70	3.76	2.73	3.47	2.24	13.87	65.34	8.88	22.06	6.17	9.08	8.5
9.0	12.32	47.33	6.71	10.78	3.98	3.04	3.67	2.49	14.69	72.63	9.40	24.52	6.53	10.10	9.0
9.5	13.00	52.31	7.08	11.92	4.21	3.36	3.88	2.75	15.50	80.28	9.92	27.10	6.89	11.16	9.5
10.0	13.69	57.53	7.45	13.10	4.43	3.69	4.08	3.03	16.32	88.28	10.44	29.81	7.25	12.27	10.0
11	15.05	68.63	8.20	15.63	4.87	4.41	4.49	3.61	17.95	105.30	11.49	35.56	7.98	14.64	11
12	16.42	80.63	8.94	18.37	5.31	5.18	4.90	4.24	19.58	123.70	12.53	41.78	8.70	17.20	12
13	17.79	93.52	9.69	21.30	5.76	6.00	5.30	4.92			13.58	48.45	9.43	19.95	13
14	19.16	107.30	10.43	24.43	6.20	6.89	5.71	5.65			14.62	55.58	10.15	22.89	14
15			11.18	27.76	6.64	7.82	6.12	6.41			15.67	63.16	10.88	26.01	15
16			11.92	31.29	7.08	8.82	6.53	7.23			16.71	71.18	11.61	29.31	16
17			12.67	35.01	7.53	9.87	6.94	8.09			17.76	79.63	12.33	32.79	17
18			13.41	38.92	7.97	10.97	7.34	8.99			18.80	88.53	13.06	36.46	18
19			14.16	43.02	8.41	12.12	7.75	9.94			19.85	97.85	13.78	40.30	19
20			14.90	47.30	8.85	13.33	8.16	10.93					14.51	44.31	20
21			15.65	51.78	9.30	14.59	8.57	11.96					15.23	48.50	21
22			16.39	56.43	9.74	15.90	8.98	13.04					15.96	52.87	22
23			17.14	61.28	10.18	17.27	9.38	14.16					16.68	57.40	23
24			17.88	66.30	10.63	18.68	9.79	15.32					17.41	62.11	24
25			18.63	71.51	11.07	20.15	10.20	16.52					18.13	66.99	25
26			19.37	76.90	11.51	21.67	10.61	17.77					18.86	72.03	26
27					11.95	23.24	11.02	19.05					19.58	77.25	27
28					12.40	24.86	11.42	20.38							28
29					12.84	26.53	11.83	21.75							29
30					13.28	28.25	12.24	23.16							30
31					13.72	30.01	12.65	24.61							31
32					14.17	31.83	13.06	26.10							32
33					14.61	33.70	13.46	27.63							33
34					15.05	35.61	13.87	29.20							34
35					15.49	37.58	14.28	30.81							35
36					15.94	39.59	14.69	32.46							36
37					16.38	41.65	15.10	34.15							37
38					16.82	43.76	15.50	35.88							38
39					17.27	45.92	15.91	37.65							39
40					17.71	48.12	16.32	39.45							40
41					18.15	50.37	16.73	41.30							41
42					18.59	52.67	17.14	43.18							42
43					19.04	55.02	17.54	45.11							43
44					19.48	57.41	17.95	47.07							44
45					19.92	59.85	18.36	49.07							45
46							18.77	51.11							46
47							19.18	53.18							47
48							19.58	55.30							48
49							19.99	57.45							49

SALCO FLEXIBLE PVC
C=150
PRESSURE LOSS PER 100 FEET OF PIPE (PSI)   SIZES ½" THROUGH 1"

	Salco – A/R Flex Hose – PVC						
Nominal Size	**½"**		**¾"**		**1"**		**Nominal Size**
Pipe ID **Pipe O.D.** **Wall Thick**	0.500 0.600 0.090		0.750 0.150 0.150		1.000 0.135 0.158		**Pipe ID** **Pipe O.D.** **Wall Thick**
Flow GPM	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Velocity FPS**	**PSI Loss**	**Flow GPM**
0.5	0.82	**0.34**	0.36	**0.05**	0.20	**0.01**	0.5
1.0	1.63	**1.24**	0.73	**0.17**	0.41	**0.04**	1.0
1.5	2.45	**2.63**	1.09	**0.37**	0.61	**0.09**	1.5
2.0	3.26	**4.48**	1.45	**0.62**	0.82	**0.15**	2.0
2.5	4.08	**6.77**	1.81	**0.94**	1.02	**0.23**	2.5
3.0	4.90	**9.50**	2.18	**1.32**	1.22	**0.33**	3.0
3.5	5.71	**12.63**	2.54	**1.76**	1.43	**0.43**	3.5
4.0	6.53	**16.18**	2.90	**2.25**	1.63	**0.55**	4.0
4.5	7.34	**20.12**	3.26	**2.80**	1.84	**0.69**	4.5
5.0	8.16	**24.45**	3.63	**3.40**	2.04	**0.84**	5.0
5.5	8.98	**29.18**	3.99	**4.06**	2.24	**1.00**	5.5
6.0	9.79	**34.28**	4.35	**4.77**	2.45	**1.18**	6.0
6.5	10.61	**39.75**	4.71	**5.53**	2.65	**1.36**	6.5
7.0	11.42	**45.60**	5.08	**6.34**	2.86	**1.56**	7.0
7.5	12.24	**51.82**	5.44	**7.20**	3.06	**1.78**	7.5
8.0	13.06	**58.40**	5.80	**8.12**	3.26	**2.00**	8.0
8.5	13.87	**65.34**	6.17	**9.08**	3.47	**2.24**	8.5
9.0	14.69	**72.63**	6.53	**10.10**	3.67	**2.49**	9.0
9.5	15.50	**80.28**	6.89	**11.16**	3.88	**2.75**	9.5
10.0	16.32	**88.28**	7.25	**12.27**	4.08	**3.03**	10.0
11	17.95	**105.30**	7.98	**14.64**	4.49	**3.61**	11
12	19.58	**123.70**	8.70	**17.20**	4.90	**4.24**	12
13			9.43	**19.95**	5.30	**4.92**	13
14			10.15	**22.89**	5.71	**5.65**	14
15			10.88	**26.01**	6.12	**6.41**	15
16			11.61	**29.31**	6.53	**7.23**	16
17			12.33	**32.79**	6.94	**8.09**	17
18			13.06	**36.46**	7.34	**8.99**	18
19			13.78	**40.30**	7.75	**9.94**	19
20			14.51	**44.31**	8.16	**10.93**	20
21			15.23	**48.50**	8.57	**11.96**	21
22			15.96	**52.87**	8.98	**13.04**	22
23			16.68	**57.40**	9.38	**14.16**	23
24			17.41	**62.11**	9.79	**15.32**	24
25			18.13	**66.99**	10.20	**16.52**	25
26			18.86	**72.03**	10.61	**17.77**	26
27			19.58	**77.25**	11.02	**19.05**	27
28					11.42	**20.38**	28
29					11.83	**21.75**	29
30					12.24	**23.16**	30
31					12.65	**24.61**	31
32					13.06	**26.10**	32
33	Shaded area represents				13.46	**27.63**	33
34	velocities over 5 fps. Use with				13.87	**29.20**	34
35	caution where water hammer is				14.28	**30.81**	35
36	a concern.				14.69	**32.46**	36
37					15.10	**34.15**	37
38					15.50	**35.88**	38
39					15.91	**37.65**	39
40					16.32	**39.45**	40
41					16.73	**41.30**	41
42					17.14	**43.18**	42
43					17.54	**45.11**	43
44					17.95	**47.07**	44
45					18.36	**49.07**	45
46					18.77	**51.11**	46
47					19.18	**53.18**	47
48					19.58	**55.30**	48
49					19.99	**57.45**	49

POLYETHYLENE PLASTIC PIPE ID CONTROLLED
PE 3408   ASTM D2239   C=140
PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
Avg. ID	0.622		0.824		1.049		1.380		1.610		2.067		2.469		3.068		4.026	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.05	0.49	0.60	0.12	0.37	0.04	0.21	0.01	0.16	0.00								
2	2.11	1.76	1.20	0.45	0.74	0.14	0.43	0.04	0.31	0.02	0.19	0.01						
3	3.16	3.73	1.80	0.95	1.11	0.29	0.64	0.08	0.47	0.04	0.29	0.01						
4	4.22	6.35	2.40	1.62	1.48	0.50	0.86	0.13	0.63	0.06	0.38	0.02	0.27	0.01				
5	5.27	9.60	3.00	2.44	1.85	0.76	1.07	0.20	0.79	0.09	0.48	0.03	0.33	0.01				
6	6.33	13.46	3.61	3.43	2.22	1.06	1.29	0.28	0.94	0.13	0.57	0.04	0.40	0.02	0.26	0.01		
7	7.38	17.91	4.21	4.56	2.60	1.41	1.50	0.37	1.10	0.18	0.67	0.05	0.47	0.02	0.30	0.01		
8	8.44	22.93	4.81	5.84	2.97	1.80	1.71	0.47	1.26	0.22	0.76	0.07	0.54	0.03	0.35	0.01		
9	9.49	28.52	5.41	7.26	3.34	2.24	1.93	0.59	1.42	0.28	0.86	0.08	0.60	0.03	0.39	0.01		
10	10.55	34.67	6.01	8.82	3.71	2.73	2.14	0.72	1.57	0.34	0.95	0.10	0.67	0.04	0.43	0.01		
12			7.21	12.37	4.45	3.82	2.57	1.01	1.89	0.48	1.15	0.14	0.80	0.06	0.52	0.02		
14			8.41	16.45	5.19	5.08	3.00	1.34	2.20	0.63	1.34	0.19	0.94	0.08	0.61	0.03		
16			9.61	21.07	5.93	6.51	3.43	1.71	2.52	0.81	1.53	0.24	1.07	0.10	0.69	0.04	0.40	0.01
18			10.82	26.21	6.67	8.10	3.86	2.13	2.83	1.01	1.72	0.30	1.20	0.13	0.78	0.04	0.45	0.01
20			12.02	31.85	7.42	9.84	4.28	2.59	3.15	1.22	1.91	0.36	1.34	0.15	0.87	0.05	0.50	0.01
22					8.16	11.74	4.71	3.09	3.46	1.46	2.10	0.43	1.47	0.18	0.95	0.06	0.55	0.02
24					8.90	13.79	5.14	3.63	3.78	1.72	2.29	0.51	1.61	0.21	1.04	0.07	0.60	0.02
26					9.64	16.00	5.57	4.21	4.09	1.99	2.48	0.59	1.74	0.25	1.13	0.09	0.65	0.02
28					10.38	18.35	6.00	4.83	4.41	2.28	2.67	0.68	1.87	0.28	1.21	0.10	0.70	0.03
30					11.12	20.85	6.43	5.49	4.72	2.59	2.86	0.77	2.01	0.32	1.30	0.11	0.76	0.03
32					11.86	23.50	6.86	6.19	5.04	2.92	3.06	0.87	2.14	0.36	1.39	0.13	0.81	0.03
34					12.61	26.29	7.28	6.92	5.35	3.27	3.25	0.97	2.28	0.41	1.47	0.14	0.86	0.04
36							7.71	7.69	5.67	3.63	3.44	1.08	2.41	0.45	1.56	0.16	0.91	0.04
38							8.14	8.50	5.98	4.02	3.63	1.19	2.54	0.50	1.65	0.17	0.96	0.05
40							8.57	9.35	6.30	4.42	3.82	1.31	2.68	0.55	1.73	0.19	1.01	0.05
42							9.00	10.24	6.61	4.83	4.01	1.43	2.81	0.60	1.82	0.21	1.06	0.06
44							9.43	11.16	6.93	5.27	4.20	1.56	2.94	0.66	1.91	0.23	1.11	0.06
46							9.86	12.12	7.24	5.72	4.39	1.70	3.08	0.71	1.99	0.25	1.16	0.07
48							10.28	13.11	7.56	6.19	4.58	1.84	3.21	0.77	2.08	0.27	1.21	0.07
50							10.71	14.14	7.87	6.68	4.77	1.98	3.35	0.83	2.17	0.29	1.26	0.08
55							11.78	16.87	8.66	7.97	5.25	2.36	3.68	0.99	2.38	0.35	1.38	0.09
60							12.85	19.82	9.44	9.36	5.73	2.77	4.02	1.17	2.60	0.41	1.51	0.11
65									10.23	10.86	6.21	3.22	4.35	1.36	2.82	0.47	1.64	0.13
70									11.02	12.45	6.68	3.69	4.69	1.55	3.03	0.54	1.76	0.14
75									11.81	14.15	7.16	4.19	5.02	1.77	3.25	0.61	1.89	0.16
80									12.59	15.95	7.64	4.73	5.35	1.99	3.47	0.69	2.01	0.18
85									13.38	17.84	8.12	5.29	5.69	2.23	3.68	0.77	2.14	0.21
90											8.59	5.88	6.02	2.48	3.90	0.86	2.27	0.23
95											9.07	6.50	6.36	2.74	4.12	0.95	2.39	0.25
100											9.55	7.15	6.69	3.01	4.33	1.05	2.52	0.28
110											10.50	8.53	7.36	3.59	4.77	1.25	2.77	0.33
120											11.46	10.02	8.03	4.22	5.20	1.47	3.02	0.39
130											12.41	11.62	8.70	4.89	5.63	1.70	3.27	0.45
140											13.37	13.33	9.37	5.61	6.07	1.95	3.52	0.52
150													10.04	6.38	6.50	2.22	3.78	0.59
160													10.71	7.19	6.94	2.50	4.03	0.67
170													11.38	8.04	7.37	2.79	4.28	0.74
180													12.05	8.94	7.80	3.11	4.53	0.83
190													12.72	9.88	8.24	3.43	4.78	0.92
200													13.39	10.87	8.67	3.78	5.03	1.01
220															9.54	4.50	5.54	1.20
240															10.40	5.29	6.04	1.41
260															11.27	6.14	6.54	1.64
280															12.14	7.04	7.05	1.88
300															13.00	8.00	7.55	2.13
320															13.87	9.02	8.05	2.40
340																	8.56	2.69
360																	9.06	2.99
380																	9.57	3.30
400																	10.07	3.63
420																	10.57	3.98
440																	11.08	4.33
460																	11.58	4.71
480																	12.08	5.09
500																	12.59	5.49

Shaded area represents velocities over 5 fps.
Use with caution.

HDPE DR 7 265 PSI (IPS SIZE, OD CONTROLLED)

ANSI/ASAE S376.2   PE3408   ASTM D2239   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg. ID	2.440		3.136		4.589		6.013		7.494		8.890		9.760		11.156		12.550	
Pipe O.D.	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.530		0.682		1.018		1.306		1.628		1.930		2.120		2.422		2.725	
Min Wall	0.500		0.643		0.946		1.232		1.536		1.821		2.000		2.286		2.571	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
50	3.43	0.78	2.07	0.23	0.97	0.04	0.56	0.01	0.36	0.00	0.26	0.00	0.21	0.00	0.16	0.00	0.13	0.00
60	4.11	1.09	2.49	0.32	1.16	0.05	0.68	0.01	0.44	0.00	0.31	0.00	0.26	0.00	0.20	0.00	0.16	0.00
70	4.80	1.45	2.90	0.43	1.36	0.07	0.79	0.02	0.51	0.01	0.36	0.00	0.30	0.00	0.23	0.00	0.18	0.00
80	5.48	1.86	3.32	0.55	1.55	0.09	0.90	0.02	0.58	0.01	0.41	0.00	0.34	0.00	0.26	0.00	0.21	0.00
90	6.17	2.31	3.73	0.68	1.74	0.11	1.02	0.03	0.65	0.01	0.46	0.00	0.39	0.00	0.30	0.00	0.23	0.00
100	6.85	2.81	4.15	0.83	1.94	0.13	1.13	0.03	0.73	0.01	0.52	0.01	0.43	0.00	0.33	0.00	0.26	0.00
120	8.22	3.93	4.98	1.16	2.32	0.18	1.35	0.05	0.87	0.02	0.62	0.01	0.51	0.00	0.39	0.00	0.31	0.00
140	9.59	5.23	5.81	1.54	2.71	0.24	1.58	0.06	1.02	0.02	0.72	0.01	0.60	0.01	0.46	0.00	0.36	0.00
160	10.96	6.70	6.64	1.98	3.10	0.31	1.81	0.08	1.16	0.03	0.83	0.01	0.69	0.01	0.52	0.00	0.41	0.00
180			7.47	2.46	3.49	0.39	2.03	0.10	1.31	0.04	0.93	0.02	0.77	0.01	0.59	0.01	0.47	0.00
200			8.30	2.99	3.87	0.47	2.26	0.13	1.45	0.04	1.03	0.02	0.86	0.01	0.66	0.01	0.52	0.00
220			9.13	3.56	4.26	0.56	2.48	0.15	1.60	0.05	1.14	0.02	0.94	0.01	0.72	0.01	0.57	0.00
240			9.96	4.19	4.65	0.66	2.71	0.18	1.74	0.06	1.24	0.03	1.03	0.02	0.79	0.01	0.62	0.00
260			10.79	4.86	5.04	0.76	2.93	0.20	1.89	0.07	1.34	0.03	1.11	0.02	0.85	0.01	0.67	0.01
280			11.62	5.57	5.42	0.87	3.16	0.23	2.03	0.08	1.45	0.02	1.20	0.02	0.92	0.01	0.73	0.01
300					5.81	0.99	3.39	0.27	2.18	0.09	1.55	0.04	1.28	0.03	0.98	0.01	0.78	0.01
320					6.20	1.12	3.61	0.30	2.32	0.10	1.65	0.04	1.37	0.03	1.05	0.01	0.83	0.01
340					6.59	1.25	3.84	0.34	2.47	0.12	1.76	0.05	1.46	0.03	1.11	0.02	0.88	0.01
360					6.97	1.39	4.06	0.37	2.62	0.13	1.86	0.06	1.54	0.04	1.18	0.02	0.93	0.01
380					7.36	1.54	4.29	0.41	2.76	0.14	1.96	0.06	1.63	0.04	1.25	0.02	0.98	0.01
400					7.75	1.69	4.51	0.45	2.91	0.16	2.06	0.07	1.71	0.04	1.31	0.02	1.04	0.01
450					8.72	2.10	5.08	0.56	3.27	0.19	2.32	0.08	1.93	0.05	1.48	0.03	1.17	0.02
500					9.69	2.56	5.64	0.69	3.63	0.24	2.58	0.10	2.14	0.06	1.64	0.03	1.30	0.02
550					10.66	3.05	6.21	0.82	4.00	0.28	2.84	0.12	2.36	0.08	1.80	0.04	1.42	0.02
600					11.62	3.58	6.77	0.96	4.36	0.33	3.10	0.14	2.57	0.09	1.97	0.05	1.55	0.03
650							7.33	1.12	4.72	0.38	3.36	0.17	2.78	0.11	2.13	0.06	1.68	0.03
700							7.90	1.28	5.09	0.44	3.61	0.19	3.00	0.12	2.29	0.06	1.81	0.04
750							8.46	1.45	5.45	0.50	3.87	0.22	3.21	0.14	2.46	0.07	1.94	0.04
800							9.03	1.64	5.81	0.56	4.13	0.24	3.43	0.16	2.62	0.08	2.07	0.05
850							9.59	1.83	6.18	0.63	4.39	0.27	3.64	0.17	2.79	0.09	2.20	0.05
900							10.16	2.04	6.54	0.70	4.65	0.30	3.85	0.19	2.95	0.10	2.33	0.06
950							10.72	2.25	6.90	0.77	4.90	0.34	4.07	0.21	3.11	0.11	2.46	0.06
1000							11.28	2.48	7.26	0.85	5.16	0.37	4.28	0.23	3.28	0.12	2.59	0.07
1050							11.85	2.71	7.63	0.93	5.42	0.40	4.50	0.26	3.44	0.13	2.72	0.08
1100									7.99	1.01	5.68	0.44	4.71	0.28	3.61	0.15	2.85	0.08
1150									8.35	1.10	5.94	0.48	4.93	0.30	3.77	0.16	2.98	0.09
1200									8.72	1.19	6.19	0.52	5.14	0.33	3.93	0.17	3.11	0.10
1250									9.08	1.28	6.45	0.56	5.35	0.35	4.10	0.19	3.24	0.10
1300									9.44	1.38	6.71	0.60	5.57	0.38	4.26	0.20	3.37	0.11
1350									9.81	1.48	6.97	0.64	5.78	0.41	4.43	0.21	3.50	0.12
1400									10.17	1.58	7.23	0.69	6.00	0.44	4.59	0.23	3.63	0.13
1450									10.53	1.69	7.49	0.74	6.21	0.47	4.75	0.24	3.76	0.14
1500									10.90	1.80	7.74	0.78	6.42	0.50	4.92	0.26	3.89	0.15
1550									11.26	1.91	8.00	0.83	6.64	0.53	5.08	0.28	4.02	0.16
1600									11.62	2.03	8.26	0.88	6.85	0.56	5.25	0.29	4.14	0.16
1650											8.52	0.93	7.07	0.59	5.41	0.31	4.27	0.17
1700											8.78	0.99	7.28	0.63	5.57	0.33	4.40	0.18
1750											9.03	1.04	7.50	0.66	5.74	0.35	4.53	0.19
1800											9.29	1.10	7.71	0.70	5.90	0.36	4.66	0.21
1900											9.81	1.21	8.14	0.77	6.23	0.40	4.92	0.23
2000											10.32	1.33	8.57	0.85	6.56	0.44	5.18	0.25
2100											10.84	1.46	8.99	0.93	6.88	0.48	5.44	0.27
2200											11.36	1.59	9.42	1.01	7.21	0.53	5.70	0.30
2300											11.87	1.73	9.85	1.10	7.54	0.57	5.96	0.32
2400													10.28	1.19	7.87	0.62	6.22	0.35
2500													10.71	1.28	8.20	0.67	6.48	0.38
2600													11.14	1.38	8.52	0.72	6.74	0.41
2700													11.56	1.48	8.85	0.77	6.99	0.43
2800													11.99	1.58	9.18	0.82	7.25	0.46
2900															9.51	0.88	7.51	0.50
3000															9.83	0.94	7.77	0.53
3300															10.82	1.12	8.55	0.63
3600															11.80	1.31	9.33	0.74
3900																	10.10	0.86
4000																	10.36	0.90

Shaded area represents velocities over 5 fps.
Use with caution.

HPDE DR 9 200 PSI (IPS SIZE, OD CONTROLLED)

ANSI/ASAE S376.2   PE3408   ASTM D2239   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg. ID	2.674		3.440		5.065		6.593		8.218		9.746		10.700		12.230		13.760	
Pipe O.D.	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.413		0.530		0.780		1.016		1.266		1.502		1.650		1.885		2.120	
Min Wall	0.389		0.500		0.736		0.958		1.194		1.417		1.556		1.778		2.000	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
50	2.85	0.50	1.72	0.15	0.80	0.02												
60	3.42	0.70	2.07	0.20	0.95	0.03												
70	3.99	0.93	2.41	0.27	1.11	0.04												
80	4.56	1.19	2.76	0.35	1.27	0.05												
90	5.14	1.48	3.10	0.43	1.43	0.07												
100	5.71	1.80	3.45	0.53	1.59	0.08	0.94	0.02										
120	6.85	2.52	4.14	0.74	1.91	0.11	1.13	0.03										
140	7.99	3.35	4.83	0.98	2.23	0.15	1.31	0.04										
160	9.13	4.29	5.52	1.26	2.54	0.19	1.50	0.05	0.97	0.02								
180			6.21	1.57	2.86	0.24	1.69	0.07	1.09	0.02								
200			6.90	1.90	3.18	0.29	1.88	0.08	1.21	0.03								
220			7.59	2.27	3.50	0.35	2.06	0.10	1.33	0.03								
240			8.27	2.67	3.82	0.41	2.25	0.11	1.45	0.04	1.03	0.02						
260			8.96	3.10	4.13	0.47	2.44	0.13	1.57	0.04	1.12	0.02						
280			9.65	3.55	4.45	0.54	2.63	0.15	1.69	0.05	1.20	0.02						
300					4.77	0.61	2.82	0.17	1.81	0.06	1.29	0.03	1.07	0.02				
320					5.09	0.69	3.00	0.19	1.93	0.07	1.37	0.03	1.14	0.02				
340					5.41	0.77	3.19	0.21	2.05	0.07	1.46	0.03	1.21	0.02				
360					5.73	0.86	3.38	0.24	2.17	0.08	1.55	0.04	1.28	0.02				
380					6.04	0.95	3.57	0.26	2.30	0.09	1.63	0.04	1.35	0.02				
400					6.36	1.05	3.75	0.29	2.42	0.10	1.72	0.04	1.43	0.03				
450					7.16	1.30	4.22	0.36	2.72	0.12	1.93	0.05	1.60	0.03	1.23	0.02		
500					7.95	1.58	4.69	0.44	3.02	0.15	2.15	0.07	1.78	0.04	1.36	0.02		
550					8.75	1.89	5.16	0.52	3.32	0.18	2.36	0.08	1.96	0.05	1.50	0.03		
600					9.54	2.22	5.63	0.61	3.62	0.21	2.58	0.09	2.14	0.06	1.64	0.03	1.29	0.02
650							6.10	0.71	3.93	0.24	2.79	0.11	2.32	0.07	1.77	0.04	1.40	0.02
700							6.57	0.82	4.23	0.28	3.01	0.12	2.49	0.08	1.91	0.04	1.51	0.02
750							7.04	0.93	4.53	0.32	3.22	0.14	2.67	0.09	2.05	0.05	1.62	0.03
800							7.51	1.05	4.83	0.36	3.44	0.16	2.85	0.10	2.18	0.05	1.72	0.03
850							7.98	1.17	5.14	0.40	3.65	0.17	3.03	0.11	2.32	0.06	1.83	0.03
900							8.45	1.30	5.44	0.45	3.87	0.19	3.21	0.12	2.45	0.06	1.94	0.04
950							8.92	1.44	5.74	0.49	4.08	0.21	3.39	0.14	2.59	0.07	2.05	0.04
1000							9.39	1.58	6.04	0.54	4.30	0.24	3.56	0.15	2.73	0.08	2.15	0.04
1050							9.86	1.73	6.34	0.59	4.51	0.26	3.74	0.16	2.86	0.09	2.26	0.05
1100									6.65	0.65	4.72	0.28	3.92	0.18	3.00	0.09	2.37	0.05
1150									6.95	0.70	4.94	0.31	4.10	0.19	3.14	0.10	2.48	0.06
1200									7.25	0.76	5.15	0.33	4.28	0.21	3.27	0.11	2.59	0.06
1250									7.55	0.82	5.37	0.36	4.45	0.23	3.41	0.12	2.69	0.07
1300									7.85	0.88	5.58	0.38	4.63	0.24	3.55	0.13	2.80	0.07
1350									8.16	0.94	5.80	0.41	4.81	0.26	3.68	0.14	2.91	0.08
1400									8.46	1.01	6.01	0.44	4.99	0.28	3.82	0.15	3.02	0.08
1450									8.76	1.08	6.23	0.47	5.17	0.30	3.96	0.16	3.12	0.09
1500									9.06	1.15	6.44	0.50	5.35	0.32	4.09	0.17	3.23	0.09
1550									9.36	1.22	6.66	0.53	5.52	0.34	4.23	0.18	3.34	0.10
1600									9.67	1.29	6.87	0.56	5.70	0.36	4.36	0.19	3.45	0.11
1650									9.97	1.37	7.09	0.60	5.88	0.38	4.50	0.20	3.56	0.11
1700											7.30	0.63	6.06	0.40	4.64	0.21	3.66	0.12
1750											7.52	0.67	6.24	0.42	4.77	0.22	3.77	0.12
1800											7.73	0.70	6.41	0.45	4.91	0.23	3.88	0.13
1900											8.16	0.78	6.77	0.49	5.18	0.26	4.09	0.14
2000											8.59	0.85	7.13	0.54	5.46	0.28	4.31	0.16
2100											9.02	0.93	7.48	0.59	5.73	0.31	4.53	0.17
2200											9.45	1.02	7.84	0.65	6.00	0.34	4.74	0.19
2300											9.88	1.10	8.20	0.70	6.27	0.37	4.96	0.21
2400													8.55	0.76	6.55	0.40	5.17	0.22
2500													8.91	0.82	6.82	0.43	5.39	0.24
2600													9.27	0.88	7.09	0.46	5.60	0.26
2700													9.62	0.94	7.36	0.49	5.82	0.28
2800													9.98	1.01	7.64	0.53	6.03	0.30
2900															7.91	0.56	6.25	0.32
3000															8.18	0.60	6.46	0.34
3300															9.00	0.71	7.11	0.40
3600															9.82	0.84	7.76	0.47
3900																	8.40	0.55
4000																	8.62	0.57

Shaded area represents velocities over 5 fps. Use with caution.

HDPE   DR 11   160 PSI (IPS SIZE, OD CONTROLLED)

ANSI/ASAE S376.2   PE3408, ASTM D2239   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg. ID	2.826		3.632		5.349		6.963		8.678		10.292		11.300		12.914		14.532	
Pipe O.D.	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.337		0.434		0.638		0.831		1.036		1.229		1.350		1.543		1.734	
Min Wall	0.318		0.409		0.602		0.784		0.977		1.159		1.273		1.455		1.636	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
50	2.55	0.38	1.55	0.11	0.71	0.02												
60	3.07	0.53	1.86	0.16	0.86	0.02												
70	3.58	0.71	2.17	0.21	1.00	0.03												
80	4.09	0.91	2.47	0.27	1.14	0.04												
90	4.60	1.13	2.78	0.33	1.28	0.05												
100	5.11	1.37	3.09	0.40	1.43	0.06	0.84	0.02										
120	6.13	1.92	3.71	0.57	1.71	0.09	1.01	0.02										
140	7.15	2.56	4.33	0.76	2.00	0.11	1.18	0.03										
160	8.17	3.28	4.95	0.97	2.28	0.15	1.35	0.04										
180	9.20	4.08	5.57	1.20	2.57	0.18	1.51	0.05										
200	10.22	4.96	6.19	1.46	2.85	0.22	1.68	0.06	1.08	0.02	0.77	0.01						
220	11.24	5.91	6.80	1.74	3.14	0.27	1.85	0.07	1.19	0.03	0.85	0.01						
240	12.26	6.95	7.42	2.05	3.42	0.31	2.02	0.09	1.30	0.03	0.92	0.01						
260			8.04	2.38	3.71	0.36	2.19	0.10	1.41	0.03	1.00	0.01						
280			8.66	2.73	3.99	0.41	2.36	0.11	1.52	0.04	1.08	0.02						
300			9.28	3.10	4.28	0.47	2.52	0.13	1.63	0.04	1.16	0.02						
320			9.90	3.49	4.56	0.53	2.69	0.15	1.73	0.05	1.23	0.02						
340			10.52	3.91	4.85	0.59	2.86	0.16	1.84	0.06	1.31	0.02	1.09	0.02				
360			11.13	4.34	5.13	0.66	3.03	0.18	1.95	0.06	1.39	0.03	1.15	0.02				
380					5.42	0.73	3.20	0.20	2.06	0.07	1.46	0.03	1.21	0.02				
400					5.70	0.80	3.37	0.22	2.17	0.08	1.54	0.03	1.28	0.02				
450					6.42	1.00	3.79	0.28	2.44	0.09	1.73	0.04	1.44	0.03				
500					7.13	1.21	4.21	0.34	2.71	0.12	1.93	0.05	1.60	0.03	1.22	0.02		
550					7.84	1.45	4.63	0.40	2.98	0.14	2.12	0.06	1.76	0.04	1.35	0.02		
600					8.56	1.70	5.05	0.47	3.25	0.16	2.31	0.07	1.92	0.04	1.47	0.02		
650					9.27	1.97	5.47	0.55	3.52	0.19	2.50	0.08	2.08	0.05	1.59	0.03		
700					9.98	2.26	5.89	0.63	3.79	0.21	2.70	0.09	2.24	0.06	1.71	0.03	1.35	0.02
750					10.69	2.57	6.31	0.71	4.06	0.24	2.89	0.11	2.40	0.07	1.83	0.04	1.45	0.02
800							6.73	0.80	4.33	0.27	3.08	0.12	2.56	0.08	1.96	0.04	1.55	0.02
850							7.15	0.90	4.61	0.31	3.27	0.13	2.72	0.09	2.08	0.04	1.64	0.03
900							7.57	1.00	4.88	0.34	3.47	0.15	2.88	0.09	2.20	0.05	1.74	0.03
950							7.99	1.10	5.15	0.38	3.66	0.16	3.04	0.10	2.32	0.05	1.84	0.03
1000							8.42	1.21	5.42	0.42	3.85	0.18	3.20	0.12	2.45	0.06	1.93	0.03
1050							8.84	1.33	5.69	0.45	4.04	0.20	3.36	0.13	2.57	0.07	2.03	0.04
1100							9.26	1.45	5.96	0.50	4.24	0.22	3.51	0.14	2.69	0.07	2.13	0.04
1150							9.68	1.57	6.23	0.54	4.43	0.23	3.67	0.15	2.81	0.08	2.22	0.04
1200							10.10	1.70	6.50	0.58	4.62	0.25	3.83	0.16	2.94	0.08	2.32	0.05
1250							10.52	1.83	6.77	0.63	4.81	0.27	3.99	0.17	3.06	0.09	2.42	0.05
1300									7.04	0.68	5.01	0.29	4.15	0.19	3.18	0.10	2.51	0.05
1350									7.31	0.72	5.20	0.32	4.31	0.20	3.30	0.10	2.61	0.06
1400									7.58	0.78	5.39	0.34	4.47	0.21	3.43	0.11	2.70	0.06
1450									7.86	0.83	5.59	0.36	4.63	0.23	3.55	0.12	2.80	0.07
1500									8.13	0.88	5.78	0.38	4.79	0.24	3.67	0.13	2.90	0.07
1550									8.40	0.94	5.97	0.41	4.95	0.26	3.79	0.14	2.99	0.08
1600									8.67	0.99	6.16	0.43	5.11	0.27	3.91	0.14	3.09	0.08
1650									8.94	1.05	6.36	0.46	5.27	0.29	4.04	0.15	3.19	0.09
1700									9.21	1.11	6.55	0.48	5.43	0.31	4.16	0.16	3.28	0.09
1750									9.48	1.17	6.74	0.51	5.59	0.32	4.28	0.17	3.38	0.10
1800									9.75	1.23	6.93	0.54	5.75	0.34	4.40	0.18	3.48	0.10
1900									10.29	1.36	7.32	0.59	6.07	0.38	4.65	0.20	3.67	0.11
2000											7.70	0.65	6.39	0.42	4.89	0.22	3.86	0.12
2100											8.09	0.72	6.71	0.45	5.14	0.24	4.06	0.13
2200											8.47	0.78	7.03	0.50	5.38	0.26	4.25	0.15
2300											8.86	0.85	7.35	0.54	5.63	0.28	4.44	0.16
2400													7.67	0.58	5.87	0.30	4.64	0.17
2500													7.99	0.63	6.12	0.33	4.83	0.18
2600													8.31	0.68	6.36	0.35	5.02	0.20
2700													8.63	0.72	6.61	0.38	5.22	0.21
2800													8.95	0.77	6.85	0.40	5.41	0.23
2900															7.09	0.43	5.60	0.24
3000															7.34	0.46	5.80	0.26
3300															8.07	0.55	6.38	0.31
3600															8.81	0.64	6.96	0.36
3900																	7.53	0.42
4000																	7.73	0.44

Shaded area represents velocities over 5 fps. Use with caution.

HDPE DR 13.5 128 PSI (IPS SIZE, OD CONTROLLED)

ANSI/ASAE S376.2   PE3408, ASTM D2239   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	3"		4"		6"		8"		10"		12"		14"		16"		18"	
Avg. ID	2.950		3.794		5.583		7.269		9.062		10.748		11.802		13.488		15.174	
Pipe O.D.	3.500		4.500		6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.275		0.353		0.521		0.678		0.844		1.001		1.099		1.256		1.413	
Min Wall	0.259		0.333		0.491		0.639		0.796		0.944		1.037		1.185		1.333	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
50	2.34	0.31	1.42	0.09	0.65	0.01												
60	2.81	0.43	1.70	0.13	0.79	0.02												
70	3.28	0.58	1.98	0.17	0.92	0.03												
80	3.75	0.74	2.27	0.22	1.05	0.03												
90	4.22	0.92	2.55	0.27	1.18	0.04												
100	4.69	1.11	2.83	0.33	1.31	0.05	0.77	0.01										
120	5.63	1.56	3.40	0.46	1.57	0.07	0.93	0.02										
140	6.56	2.08	3.97	0.61	1.83	0.09	1.08	0.03										
160	7.50	2.66	4.54	0.78	2.09	0.12	1.24	0.03										
180	8.44	3.31	5.10	0.97	2.36	0.15	1.39	0.04										
200			5.67	1.18	2.62	0.18	1.54	0.05	0.99	0.02	0.71	0.01						
220			6.24	1.41	2.88	0.22	1.70	0.06	1.09	0.02	0.78	0.01						
240			6.80	1.66	3.14	0.25	1.85	0.07	1.19	0.02	0.85	0.01						
260			7.37	1.92	3.40	0.29	2.01	0.08	1.29	0.03	0.92	0.01						
280			7.94	2.20	3.67	0.34	2.16	0.09	1.39	0.03	0.99	0.01						
300					3.93	0.38	2.32	0.11	1.49	0.04	1.06	0.02						
320					4.19	0.43	2.47	0.12	1.59	0.04	1.13	0.02						
340					4.45	0.48	2.63	0.13	1.69	0.05	1.20	0.02	1.00	0.01				
360					4.71	0.54	2.78	0.15	1.79	0.05	1.27	0.02	1.05	0.01				
380					4.97	0.59	2.93	0.16	1.89	0.06	1.34	0.02	1.11	0.02				
400					5.24	0.65	3.09	0.18	1.99	0.06	1.41	0.03	1.17	0.02				
450					5.89	0.81	3.47	0.22	2.24	0.08	1.59	0.03	1.32	0.02				
500					6.54	0.98	3.86	0.27	2.48	0.09	1.77	0.04	1.46	0.03	1.12	0.01		
550					7.20	1.17	4.25	0.33	2.73	0.11	1.94	0.05	1.61	0.03	1.23	0.02		
600					7.85	1.38	4.63	0.38	2.98	0.13	2.12	0.06	1.76	0.04	1.35	0.02		
650					8.51	1.60	5.02	0.44	3.23	0.15	2.30	0.07	1.90	0.04	1.46	0.02		
700							5.41	0.51	3.48	0.17	2.47	0.08	2.05	0.05	1.57	0.03	1.24	0.01
750							5.79	0.58	3.73	0.20	2.65	0.09	2.20	0.05	1.68	0.03	1.33	0.02
800							6.18	0.65	3.97	0.22	2.83	0.10	2.34	0.06	1.79	0.03	1.42	0.02
850							6.56	0.73	4.22	0.25	3.00	0.11	2.49	0.07	1.91	0.04	1.51	0.02
900							6.95	0.81	4.47	0.28	3.18	0.12	2.64	0.08	2.02	0.04	1.59	0.02
950							7.34	0.90	4.72	0.31	3.36	0.13	2.78	0.08	2.13	0.04	1.68	0.02
1000							7.72	0.98	4.97	0.34	3.53	0.15	2.93	0.09	2.24	0.05	1.77	0.03
1050							8.11	1.08	5.22	0.37	3.71	0.16	3.08	0.10	2.35	0.05	1.86	0.03
1100									5.47	0.40	3.89	0.18	3.22	0.11	2.47	0.06	1.95	0.03
1150									5.71	0.44	4.06	0.19	3.37	0.12	2.58	0.06	2.04	0.04
1200									5.96	0.47	4.24	0.21	3.52	0.13	2.69	0.07	2.13	0.04
1250									6.21	0.51	4.41	0.22	3.66	0.14	2.80	0.07	2.21	0.04
1300									6.46	0.55	4.59	0.24	3.81	0.15	2.92	0.08	2.30	0.04
1350									6.71	0.59	4.77	0.26	3.95	0.16	3.03	0.08	2.39	0.05
1400									6.96	0.63	4.94	0.27	4.10	0.17	3.14	0.09	2.48	0.05
1450									7.20	0.67	5.12	0.29	4.25	0.19	3.25	0.10	2.57	0.05
1500									7.45	0.71	5.30	0.31	4.39	0.20	3.36	0.10	2.66	0.06
1550									7.70	0.76	5.47	0.33	4.54	0.21	3.48	0.11	2.75	0.06
1600									7.95	0.80	5.65	0.35	4.69	0.22	3.59	0.12	2.84	0.07
1650									8.20	0.85	5.83	0.37	4.83	0.24	3.70	0.12	2.92	0.07
1700											6.00	0.39	4.98	0.25	3.81	0.13	3.01	0.07
1750											6.18	0.41	5.13	0.26	3.92	0.14	3.10	0.08
1800											6.36	0.44	5.27	0.28	4.04	0.14	3.19	0.08
1900											6.71	0.48	5.57	0.31	4.26	0.16	3.37	0.09
2000											7.06	0.53	5.86	0.34	4.49	0.18	3.54	0.10
2100											7.42	0.58	6.15	0.37	4.71	0.19	3.72	0.11
2200											7.77	0.63	6.44	0.40	4.93	0.21	3.90	0.12
2300											8.12	0.69	6.74	0.44	5.16	0.23	4.08	0.13
2400													7.03	0.47	5.38	0.25	4.25	0.14
2500													7.32	0.51	5.61	0.27	4.43	0.15
2600													7.62	0.55	5.83	0.29	4.61	0.16
2700													7.91	0.59	6.06	0.31	4.78	0.17
2800													8.20	0.63	6.28	0.33	4.96	0.18
2900															6.50	0.35	5.14	0.20
3000															6.73	0.37	5.32	0.21
3300															7.40	0.44	5.85	0.25
3600															8.07	0.52	6.38	0.29
3900																	6.91	0.34
4000																	7.09	0.36

Shaded area represents velocities over 5 fps. Use with caution.

C900   DR 25   CLASS 100 (C.I.O.D.)

AWWA C900   ASTM D1784   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"	
Avg. ID	4.392		6.314		8.282		10.158		12.080	
Pipe OD	4.800		6.900		9.050		11.100		13.200	
Avg. Wall	0.204		0.293		0.384		0.471		0.560	
Min. Wall	0.192		0.276		0.362		0.444		0.528	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.53	0.01	0.26	0.00	0.15	0.00	0.10	0.00	0.07	0.00
50	1.06	0.04	0.51	0.01	0.30	0.00	0.20	0.00	0.14	0.00
75	1.59	0.09	0.77	0.02	0.45	0.00	0.30	0.00	0.21	0.00
100	2.12	0.16	1.02	0.03	0.59	0.01	0.40	0.00	0.28	0.00
125	2.64	0.24	1.28	0.04	0.74	0.01	0.49	0.00	0.35	0.00
150	3.17	0.34	1.54	0.06	0.89	0.02	0.59	0.01	0.42	0.00
175	3.70	0.45	1.79	0.08	1.04	0.02	0.69	0.01	0.49	0.00
200	4.23	0.58	2.05	0.10	1.19	0.03	0.79	0.01	0.56	0.00
225	4.76	0.72	2.30	0.12	1.34	0.03	0.89	0.01	0.63	0.01
250	5.29	0.88	2.56	0.15	1.49	0.04	0.99	0.01	0.70	0.01
275	5.82	1.05	2.81	0.18	1.64	0.05	1.09	0.02	0.77	0.01
300	6.35	1.23	3.07	0.21	1.78	0.06	1.19	0.02	0.84	0.01
325	6.87	1.43	3.33	0.24	1.93	0.07	1.29	0.02	0.91	0.01
350	7.40	1.63	3.58	0.28	2.08	0.07	1.38	0.03	0.98	0.01
375			3.84	0.32	2.23	0.08	1.48	0.03	1.05	0.01
400			4.09	0.36	2.38	0.10	1.58	0.04	1.12	0.02
450			4.61	0.45	2.68	0.12	1.78	0.04	1.26	0.02
500			5.12	0.54	2.97	0.14	1.98	0.05	1.40	0.02
550			5.63	0.65	3.27	0.17	2.17	0.06	1.54	0.03
600			6.14	0.76	3.57	0.20	2.37	0.08	1.68	0.03
700			7.16	1.01	4.16	0.27	2.77	0.10	1.96	0.04
800			8.19	1.29	4.76	0.35	3.16	0.13	2.24	0.05
900			9.21	1.61	5.35	0.43	3.56	0.16	2.52	0.07
1000			10.23	1.95	5.95	0.52	3.95	0.19	2.80	0.08
1100					6.54	0.62	4.35	0.23	3.08	0.10
1200					7.14	0.73	4.74	0.27	3.36	0.12
1300					7.73	0.85	5.14	0.31	3.63	0.14
1400					8.33	0.97	5.54	0.36	3.91	0.16
1500					8.92	1.11	5.93	0.41	4.19	0.18
1600					9.52	1.25	6.33	0.46	4.47	0.20
1700							6.72	0.52	4.75	0.22
1800							7.12	0.57	5.03	0.25
1900							7.51	0.63	5.31	0.27
2000							7.91	0.70	5.59	0.30
2100							8.30	0.76	5.87	0.33
2200							8.70	0.83	6.15	0.36
2300									6.43	0.39
2400									6.71	0.42
2500									6.99	0.45
2600									7.27	0.49
2700									7.55	0.52
2800									7.83	0.56
2900									8.11	0.60
3000									8.39	0.64
3100									8.67	0.68
3200										
3300										
3400										
3500										
3600										
3800										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

Shaded area represents velocities over 5 fps. Use with caution.

C900 DR 18 CLASS 150 (C.I.O.D.)

AWWA C900 ASTM D1784 C=150

PSI Loss per 100 Feet of Pipe

Nominal **Size**	4"		6"		8"		10"		12"	
Avg. ID	4.234		6.088		7.984		9.792		11.646	
Pipe OD	4.800		6.900		9.050		11.100		13.200	
Avg. Wall	0.283		0.406		0.533		0.654		0.777	
Min. Wall	0.267		0.383		0.503		0.617		0.733	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.57	0.01	0.28	0.00	0.16	0.00	0.11	0.00	0.08	0.00
50	1.14	0.05	0.55	0.01	0.32	0.00	0.21	0.00	0.15	0.00
75	1.71	0.11	0.83	0.02	0.48	0.01	0.32	0.00	0.23	0.00
100	2.28	0.19	1.10	0.03	0.64	0.01	0.43	0.00	0.30	0.00
125	2.84	0.29	1.38	0.05	0.80	0.01	0.53	0.00	0.38	0.00
150	3.41	0.41	1.65	0.07	0.96	0.02	0.64	0.01	0.45	0.00
175	3.98	0.54	1.93	0.09	1.12	0.02	0.74	0.01	0.53	0.00
200	4.55	0.69	2.20	0.12	1.28	0.03	0.85	0.01	0.60	0.01
225	5.12	0.86	2.48	0.15	1.44	0.04	0.96	0.01	0.68	0.01
250	5.69	1.05	2.75	0.18	1.60	0.05	1.06	0.02	0.75	0.01
275	6.26	1.25	3.03	0.21	1.76	0.06	1.17	0.02	0.83	0.01
300	6.83	1.47	3.30	0.25	1.92	0.07	1.28	0.02	0.90	0.01
325	7.40	1.70	3.58	0.29	2.08	0.08	1.38	0.03	0.98	0.01
350	7.97	1.95	3.85	0.33	2.24	0.09	1.49	0.03	1.05	0.01
375	8.53	2.22	4.13	0.38	2.40	0.10	1.60	0.04	1.13	0.02
400	9.10	2.50	4.40	0.43	2.56	0.11	1.70	0.04	1.20	0.02
450			4.95	0.53	2.88	0.14	1.91	0.05	1.35	0.02
500			5.50	0.65	3.20	0.17	2.13	0.06	1.50	0.03
550			6.05	0.77	3.52	0.21	2.34	0.08	1.65	0.03
600			6.60	0.91	3.84	0.24	2.55	0.09	1.80	0.04
700			7.71	1.20	4.48	0.32	2.98	0.12	2.11	0.05
800			8.81	1.54	5.12	0.41	3.40	0.15	2.41	0.07
900			9.91	1.92	5.76	0.51	3.83	0.19	2.71	0.08
1000					6.40	0.62	4.26	0.23	3.01	0.10
1100					7.04	0.74	4.68	0.28	3.31	0.12
1200					7.68	0.87	5.11	0.32	3.61	0.14
1300					8.32	1.01	5.53	0.38	3.91	0.16
1400					8.96	1.16	5.96	0.43	4.21	0.19
1500					9.60	1.32	6.38	0.49	4.51	0.21
1600					10.24	1.49	6.81	0.55	4.81	0.24
1700							7.23	0.62	5.11	0.27
1800							7.66	0.69	5.41	0.29
1900							8.08	0.76	5.72	0.33
2000							8.51	0.83	6.02	0.36
2100							8.94	0.91	6.32	0.39
2200							9.36	0.99	6.62	0.43
2300									6.92	0.46
2400									7.22	0.50
2500									7.52	0.54
2600									7.82	0.58
2700									8.12	0.63
2800										
2900										
3000										
3100										
3200										
3300										
3400										
3500										
3600										
3800										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

**Shaded area represents velocities over 5 fps.
Use with caution.**

C900 DR 14 CLASS 200 (C.I.O.D.)

AWWA C900 ASTM D1784 C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"	
Avg. ID	4.072		5.854		7.680		9.418		11.200	
Pipe OD	4.800		6.900		9.050		11.100		13.200	
Avg. Wall	0.364		0.523		0.685		0.841		1.000	
Min. Wall	0.343		0.493		0.646		0.793		0.943	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.62	0.02	0.30	0.00	0.17	0.00	0.11	0.00	0.08	0.00
50	1.23	0.06	0.60	0.01	0.35	0.00	0.23	0.00	0.16	0.00
75	1.85	0.14	0.89	0.02	0.52	0.01	0.34	0.00	0.24	0.00
100	2.46	0.23	1.19	0.04	0.69	0.01	0.46	0.00	0.33	0.00
125	3.08	0.35	1.49	0.06	0.86	0.02	0.57	0.01	0.41	0.00
150	3.69	0.49	1.79	0.08	1.04	0.02	0.69	0.01	0.49	0.00
175	4.31	0.65	2.08	0.11	1.21	0.03	0.80	0.01	0.57	0.00
200	4.92	0.84	2.38	0.14	1.38	0.04	0.92	0.01	0.65	0.01
225	5.54	1.04	2.68	0.18	1.56	0.05	1.03	0.02	0.73	0.01
250	6.15	1.27	2.98	0.22	1.73	0.06	1.15	0.02	0.81	0.01
275	6.77	1.51	3.27	0.26	1.90	0.07	1.26	0.03	0.89	0.01
300	7.38	1.78	3.57	0.30	2.08	0.08	1.38	0.03	0.98	0.01
325	8.00	2.06	3.87	0.35	2.25	0.09	1.49	0.03	1.06	0.01
350	8.61	2.36	4.17	0.40	2.42	0.11	1.61	0.04	1.14	0.02
375	9.23	2.68	4.46	0.46	2.59	0.12	1.72	0.05	1.22	0.02
400			4.76	0.52	2.77	0.14	1.84	0.05	1.30	0.02
450			5.36	0.64	3.11	0.17	2.07	0.06	1.46	0.03
500			5.95	0.78	3.46	0.21	2.30	0.08	1.63	0.03
550			6.55	0.93	3.80	0.25	2.53	0.09	1.79	0.04
600			7.14	1.10	4.15	0.29	2.76	0.11	1.95	0.05
700			8.33	1.46	4.84	0.39	3.22	0.14	2.28	0.06
800			9.52	1.87	5.53	0.50	3.68	0.18	2.60	0.08
900			10.72	2.32	6.23	0.62	4.14	0.23	2.93	0.10
1000					6.92	0.75	4.60	0.28	3.25	0.12
1100					7.61	0.90	5.06	0.33	3.58	0.14
1200					8.30	1.06	5.52	0.39	3.90	0.17
1300					8.99	1.22	5.98	0.45	4.23	0.20
1400					9.68	1.40	6.44	0.52	4.55	0.22
1500					10.38	1.60	6.90	0.59	4.88	0.25
1600					11.07	1.80	7.36	0.67	5.20	0.29
1700							7.82	0.75	5.53	0.32
1800							8.28	0.83	5.85	0.36
1900							8.74	0.92	6.18	0.39
2000							9.20	1.01	6.51	0.43
2100							9.66	1.10	6.83	0.47
2200							10.12	1.20	7.16	0.52
2300									7.48	0.56
2400									7.81	0.61
2500									8.13	0.66
2600									8.46	0.70
2700									8.78	0.76
2800									9.11	0.81
2900									9.43	0.86
3000									9.76	0.92
3100									10.08	0.98
3200										
3300										
3400										
3500										
3600										
3800										
3900										
4000										
4200										
4400										
4600										
4800										
5000										
5500										
6000										
6500										
7000										
7500										
8000										
8500										

Shaded area represents velocities over 5 fps. Use with caution.

C905 DR 25   165 PSI (C.I.O.D.)

AWWA C905   ASTM D1784   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	14"		16"		18"		20"		24"		30"	
Avg. ID	14.002		15.924		17.846		19.768		23.612		29.286	
Pipe OD	15.300		17.400		19.500		21.600		25.800		32.000	
Avg. Wall	0.649		0.738		0.827		0.916		1.094		1.357	
Min. Wall	0.612		0.696		0.780		0.864		1.032		1.280	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
400	0.83	0.01	0.64	0.00	0.51	0.00	0.42	0.00	0.29	0.00	0.19	0.00
450	0.94	0.01	0.72	0.00	0.58	0.00	0.47	0.00	0.33	0.00	0.21	0.00
500	1.04	0.01	0.80	0.01	0.64	0.00	0.52	0.00	0.37	0.00	0.24	0.00
550	1.14	0.01	0.88	0.01	0.70	0.00	0.57	0.00	0.40	0.00	0.26	0.00
600	1.25	0.02	0.97	0.01	0.77	0.00	0.63	0.00	0.44	0.00	0.29	0.00
650	1.35	0.02	1.05	0.01	0.83	0.01	0.68	0.00	0.48	0.00	0.31	0.00
700	1.46	0.02	1.13	0.01	0.90	0.01	0.73	0.00	0.51	0.00	0.33	0.00
750	1.56	0.02	1.21	0.01	0.96	0.01	0.78	0.00	0.55	0.00	0.36	0.00
800	1.66	0.03	1.29	0.01	1.02	0.01	0.84	0.01	0.59	0.00	0.38	0.00
850	1.77	0.03	1.37	0.02	1.09	0.01	0.89	0.01	0.62	0.00	0.40	0.00
900	1.87	0.03	1.45	0.02	1.15	0.01	0.94	0.01	0.66	0.00	0.43	0.00
950	1.98	0.04	1.53	0.02	1.22	0.01	0.99	0.01	0.70	0.00	0.45	0.00
1000	2.08	0.04	1.61	0.02	1.28	0.01	1.04	0.01	0.73	0.00	0.48	0.00
1100	2.29	0.05	1.77	0.03	1.41	0.01	1.15	0.01	0.80	0.00	0.52	0.00
1200	2.50	0.06	1.93	0.03	1.54	0.02	1.25	0.01	0.88	0.00	0.57	0.00
1300	2.71	0.07	2.09	0.04	1.67	0.02	1.36	0.01	0.95	0.01	0.62	0.00
1400	2.91	0.08	2.25	0.04	1.79	0.02	1.46	0.01	1.02	0.01	0.67	0.00
1500	3.12	0.09	2.41	0.05	1.92	0.03	1.57	0.02	1.10	0.01	0.71	0.00
1600	3.33	0.10	2.57	0.05	2.05	0.03	1.67	0.02	1.17	0.01	0.76	0.00
1700	3.54	0.11	2.74	0.06	2.18	0.03	1.77	0.02	1.24	0.01	0.81	0.00
1800	3.75	0.12	2.90	0.06	2.31	0.04	1.88	0.02	1.32	0.01	0.86	0.00
1900	3.95	0.13	3.06	0.07	2.43	0.04	1.98	0.02	1.39	0.01	0.90	0.00
2000	4.16	0.15	3.22	0.08	2.56	0.04	2.09	0.03	1.46	0.01	0.95	0.00
2100	4.37	0.16	3.38	0.09	2.69	0.05	2.19	0.03	1.54	0.01	1.00	0.00
2200	4.58	0.17	3.54	0.09	2.82	0.05	2.30	0.03	1.61	0.01	1.05	0.00
2300	4.79	0.19	3.70	0.10	2.95	0.06	2.40	0.04	1.68	0.01	1.09	0.01
2400	4.99	0.21	3.86	0.11	3.07	0.06	2.51	0.04	1.76	0.02	1.14	0.01
2500	5.20	0.22	4.02	0.12	3.20	0.07	2.61	0.04	1.83	0.02	1.19	0.01
2600	5.41	0.24	4.18	0.13	3.33	0.07	2.71	0.04	1.90	0.02	1.24	0.01
2700	5.62	0.26	4.34	0.14	3.46	0.08	2.82	0.05	1.98	0.02	1.28	0.01
2800	5.83	0.27	4.51	0.15	3.59	0.08	2.92	0.05	2.05	0.02	1.33	0.01
2900	6.04	0.29	4.67	0.16	3.72	0.09	3.03	0.05	2.12	0.02	1.38	0.01
3000	6.24	0.31	4.83	0.17	3.84	0.10	3.13	0.06	2.20	0.02	1.43	0.01
3100	6.45	0.33	4.99	0.18	3.97	0.10	3.24	0.06	2.27	0.03	1.47	0.01
3200	6.66	0.35	5.15	0.19	4.10	0.11	3.34	0.07	2.34	0.03	1.52	0.01
3300	6.87	0.37	5.31	0.20	4.23	0.11	3.45	0.07	2.41	0.03	1.57	0.01
3400	7.08	0.39	5.47	0.21	4.36	0.12	3.55	0.07	2.49	0.03	1.62	0.01
3500	7.28	0.41	5.63	0.22	4.48	0.13	3.65	0.08	2.56	0.03	1.66	0.01
3600	7.49	0.43	5.79	0.23	4.61	0.13	3.76	0.08	2.63	0.03	1.71	0.01
3700	7.70	0.46	5.95	0.24	4.74	0.14	3.86	0.09	2.71	0.04	1.76	0.01
3800			6.11	0.26	4.87	0.15	3.97	0.09	2.78	0.04	1.81	0.01
3900			6.28	0.27	5.00	0.15	4.07	0.09	2.85	0.04	1.86	0.01
4000			6.44	0.28	5.12	0.16	4.18	0.10	2.93	0.04	1.90	0.01
4200			6.76	0.31	5.38	0.18	4.39	0.11	3.07	0.05	2.00	0.02
4400			7.08	0.34	5.64	0.19	4.59	0.12	3.22	0.05	2.09	0.02
4600			7.40	0.37	5.89	0.21	4.80	0.13	3.37	0.05	2.19	0.02
4800			7.72	0.40	6.15	0.23	5.01	0.14	3.51	0.06	2.28	0.02
5000					6.41	0.25	5.22	0.15	3.66	0.06	2.38	0.02
5200					6.66	0.26	5.43	0.16	3.81	0.07	2.47	0.02
5400					6.92	0.28	5.64	0.17	3.95	0.07	2.57	0.03
5600					7.17	0.30	5.85	0.18	4.10	0.08	2.66	0.03
5800					7.43	0.32	6.06	0.20	4.24	0.08	2.76	0.03
6000					7.69	0.34	6.26	0.21	4.39	0.09	2.85	0.03
6200					7.94	0.37	6.47	0.22	4.54	0.09	2.95	0.03
6400							6.68	0.24	4.68	0.10	3.04	0.03
6600							6.89	0.25	4.83	0.10	3.14	0.04
6800							7.10	0.26	4.98	0.11	3.23	0.04
7000							7.31	0.28	5.12	0.12	3.33	0.04
7500							7.83	0.32	5.49	0.13	3.57	0.05
8000									5.85	0.15	3.81	0.05
8500									6.22	0.17	4.04	0.06
9000									6.59	0.19	4.28	0.07
9500									6.95	0.21	4.52	0.07
10000									7.32	0.23	4.76	0.08
10500									7.68	0.25	4.99	0.09

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

C905   DR 18   235 PSI (C.I.O.D.)

AWWA C905   ASTM D1784   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	14"		16"		18"		20"		24"		30"	
Avg. ID	13.50		15.35		17.20		19.06		22.76		28.23	
Pipe OD	15.30		17.40		19.50		21.60		25.80		32.00	
Avg. Wall	0.901		1.025		1.148		1.272		1.519		1.885	
Min. Wall	0.850		0.967		1.083		1.200		1.433		1.778	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
400	0.90	0.01	0.69	0.00	0.55	0.00	0.45	0.00	0.31	0.00	0.20	0.00
450	1.01	0.01	0.78	0.01	0.62	0.00	0.51	0.00	0.35	0.00	0.23	0.00
500	1.12	0.01	0.87	0.01	0.69	0.00	0.56	0.00	0.39	0.00	0.26	0.00
550	1.23	0.02	0.95	0.01	0.76	0.00	0.62	0.00	0.43	0.00	0.28	0.00
600	1.34	0.02	1.04	0.01	0.83	0.01	0.67	0.00	0.47	0.00	0.31	0.00
650	1.46	0.02	1.13	0.01	0.90	0.01	0.73	0.00	0.51	0.00	0.33	0.00
700	1.57	0.03	1.21	0.01	0.96	0.01	0.79	0.00	0.55	0.00	0.36	0.00
750	1.68	0.03	1.30	0.02	1.03	0.01	0.84	0.01	0.59	0.00	0.38	0.00
800	1.79	0.03	1.39	0.02	1.10	0.01	0.90	0.01	0.63	0.00	0.41	0.00
850	1.90	0.04	1.47	0.02	1.17	0.01	0.96	0.01	0.67	0.00	0.44	0.00
900	2.02	0.04	1.56	0.02	1.24	0.01	1.01	0.01	0.71	0.00	0.46	0.00
950	2.13	0.04	1.65	0.02	1.31	0.01	1.07	0.01	0.75	0.00	0.49	0.00
1000	2.24	0.05	1.73	0.03	1.38	0.01	1.12	0.01	0.79	0.00	0.51	0.00
1100	2.46	0.06	1.90	0.03	1.52	0.02	1.24	0.01	0.87	0.00	0.56	0.00
1200	2.69	0.07	2.08	0.04	1.65	0.02	1.35	0.01	0.94	0.01	0.61	0.00
1300	2.91	0.08	2.25	0.04	1.79	0.02	1.46	0.01	1.02	0.01	0.67	0.00
1400	3.14	0.09	2.42	0.05	1.93	0.03	1.57	0.02	1.10	0.01	0.72	0.00
1500	3.36	0.10	2.60	0.05	2.07	0.03	1.69	0.02	1.18	0.01	0.77	0.00
1600	3.58	0.12	2.77	0.06	2.21	0.04	1.80	0.02	1.26	0.01	0.82	0.00
1700	3.81	0.13	2.94	0.07	2.34	0.04	1.91	0.02	1.34	0.01	0.87	0.00
1800	4.03	0.14	3.12	0.08	2.48	0.04	2.02	0.03	1.42	0.01	0.92	0.00
1900	4.25	0.16	3.29	0.09	2.62	0.05	2.13	0.03	1.50	0.01	0.97	0.00
2000	4.48	0.17	3.46	0.09	2.76	0.05	2.25	0.03	1.57	0.01	1.02	0.00
2100	4.70	0.19	3.64	0.10	2.89	0.06	2.36	0.04	1.65	0.02	1.08	0.01
2200	4.93	0.21	3.81	0.11	3.03	0.06	2.47	0.04	1.73	0.02	1.13	0.01
2300	5.15	0.23	3.98	0.12	3.17	0.07	2.58	0.04	1.81	0.02	1.18	0.01
2400	5.37	0.25	4.16	0.13	3.31	0.08	2.70	0.05	1.89	0.02	1.23	0.01
2500	5.60	0.26	4.33	0.14	3.45	0.08	2.81	0.05	1.97	0.02	1.28	0.01
2600	5.82	0.28	4.50	0.15	3.58	0.09	2.92	0.05	2.05	0.02	1.33	0.01
2700	6.05	0.30	4.68	0.16	3.72	0.09	3.03	0.06	2.13	0.02	1.38	0.01
2800	6.27	0.33	4.85	0.17	3.86	0.10	3.15	0.06	2.20	0.03	1.43	0.01
2900	6.49	0.35	5.02	0.19	4.00	0.11	3.26	0.06	2.28	0.03	1.48	0.01
3000	6.72	0.37	5.19	0.20	4.14	0.11	3.37	0.07	2.36	0.03	1.54	0.01
3100	6.94	0.39	5.37	0.21	4.27	0.12	3.48	0.07	2.44	0.03	1.59	0.01
3200	7.17	0.42	5.54	0.22	4.41	0.13	3.60	0.08	2.52	0.03	1.64	0.01
3300			5.71	0.24	4.55	0.14	3.71	0.08	2.60	0.03	1.69	0.01
3400			5.89	0.25	4.69	0.14	3.82	0.09	2.68	0.04	1.74	0.01
3500			6.06	0.26	4.82	0.15	3.93	0.09	2.76	0.04	1.79	0.01
3600			6.23	0.28	4.96	0.16	4.04	0.10	2.83	0.04	1.84	0.01
3700			6.41	0.29	5.10	0.17	4.16	0.10	2.91	0.04	1.89	0.02
3800			6.58	0.31	5.24	0.18	4.27	0.11	2.99	0.05	1.95	0.02
3900			6.75	0.32	5.38	0.18	4.38	0.11	3.07	0.05	2.00	0.02
4000			6.93	0.34	5.51	0.19	4.49	0.12	3.15	0.05	2.05	0.02
4200			7.27	0.37	5.79	0.21	4.72	0.13	3.31	0.05	2.15	0.02
4400			7.62	0.40	6.07	0.23	4.94	0.14	3.46	0.06	2.25	0.02
4600					6.34	0.25	5.17	0.15	3.62	0.06	2.36	0.02
4800					6.62	0.27	5.39	0.17	3.78	0.07	2.46	0.02
5000					6.89	0.29	5.62	0.18	3.94	0.08	2.56	0.03
5200					7.17	0.32	5.84	0.19	4.09	0.08	2.66	0.03
5400					7.44	0.34	6.07	0.21	4.25	0.09	2.76	0.03
5600							6.29	0.22	4.41	0.09	2.87	0.03
5800							6.52	0.23	4.57	0.10	2.97	0.03
6000							6.74	0.25	4.72	0.11	3.07	0.04
6200							6.97	0.27	4.88	0.11	3.17	0.04
6400							7.19	0.28	5.04	0.12	3.28	0.04
6600							7.42	0.30	5.20	0.13	3.38	0.04
6800							7.64	0.31	5.35	0.13	3.48	0.05
7000							7.86	0.33	5.51	0.14	3.58	0.05
7500									5.91	0.16	3.84	0.06
8000									6.30	0.18	4.10	0.06
8500									6.69	0.20	4.35	0.07
9000									7.09	0.22	4.61	0.08
9500									7.48	0.25	4.86	0.09
10000											5.12	0.10
10500											5.38	0.10

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

PVC 63   IPS PLASTIC PIPE

ANSI/ASAE S376.2   ASTM D1784   SDR 64   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"	
Avg. ID	4.340		6.397		8.335		10.394		12.328	
Pipe OD	4.500		6.625		8.625		10.750		12.750	
Avg. Wall	0.080		0.114		0.145		0.178		0.211	
Min. Wall	0.070		0.104		0.135		0.168		0.199	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
10	0.22	0.00	0.10	0.00	0.06	0.00	0.04	0.00	0.03	0.00
20	0.43	0.01	0.20	0.00	0.12	0.00	0.08	0.00	0.05	0.00
30	0.65	0.02	0.30	0.00	0.18	0.00	0.11	0.00	0.08	0.00
40	0.87	0.03	0.40	0.00	0.23	0.00	0.15	0.00	0.11	0.00
50	1.08	0.05	0.50	0.01	0.29	0.00	0.19	0.00	0.13	0.00
60	1.30	0.07	0.60	0.01	0.35	0.00	0.23	0.00	0.16	0.00
70	1.52	0.09	0.70	0.01	0.41	0.00	0.26	0.00	0.19	0.00
80	1.73	0.11	0.80	0.02	0.47	0.00	0.30	0.00	0.21	0.00
90	1.95	0.14	0.90	0.02	0.53	0.01	0.34	0.00	0.24	0.00
100	2.17	0.17	1.00	0.03	0.59	0.01	0.38	0.00	0.27	0.00
120	2.60	0.24	1.20	0.04	0.70	0.01	0.45	0.00	0.32	0.00
140	3.03	0.32	1.40	0.05	0.82	0.01	0.53	0.00	0.38	0.00
160	3.47	0.41	1.60	0.06	0.94	0.02	0.60	0.01	0.43	0.00
180	3.90	0.51	1.79	0.08	1.06	0.02	0.68	0.01	0.48	0.00
200	4.33	0.61	1.99	0.09	1.17	0.03	0.76	0.01	0.54	0.00
225	4.87	0.76	2.24	0.12	1.32	0.03	0.85	0.01	0.60	0.00
250	5.42	0.93	2.49	0.14	1.47	0.04	0.94	0.01	0.67	0.01
275	5.96	1.11	2.74	0.17	1.62	0.05	1.04	0.02	0.74	0.01
300	6.50	1.30	2.99	0.20	1.76	0.05	1.13	0.02	0.81	0.01
325	7.04	1.51	3.24	0.23	1.91	0.06	1.23	0.02	0.87	0.01
350	7.58	1.73	3.49	0.26	2.06	0.07	1.32	0.02	0.94	0.01
375			3.74	0.30	2.20	0.08	1.42	0.03	1.01	0.01
400			3.99	0.34	2.35	0.09	1.51	0.03	1.07	0.01
425			4.24	0.38	2.50	0.10	1.61	0.04	1.14	0.02
450			4.49	0.42	2.64	0.12	1.70	0.04	1.21	0.02
475			4.74	0.46	2.79	0.13	1.79	0.04	1.28	0.02
500			4.99	0.51	2.94	0.14	1.89	0.05	1.34	0.02
550			5.48	0.61	3.23	0.17	2.08	0.06	1.48	0.02
600			5.98	0.71	3.52	0.20	2.27	0.07	1.61	0.03
650			6.48	0.83	3.82	0.23	2.45	0.08	1.74	0.03
700			6.98	0.95	4.11	0.26	2.64	0.09	1.88	0.04
750			7.48	1.08	4.40	0.30	2.83	0.10	2.01	0.04
800			7.98	1.21	4.70	0.33	3.02	0.11	2.15	0.05
850					4.99	0.37	3.21	0.13	2.28	0.06
900					5.29	0.42	3.40	0.14	2.42	0.06
950					5.58	0.46	3.59	0.16	2.55	0.07
1000					5.87	0.51	3.78	0.17	2.68	0.08
1050					6.17	0.55	3.97	0.19	2.82	0.08
1150					6.75	0.66	4.34	0.22	3.09	0.10
1200					7.05	0.71	4.53	0.24	3.22	0.11
1250							4.72	0.26	3.36	0.11
1300							4.91	0.28	3.49	0.12
1350							5.10	0.30	3.62	0.13
1400							5.29	0.32	3.76	0.14
1500							5.66	0.37	4.03	0.16
1550							5.85	0.39	4.16	0.17
1600							6.04	0.41	4.30	0.18
1650							6.23	0.44	4.43	0.19
1700							6.42	0.46	4.56	0.20
1750							6.61	0.49	4.70	0.21
1800									4.83	0.22
1850									4.97	0.24
1900									5.10	0.25
1950									5.23	0.26
2000									5.37	0.27
2100									5.64	0.30
2200									5.91	0.32
2300									6.17	0.35
2400									6.44	0.38
2500									6.71	0.41
2600										
2700										
2800										
2900										
3000										

**Shaded area represents velocities over 5 fps.
Use with caution.**

PVC 100   IPS PLASTIC PIPE

ANSI/ASAE S376.2   ASTM D1784   SDR 41   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		14"		16"		18"	
Avg. ID	6.281		8.179		10.194		12.090		13.270		15.164		17.060	
Pipe OD	6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.172		0.223		0.278		0.330		0.365		0.418		0.470	
Min. Wall	0.162		0.210		0.262		0.311		0.341		0.390		0.439	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
20	0.21	0.00	0.12	0.00	0.08	0.00	0.06	0.00	0.05	0.00	0.04	0.00	0.03	0.00
40	0.41	0.01	0.24	0.00	0.16	0.00	0.11	0.00	0.09	0.00	0.07	0.00	0.06	0.00
60	0.62	0.01	0.37	0.00	0.24	0.00	0.17	0.00	0.14	0.00	0.11	0.00	0.08	0.00
80	0.83	0.02	0.49	0.01	0.31	0.00	0.22	0.00	0.19	0.00	0.14	0.00	0.11	0.00
100	1.03	0.03	0.61	0.01	0.39	0.00	0.28	0.00	0.23	0.00	0.18	0.00	0.14	0.00
150	1.55	0.06	0.91	0.02	0.59	0.01	0.42	0.00	0.35	0.00	0.27	0.00	0.21	0.00
200	2.07	0.10	1.22	0.03	0.79	0.01	0.56	0.00	0.46	0.00	0.35	0.00	0.28	0.00
250	2.59	0.15	1.52	0.04	0.98	0.01	0.70	0.01	0.58	0.00	0.44	0.00	0.35	0.00
300	3.10	0.22	1.83	0.06	1.18	0.02	0.84	0.01	0.70	0.01	0.53	0.00	0.42	0.00
350	3.62	0.29	2.13	0.08	1.37	0.03	0.98	0.01	0.81	0.01	0.62	0.00	0.49	0.00
400	4.14	0.37	2.44	0.10	1.57	0.03	1.12	0.02	0.93	0.01	0.71	0.01	0.56	0.00
450	4.65	0.46	2.74	0.13	1.77	0.04	1.26	0.02	1.04	0.01	0.80	0.01	0.63	0.00
500	5.17	0.56	3.05	0.15	1.96	0.05	1.40	0.02	1.16	0.01	0.89	0.01	0.70	0.00
550	5.69	0.66	3.35	0.18	2.16	0.06	1.54	0.03	1.27	0.02	0.98	0.01	0.77	0.01
600	6.21	0.78	3.66	0.22	2.36	0.07	1.67	0.03	1.39	0.02	1.06	0.01	0.84	0.01
650	6.72	0.90	3.96	0.25	2.55	0.09	1.81	0.04	1.51	0.02	1.15	0.01	0.91	0.01
700	7.24	1.04	4.27	0.29	2.75	0.10	1.95	0.04	1.62	0.03	1.24	0.01	0.98	0.01
750	7.76	1.18	4.57	0.33	2.94	0.11	2.09	0.05	1.74	0.03	1.33	0.02	1.05	0.01
800	8.27	1.33	4.88	0.37	3.14	0.13	2.23	0.05	1.85	0.03	1.42	0.02	1.12	0.01
850	8.79	1.48	5.18	0.41	3.34	0.14	2.37	0.06	1.97	0.04	1.51	0.02	1.19	0.01
900			5.49	0.46	3.53	0.16	2.51	0.07	2.09	0.04	1.60	0.02	1.26	0.01
950			5.79	0.50	3.73	0.17	2.65	0.08	2.20	0.05	1.69	0.03	1.33	0.01
1000			6.10	0.55	3.93	0.19	2.79	0.08	2.32	0.05	1.77	0.03	1.40	0.02
1050			6.40	0.61	4.12	0.21	2.93	0.09	2.43	0.06	1.86	0.03	1.47	0.02
1100			6.71	0.66	4.32	0.23	3.07	0.10	2.55	0.06	1.95	0.03	1.54	0.02
1150					4.52	0.25	3.21	0.11	2.66	0.07	2.04	0.04	1.61	0.02
1200					4.71	0.27	3.35	0.12	2.78	0.07	2.13	0.04	1.68	0.02
1250					4.91	0.29	3.49	0.13	2.90	0.08	2.22	0.04	1.75	0.02
1300					5.10	0.31	3.63	0.13	3.01	0.09	2.31	0.04	1.82	0.03
1350					5.30	0.33	3.77	0.14	3.13	0.09	2.40	0.05	1.89	0.03
1400					5.50	0.35	3.91	0.15	3.24	0.10	2.48	0.05	1.96	0.03
1450					5.69	0.38	4.05	0.16	3.36	0.10	2.57	0.05	2.03	0.03
1500					5.89	0.40	4.19	0.18	3.48	0.11	2.66	0.06	2.10	0.03
1600					6.28	0.45	4.47	0.20	3.71	0.13	2.84	0.07	2.24	0.04
1700					6.67	0.51	4.75	0.22	3.94	0.14	3.02	0.07	2.38	0.04
1800							5.02	0.25	4.17	0.16	3.19	0.08	2.52	0.05
1900							5.30	0.27	4.40	0.17	3.37	0.09	2.66	0.05
2000							5.58	0.30	4.63	0.19	3.55	0.10	2.80	0.06
2100							5.86	0.33	4.87	0.21	3.73	0.11	2.94	0.06
2200							6.14	0.36	5.10	0.23	3.90	0.12	3.08	0.07
2300							6.42	0.39	5.33	0.25	4.08	0.13	3.22	0.07
2400							6.70	0.42	5.56	0.27	4.26	0.14	3.36	0.08
2500							6.98	0.45	5.79	0.29	4.44	0.15	3.50	0.08
2600							7.26	0.49	6.02	0.31	4.61	0.16	3.64	0.09
2700							7.54	0.52	6.26	0.33	4.79	0.17	3.78	0.10
2800							7.82	0.56	6.49	0.35	4.97	0.19	3.93	0.10
2900							8.09	0.59	6.72	0.38	5.15	0.20	4.07	0.11
3000							8.37	0.63	6.95	0.40	5.32	0.21	4.21	0.12
3100							8.65	0.67	7.18	0.43	5.50	0.22	4.35	0.13
3200							8.93	0.71	7.41	0.45	5.68	0.24	4.49	0.13
3300									7.65	0.48	5.86	0.25	4.63	0.14
3400									7.88	0.51	6.03	0.27	4.77	0.15
3500									8.11	0.54	6.21	0.28	4.91	0.16
3600									8.34	0.56	6.39	0.29	5.05	0.17
3700									8.57	0.59	6.56	0.31	5.19	0.17
3800											6.74	0.33	5.33	0.18
3900											6.92	0.34	5.47	0.19
4000											7.10	0.36	5.61	0.20
4100											7.27	0.38	5.75	0.21
4200											7.45	0.39	5.89	0.22
4300													6.03	0.23
4400													6.17	0.24
4500													6.31	0.25
4600													6.45	0.26
4700													6.59	0.27

Shaded area represents velocities over 5 fps. Use with caution.

PVC 125   IPS PLASTIC PIPE

ANSI/ASAE S376.2   ASTM D1784   SDR 32.5   C=150

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		14"		16"		18"	
Avg. ID	6.193		8.063		10.048		11.918		13.088		14.956		16.826	
Pipe OD	6.625		8.625		10.750		12.750		14.000		16.000		18.000	
Avg. Wall	0.216		0.281		0.351		0.416		0.456		0.522		0.587	
Min. Wall	0.204		0.265		0.331		0.392		0.430		0.492		0.554	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
20	0.21	0.00	0.13	0.00	0.08	0.00	0.06	0.00	0.05	0.00	0.04	0.00	0.03	0.00
40	0.43	0.01	0.25	0.00	0.16	0.00	0.11	0.00	0.10	0.00	0.07	0.00	0.06	0.00
60	0.64	0.01	0.38	0.00	0.24	0.00	0.17	0.00	0.14	0.00	0.11	0.00	0.09	0.00
80	0.85	0.02	0.50	0.01	0.32	0.00	0.23	0.00	0.19	0.00	0.15	0.00	0.12	0.00
100	1.06	0.03	0.63	0.01	0.40	0.00	0.29	0.00	0.24	0.00	0.18	0.00	0.14	0.00
150	1.60	0.06	0.94	0.02	0.61	0.01	0.43	0.00	0.36	0.00	0.27	0.00	0.22	0.00
200	2.13	0.11	1.26	0.03	0.81	0.01	0.57	0.00	0.48	0.00	0.36	0.00	0.29	0.00
250	2.66	0.16	1.57	0.05	1.01	0.02	0.72	0.01	0.60	0.00	0.46	0.00	0.36	0.00
300	3.19	0.23	1.88	0.06	1.21	0.02	0.86	0.01	0.71	0.01	0.55	0.00	0.43	0.00
350	3.72	0.31	2.20	0.09	1.41	0.03	1.01	0.01	0.83	0.01	0.64	0.00	0.50	0.00
400	4.26	0.39	2.51	0.11	1.62	0.04	1.15	0.02	0.95	0.01	0.73	0.01	0.58	0.00
450	4.79	0.49	2.82	0.14	1.82	0.05	1.29	0.02	1.07	0.01	0.82	0.01	0.65	0.00
500	5.32	0.59	3.14	0.16	2.02	0.06	1.44	0.02	1.19	0.02	0.91	0.01	0.72	0.00
550	5.85	0.71	3.45	0.20	2.22	0.07	1.58	0.03	1.31	0.02	1.00	0.01	0.79	0.01
600	6.38	0.83	3.77	0.23	2.42	0.08	1.72	0.03	1.43	0.02	1.09	0.01	0.86	0.01
650	6.91	0.97	4.08	0.27	2.63	0.09	1.87	0.04	1.55	0.03	1.19	0.01	0.94	0.01
700	7.45	1.11	4.39	0.31	2.83	0.11	2.01	0.05	1.67	0.03	1.28	0.02	1.01	0.01
750	7.98	1.26	4.71	0.35	3.03	0.12	2.15	0.05	1.79	0.03	1.37	0.02	1.08	0.01
800	8.51	1.42	5.02	0.39	3.23	0.13	2.30	0.06	1.91	0.04	1.46	0.02	1.15	0.01
850	9.04	1.59	5.33	0.44	3.43	0.15	2.44	0.07	2.02	0.04	1.55	0.02	1.22	0.01
900			5.65	0.49	3.64	0.17	2.59	0.07	2.14	0.05	1.64	0.02	1.30	0.01
950			5.96	0.54	3.84	0.19	2.73	0.08	2.26	0.05	1.73	0.03	1.37	0.02
1000			6.28	0.59	4.04	0.20	2.87	0.09	2.38	0.06	1.82	0.03	1.44	0.02
1050			6.59	0.65	4.24	0.22	3.02	0.10	2.50	0.06	1.92	0.03	1.51	0.02
1100			6.90	0.71	4.45	0.24	3.16	0.11	2.62	0.07	2.01	0.04	1.59	0.02
1150					4.65	0.26	3.30	0.11	2.74	0.07	2.10	0.04	1.66	0.02
1200					4.85	0.29	3.45	0.12	2.86	0.08	2.19	0.04	1.73	0.02
1250					5.05	0.31	3.59	0.13	2.98	0.09	2.28	0.04	1.80	0.03
1300					5.25	0.33	3.73	0.14	3.10	0.09	2.37	0.05	1.87	0.03
1350					5.46	0.36	3.88	0.15	3.22	0.10	2.46	0.05	1.95	0.03
1400					5.66	0.38	4.02	0.17	3.33	0.10	2.55	0.05	2.02	0.03
1450					5.86	0.41	4.17	0.18	3.45	0.11	2.64	0.06	2.09	0.03
1500					6.06	0.43	4.31	0.19	3.57	0.12	2.74	0.06	2.16	0.04
1600					6.47	0.49	4.60	0.21	3.81	0.13	2.92	0.07	2.31	0.04
1700					6.87	0.54	4.88	0.24	4.05	0.15	3.10	0.08	2.45	0.04
1800							5.17	0.26	4.29	0.17	3.28	0.09	2.59	0.05
1900							5.46	0.29	4.53	0.18	3.47	0.10	2.74	0.05
2000							5.74	0.32	4.76	0.20	3.65	0.11	2.88	0.06
2100							6.03	0.35	5.00	0.22	3.83	0.12	3.03	0.07
2200							6.32	0.38	5.24	0.24	4.01	0.13	3.17	0.07
2300							6.61	0.42	5.48	0.26	4.20	0.14	3.31	0.08
2400							6.89	0.45	5.72	0.28	4.38	0.15	3.46	0.08
2500							7.18	0.48	5.95	0.31	4.56	0.16	3.60	0.09
2600							7.47	0.52	6.19	0.33	4.74	0.17	3.75	0.10
2700							7.76	0.56	6.43	0.35	4.92	0.19	3.89	0.10
2800							8.04	0.60	6.67	0.38	5.11	0.20	4.04	0.11
2900							8.33	0.64	6.91	0.40	5.29	0.21	4.18	0.12
3000							8.62	0.68	7.15	0.43	5.47	0.22	4.32	0.13
3100							8.90	0.72	7.38	0.46	5.65	0.24	4.47	0.13
3200							9.19	0.77	7.62	0.49	5.84	0.25	4.61	0.14
3300									7.86	0.51	6.02	0.27	4.76	0.15
3400									8.10	0.54	6.20	0.28	4.90	0.16
3500									8.34	0.57	6.38	0.30	5.04	0.17
3600									8.57	0.60	6.57	0.32	5.19	0.18
3700									8.81	0.63	6.75	0.33	5.33	0.19
3800											6.93	0.35	5.48	0.20
3900											7.11	0.37	5.62	0.21
4000											7.30	0.38	5.76	0.22
4100											7.48	0.40	5.91	0.23
4200											7.66	0.42	6.05	0.24
4300													6.20	0.25
4400													6.34	0.26
4500													6.49	0.27
4600													6.63	0.28
4700													6.77	0.29

**Shaded area represents velocities over 5 fps.
Use with caution.**

50 FOOT HEAD   PLASTIC IRRIGATION PIPE (PIP)

ANSI/ASAE S376.2   C=150   Water Temperature 73˚ F

PSI Loss per 100 Feet of Pipe

Nominal Size	4"		6"		8"		10"		12"		15"	
Avg. ID	3.984		5.980		7.980		9.980		11.980		14.980	
Pipe OD	4.134		6.140		8.160		10.200		12.240		15.300	
Avg.Wall	0.075		0.080		0.090		0.110		0.130		0.160	
Min.Wall	0.065		0.070		0.080		0.100		0.120		0.150	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
25	0.64	0.02	0.29	0.00	0.16	0.00	0.10	0.00	0.07	0.00		
50	1.29	0.07	0.57	0.01	0.32	0.00	0.20	0.00	0.14	0.00	0.09	0.00
75	1.93	0.15	0.86	0.02	0.48	0.01	0.31	0.00	0.21	0.00	0.14	0.00
100	2.57	0.26	1.14	0.04	0.64	0.01	0.41	0.00	0.28	0.00	0.18	0.00
125	3.21	0.39	1.43	0.05	0.80	0.01	0.51	0.00	0.36	0.00	0.23	0.00
150	3.86	0.55	1.71	0.08	0.96	0.02	0.61	0.01	0.43	0.00	0.27	0.00
175	4.50	0.73	2.00	0.10	1.12	0.02	0.72	0.01	0.50	0.00	0.32	0.00
200	5.14	0.93	2.28	0.13	1.28	0.03	0.82	0.01	0.57	0.00	0.36	0.00
225	5.78	1.16	2.57	0.16	1.44	0.04	0.92	0.01	0.64	0.01	0.41	0.00
250	6.43	1.41	2.85	0.20	1.60	0.05	1.02	0.02	0.71	0.01	0.45	0.00
275	7.07	1.68	3.14	0.23	1.76	0.06	1.13	0.02	0.78	0.01	0.50	0.00
300	7.71	1.97	3.42	0.27	1.92	0.07	1.23	0.02	0.85	0.01	0.55	0.00
325	8.35	2.29	3.71	0.32	2.08	0.08	1.33	0.03	0.92	0.01	0.59	0.00
350	9.00	2.63	3.99	0.36	2.24	0.09	1.43	0.03	0.99	0.01	0.64	0.00
375	9.64	2.99	4.28	0.41	2.40	0.10	1.54	0.03	1.07	0.01	0.68	0.00
400			4.56	0.47	2.56	0.11	1.64	0.04	1.14	0.02	0.73	0.01
425			4.85	0.52	2.72	0.13	1.74	0.04	1.21	0.02	0.77	0.01
450			5.13	0.58	2.88	0.14	1.84	0.05	1.28	0.02	0.82	0.01
475			5.42	0.64	3.04	0.16	1.95	0.05	1.35	0.02	0.86	0.01
500			5.70	0.70	3.20	0.17	2.05	0.06	1.42	0.02	0.91	0.01
550			6.28	0.84	3.52	0.21	2.25	0.07	1.56	0.03	1.00	0.01
600			6.85	0.99	3.84	0.24	2.46	0.08	1.71	0.03	1.09	0.01
650			7.42	1.15	4.16	0.28	2.66	0.09	1.85	0.04	1.18	0.01
700			7.99	1.31	4.48	0.32	2.87	0.11	1.99	0.04	1.27	0.02
750			8.56	1.49	4.81	0.37	3.07	0.12	2.13	0.05	1.36	0.02
800					5.13	0.41	3.28	0.14	2.27	0.06	1.45	0.02
850					5.45	0.46	3.48	0.16	2.42	0.06	1.55	0.02
900					5.77	0.51	3.69	0.17	2.56	0.07	1.64	0.02
950					6.09	0.57	3.89	0.19	2.70	0.08	1.73	0.03
1000					6.41	0.63	4.10	0.21	2.84	0.09	1.82	0.03
1100					7.05	0.75	4.51	0.25	3.13	0.10	2.00	0.03
1200					7.69	0.88	4.92	0.30	3.41	0.12	2.18	0.04
1300					8.33	1.02	5.33	0.34	3.70	0.14	2.36	0.05
1400					8.97	1.17	5.73	0.39	3.98	0.16	2.55	0.05
1500							6.14	0.45	4.26	0.18	2.73	0.06
1600							6.55	0.50	4.55	0.21	2.91	0.07
1700							6.96	0.56	4.83	0.23	3.09	0.08
1800							7.37	0.63	5.12	0.26	3.27	0.09
1900							7.78	0.69	5.40	0.28	3.45	0.10
2000							8.19	0.76	5.69	0.31	3.64	0.11
2100									5.97	0.34	3.82	0.12
2200									6.25	0.37	4.00	0.13
2300									6.54	0.40	4.18	0.14
2400									6.82	0.44	4.36	0.15
2500									7.11	0.47	4.55	0.16
2600									7.39	0.51	4.73	0.17
2700									7.68	0.54	4.91	0.18
2800									7.96	0.58	5.09	0.20
2900									8.24	0.62	5.27	0.21
3000									8.53	0.66	5.45	0.22
3200											5.82	0.25
3400											6.18	0.28
3600											6.55	0.31
3800											6.91	0.35
4000											7.27	0.38
4200											7.64	0.42
4400											8.00	0.45
4600											8.36	0.49
4800											8.73	0.53
5000											9.09	0.57
5200												
5400												
5600												
5800												
6000												

Shaded area represents velocities over 5 fps. Use with caution.

100 FOOT HEAD PLASTIC IRRIGATION PIPE (PIP)

ANSI/ASAE S376.2 C=150 Water Temperature 73° F
PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		15"		18"		21"		24"	
Avg. ID	5.980		7.966		9.962		11.958		14.952		18.277		21.547		24.239	
Pipe OD	6.140		8.160		10.200		12.240		15.300		18.701		22.047		24.803	
Avg.Wall	0.080		0.097		0.119		0.141		0.174		0.212		0.250		0.282	
Min.Wall	0.070		0.087		0.109		0.131		0.016		0.200		0.236		0.266	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.29	0.00	0.16	0.00	0.10	0.00	0.07	0.00	0.05	0.00						
50	0.57	0.01	0.32	0.00	0.21	0.00	0.14	0.00	0.09	0.00	0.06	0.00				
75	0.86	0.02	0.48	0.01	0.31	0.00	0.21	0.00	0.14	0.00	0.09	0.00				
100	1.14	0.04	0.64	0.01	0.41	0.00	0.29	0.00	0.18	0.00	0.12	0.00	0.09	0.00	0.07	0.00
125	1.43	0.05	0.80	0.01	0.51	0.00	0.36	0.00	0.23	0.00	0.15	0.00	0.11	0.00	0.09	0.00
150	1.71	0.08	0.96	0.02	0.62	0.01	0.43	0.00	0.27	0.00	0.18	0.00	0.13	0.00	0.10	0.00
175	2.00	0.10	1.13	0.02	0.72	0.01	0.50	0.00	0.32	0.00	0.21	0.00	0.15	0.00	0.12	0.00
200	2.28	0.13	1.29	0.03	0.82	0.01	0.57	0.00	0.36	0.00	0.24	0.00	0.18	0.00	0.14	0.00
225	2.57	0.16	1.45	0.04	0.93	0.01	0.64	0.01	0.41	0.00	0.27	0.00	0.20	0.00	0.16	0.00
250	2.85	0.20	1.61	0.05	1.03	0.02	0.71	0.01	0.46	0.00	0.31	0.00	0.22	0.00	0.17	0.00
275	3.14	0.23	1.77	0.06	1.13	0.02	0.78	0.01	0.50	0.00	0.34	0.00	0.24	0.00	0.19	0.00
300	3.42	0.27	1.93	0.07	1.23	0.02	0.86	0.01	0.55	0.00	0.37	0.00	0.26	0.00	0.21	0.00
325	3.71	0.32	2.09	0.08	1.34	0.03	0.93	0.01	0.59	0.00	0.40	0.00	0.29	0.00	0.23	0.00
350	3.99	0.36	2.25	0.09	1.44	0.03	1.00	0.01	0.64	0.00	0.43	0.00	0.31	0.00	0.24	0.00
375	4.28	0.41	2.41	0.10	1.54	0.03	1.07	0.01	0.68	0.00	0.46	0.00	0.33	0.00	0.26	0.00
400	4.56	0.47	2.57	0.12	1.64	0.04	1.14	0.02	0.73	0.01	0.49	0.00	0.35	0.00	0.28	0.00
425	4.85	0.52	2.73	0.13	1.75	0.04	1.21	0.02	0.78	0.01	0.52	0.00	0.37	0.00	0.30	0.00
450	5.13	0.58	2.89	0.14	1.85	0.05	1.28	0.02	0.82	0.01	0.55	0.00	0.40	0.00	0.31	0.00
475	5.42	0.64	3.05	0.16	1.95	0.05	1.36	0.02	0.87	0.01	0.58	0.00	0.42	0.00	0.33	0.00
500	5.70	0.70	3.21	0.17	2.06	0.06	1.43	0.02	0.91	0.01	0.61	0.00	0.44	0.00	0.35	0.00
550	6.28	0.84	3.54	0.21	2.26	0.07	1.57	0.03	1.00	0.01	0.67	0.00	0.48	0.00	0.38	0.00
600	6.85	0.99	3.86	0.24	2.47	0.08	1.71	0.03	1.09	0.01	0.73	0.00	0.53	0.00	0.42	0.00
650	7.42	1.15	4.18	0.28	2.67	0.10	1.85	0.04	1.19	0.01	0.79	0.00	0.57	0.00	0.45	0.00
700	7.99	1.31	4.50	0.33	2.88	0.11	2.00	0.05	1.28	0.02	0.85	0.01	0.62	0.00	0.49	0.00
750	8.56	1.49	4.82	0.37	3.08	0.12	2.14	0.05	1.37	0.02	0.92	0.01	0.66	0.00	0.52	0.00
800			5.14	0.42	3.29	0.14	2.28	0.06	1.46	0.02	0.98	0.01	0.70	0.00	0.56	0.00
850			5.47	0.47	3.49	0.16	2.43	0.06	1.55	0.02	1.04	0.01	0.75	0.00	0.59	0.00
900			5.79	0.52	3.70	0.17	2.57	0.07	1.64	0.02	1.10	0.01	0.79	0.00	0.62	0.00
950			6.11	0.57	3.91	0.19	2.71	0.08	1.73	0.03	1.16	0.01	0.83	0.00	0.66	0.00
1000			6.43	0.62	4.11	0.21	2.85	0.09	1.82	0.03	1.22	0.01	0.88	0.00	0.69	0.00
1100			7.07	0.75	4.52	0.25	3.14	0.10	2.01	0.04	1.34	0.01	0.97	0.01	0.76	0.00
1200			7.72	0.88	4.93	0.30	3.42	0.12	2.19	0.04	1.47	0.02	1.05	0.01	0.83	0.00
1300			8.36	1.02	5.34	0.35	3.71	0.14	2.37	0.05	1.59	0.02	1.14	0.01	0.90	0.00
1400			9.00	1.18	5.76	0.40	3.99	0.16	2.55	0.05	1.71	0.02	1.23	0.01	0.97	0.01
1500					6.17	0.45	4.28	0.19	2.74	0.06	1.83	0.02	1.32	0.01	1.04	0.01
1600					6.58	0.51	4.57	0.21	2.92	0.07	1.95	0.03	1.41	0.01	1.11	0.01
1700					6.99	0.57	4.85	0.23	3.10	0.08	2.08	0.03	1.49	0.01	1.18	0.01
1800					7.40	0.63	5.14	0.26	3.28	0.09	2.20	0.03	1.58	0.01	1.25	0.01
1900					7.81	0.70	5.42	0.29	3.47	0.10	2.32	0.04	1.67	0.02	1.32	0.01
2000					8.22	0.77	5.71	0.32	3.65	0.11	2.44	0.04	1.76	0.02	1.39	0.01
2100							5.99	0.35	3.83	0.12	2.56	0.04	1.85	0.02	1.46	0.01
2200							6.28	0.38	4.01	0.13	2.69	0.05	1.93	0.02	1.53	0.01
2300							6.56	0.41	4.20	0.14	2.81	0.05	2.02	0.02	1.60	0.01
2400							6.85	0.44	4.38	0.15	2.93	0.06	2.11	0.03	1.67	0.01
2500							7.13	0.48	4.56	0.16	3.05	0.06	2.20	0.03	1.74	0.02
2600							7.42	0.51	4.74	0.17	3.18	0.07	2.28	0.03	1.81	0.02
2700							7.70	0.55	4.93	0.19	3.30	0.07	2.37	0.03	1.87	0.02
2800							7.99	0.59	5.11	0.20	3.42	0.07	2.46	0.03	1.94	0.02
2900							8.27	0.63	5.29	0.21	3.54	0.08	2.55	0.04	2.01	0.02
3000							8.56	0.67	5.47	0.23	3.66	0.08	2.64	0.04	2.08	0.02
3200									5.84	0.25	3.91	0.10	2.81	0.04	2.22	0.02
3400									6.20	0.28	4.15	0.11	2.99	0.05	2.36	0.03
3600									6.57	0.32	4.40	0.12	3.16	0.05	2.50	0.03
3800									6.93	0.35	4.64	0.13	3.34	0.06	2.64	0.03
4000									7.30	0.38	4.89	0.14	3.52	0.06	2.78	0.04
4200											5.13	0.16	3.69	0.07	2.92	0.04
4400											5.37	0.17	3.87	0.08	3.06	0.04
4600											5.62	0.19	4.04	0.08	3.19	0.05
4800											5.86	0.20	4.22	0.09	3.33	0.05
5000											6.11	0.22	4.39	0.10	3.47	0.06
5200													4.57	0.11	3.61	0.06
5400													4.75	0.11	3.75	0.06
5600													4.92	0.12	3.89	0.07
5800													5.10	0.13	4.03	0.07
6000													5.27	0.14	4.17	0.08

Shaded area represents velocities over 5 fps. Use with caution.

SDR-81   50 PSI   PLASTIC IRRIGATION PIPE (PIP)

ANSI/ASAE S376.2   C=150   Water Temerature 73° F

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		15"		18"		21"		24"	
Avg. ID	5.968		7.938		9.928		11.918		14.898		18.211		21.469		24.153	
Pipe OD	6.140		8.160		10.200		12.240		15.300		18.701		22.047		24.803	
Avg.Wall	0.086		0.111		0.136		0.161		0.201		0.245		0.289		0.325	
Min.Wall	0.076		0.101		0.126		0.151		0.189		0.231		0.272		0.306	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
25	0.29	0.00	0.16	0.00	0.10	0.00	0.07	0.00	0.05	0.00						
50	0.57	0.01	0.32	0.00	0.21	0.00	0.14	0.00	0.09	0.00	0.06	0.00				
75	0.86	0.02	0.49	0.01	0.31	0.00	0.22	0.00	0.14	0.00	0.09	0.00				
100	1.15	0.04	0.65	0.01	0.41	0.00	0.29	0.00	0.18	0.00	0.12	0.00	0.09	0.00	0.07	0.00
125	1.43	0.05	0.81	0.01	0.52	0.00	0.36	0.00	0.23	0.00	0.15	0.00	0.11	0.00	0.09	0.00
150	1.72	0.08	0.97	0.02	0.62	0.01	0.43	0.00	0.28	0.00	0.18	0.00	0.13	0.00	0.10	0.00
175	2.00	0.10	1.13	0.03	0.72	0.01	0.50	0.00	0.32	0.00	0.22	0.00	0.15	0.00	0.12	0.00
200	2.29	0.13	1.29	0.03	0.83	0.01	0.57	0.00	0.37	0.00	0.25	0.00	0.18	0.00	0.14	0.00
225	2.58	0.16	1.46	0.04	0.93	0.01	0.65	0.01	0.41	0.00	0.28	0.00	0.20	0.00	0.16	0.00
250	2.86	0.20	1.62	0.05	1.03	0.02	0.72	0.01	0.46	0.00	0.31	0.00	0.22	0.00	0.17	0.00
275	3.15	0.24	1.78	0.06	1.14	0.02	0.79	0.01	0.51	0.00	0.34	0.00	0.24	0.00	0.19	0.00
300	3.44	0.28	1.94	0.07	1.24	0.02	0.86	0.01	0.55	0.00	0.37	0.00	0.27	0.00	0.21	0.00
325	3.72	0.32	2.10	0.08	1.35	0.03	0.93	0.01	0.60	0.00	0.40	0.00	0.29	0.00	0.23	0.00
350	4.01	0.37	2.27	0.09	1.45	0.03	1.01	0.01	0.64	0.01	0.43	0.00	0.31	0.00	0.24	0.00
375	4.30	0.42	2.43	0.10	1.55	0.04	1.08	0.01	0.69	0.01	0.46	0.00	0.33	0.00	0.26	0.00
400	4.58	0.47	2.59	0.12	1.66	0.04	1.15	0.02	0.74	0.01	0.49	0.00	0.35	0.00	0.28	0.00
425	4.87	0.53	2.75	0.13	1.76	0.04	1.22	0.02	0.78	0.01	0.52	0.00	0.38	0.00	0.30	0.00
450	5.15	0.59	2.91	0.15	1.86	0.05	1.29	0.02	0.83	0.01	0.55	0.00	0.40	0.00	0.31	0.00
475	5.44	0.65	3.08	0.16	1.97	0.05	1.36	0.02	0.87	0.01	0.58	0.00	0.42	0.00	0.33	0.00
500	5.73	0.71	3.24	0.18	2.07	0.06	1.44	0.02	0.92	0.01	0.62	0.00	0.44	0.00	0.35	0.00
550	6.30	0.85	3.56	0.21	2.28	0.07	1.58	0.03	1.01	0.01	0.68	0.00	0.49	0.00	0.38	0.00
600	6.87	1.00	3.88	0.25	2.48	0.08	1.72	0.03	1.10	0.01	0.74	0.00	0.53	0.00	0.42	0.00
650	7.45	1.16	4.21	0.29	2.69	0.10	1.87	0.04	1.19	0.01	0.80	0.01	0.58	0.00	0.45	0.00
700	8.02	1.33	4.53	0.33	2.90	0.11	2.01	0.05	1.29	0.02	0.86	0.01	0.62	0.00	0.49	0.00
750	8.59	1.51	4.86	0.38	3.10	0.13	2.15	0.05	1.38	0.02	0.92	0.01	0.66	0.00	0.52	0.00
800			5.18	0.42	3.31	0.14	2.30	0.06	1.47	0.02	0.98	0.01	0.71	0.00	0.56	0.00
850			5.50	0.47	3.52	0.16	2.44	0.07	1.56	0.02	1.05	0.01	0.75	0.00	0.59	0.00
900			5.83	0.53	3.73	0.18	2.59	0.07	1.65	0.02	1.11	0.01	0.80	0.00	0.63	0.00
950			6.15	0.58	3.93	0.20	2.73	0.08	1.75	0.03	1.17	0.01	0.84	0.00	0.66	0.00
1000			6.47	0.64	4.14	0.22	2.87	0.09	1.84	0.03	1.23	0.01	0.89	0.01	0.70	0.00
1100			7.12	0.77	4.55	0.26	3.16	0.11	2.02	0.04	1.35	0.01	0.97	0.01	0.77	0.00
1200			7.77	0.90	4.97	0.30	3.45	0.12	2.21	0.04	1.48	0.02	1.06	0.01	0.84	0.00
1300			8.42	1.04	5.38	0.35	3.73	0.14	2.39	0.05	1.60	0.02	1.15	0.01	0.91	0.00
1400			9.06	1.20	5.80	0.40	4.02	0.17	2.57	0.06	1.72	0.02	1.24	0.01	0.98	0.01
1500					6.21	0.46	4.31	0.19	2.76	0.06	1.85	0.02	1.33	0.01	1.05	0.01
1600					6.62	0.52	4.60	0.21	2.94	0.07	1.97	0.03	1.42	0.01	1.12	0.01
1700					7.04	0.58	4.88	0.24	3.13	0.08	2.09	0.03	1.50	0.01	1.19	0.01
1800					7.45	0.64	5.17	0.26	3.31	0.09	2.21	0.03	1.59	0.02	1.26	0.01
1900					7.86	0.71	5.46	0.29	3.49	0.10	2.34	0.04	1.68	0.02	1.33	0.01
2000					8.28	0.78	5.74	0.32	3.68	0.11	2.46	0.04	1.77	0.02	1.40	0.01
2100							6.03	0.35	3.86	0.12	2.58	0.04	1.86	0.02	1.47	0.01
2200							6.32	0.38	4.04	0.13	2.71	0.05	1.95	0.02	1.54	0.01
2300							6.61	0.42	4.23	0.14	2.83	0.05	2.04	0.02	1.61	0.01
2400							6.89	0.45	4.41	0.15	2.95	0.06	2.12	0.03	1.68	0.01
2500							7.18	0.48	4.60	0.16	3.08	0.06	2.21	0.03	1.75	0.02
2600							7.47	0.52	4.78	0.18	3.20	0.07	2.30	0.03	1.82	0.02
2700							7.76	0.56	4.96	0.19	3.32	0.07	2.39	0.03	1.89	0.02
2800							8.04	0.60	5.15	0.20	3.44	0.08	2.48	0.03	1.96	0.02
2900							8.33	0.64	5.33	0.22	3.57	0.08	2.57	0.04	2.03	0.02
3000							8.62	0.68	5.51	0.23	3.69	0.09	2.66	0.04	2.10	0.02
3200									5.88	0.26	3.94	0.10	2.83	0.04	2.24	0.02
3400									6.25	0.29	4.18	0.11	3.01	0.05	2.38	0.03
3600									6.62	0.32	4.43	0.12	3.19	0.05	2.52	0.03
3800									6.99	0.36	4.67	0.13	3.36	0.06	2.66	0.03
4000									7.35	0.39	4.92	0.15	3.54	0.07	2.80	0.04
4200											5.17	0.16	3.72	0.07	2.94	0.04
4400											5.41	0.18	3.89	0.08	3.08	0.04
4600											5.66	0.19	4.07	0.09	3.22	0.05
4800											5.91	0.21	4.25	0.09	3.36	0.05
5000											6.15	0.22	4.43	0.10	3.50	0.06
5200													4.60	0.11	3.64	0.06
5400													4.78	0.12	3.78	0.06
5600													4.96	0.12	3.92	0.07
5800													5.13	0.13	4.06	0.07
6000													5.31	0.14	4.20	0.08

Shaded area represents velocities over 5 fps. Use with caution.

SDR-51   80 PSI   PLASTIC IRRIGATION PIPE (PIP)

ANSI/ASAE S376.2   C=150   Water Temerature 73° F

PSI Loss per 100 Feet of Pipe

Nominal Size	6"		8"		10"		12"		15"		18"		21"		24"	
Avg. ID	5.880		7.820		9.776		11.730		14.658		17.917		21.123		23.763	
Pipe OD	6.140		8.160		10.200		12.240		15.300		18.701		22.047		24.803	
Avg.Wall	0.130		0.170		0.212		0.255		0.321		0.392		0.462		0.520	
Min.Wall	0.120		0.160		0.200		0.240		0.300		0.366		0.432		0.486	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.30	0.00	0.17	0.00	0.11	0.00	0.07	0.00	0.05	0.00						
50	0.59	0.01	0.33	0.00	0.21	0.00	0.15	0.00	0.09	0.00	0.06	0.00				
75	0.89	0.02	0.50	0.01	0.32	0.00	0.22	0.00	0.14	0.00	0.10	0.00				
100	1.18	0.04	0.67	0.01	0.43	0.00	0.30	0.00	0.19	0.00	0.13	0.00	0.09	0.00	0.07	0.00
125	1.48	0.06	0.83	0.01	0.53	0.00	0.37	0.00	0.24	0.00	0.16	0.00	0.11	0.00	0.09	0.00
150	1.77	0.08	1.00	0.02	0.64	0.01	0.44	0.00	0.28	0.00	0.19	0.00	0.14	0.00	0.11	0.00
175	2.07	0.11	1.17	0.03	0.75	0.01	0.52	0.00	0.33	0.00	0.22	0.00	0.16	0.00	0.13	0.00
200	2.36	0.14	1.33	0.04	0.85	0.01	0.59	0.00	0.38	0.00	0.25	0.00	0.18	0.00	0.14	0.00
225	2.66	0.17	1.50	0.04	0.96	0.01	0.67	0.01	0.43	0.00	0.29	0.00	0.21	0.00	0.16	0.00
250	2.95	0.21	1.67	0.05	1.07	0.02	0.74	0.01	0.47	0.00	0.32	0.00	0.23	0.00	0.18	0.00
275	3.25	0.25	1.83	0.06	1.17	0.02	0.82	0.01	0.52	0.00	0.35	0.00	0.25	0.00	0.20	0.00
300	3.54	0.30	2.00	0.07	1.28	0.03	0.89	0.01	0.57	0.00	0.38	0.00	0.27	0.00	0.22	0.00
325	3.84	0.34	2.17	0.09	1.39	0.03	0.96	0.01	0.62	0.00	0.41	0.00	0.30	0.00	0.23	0.00
350	4.13	0.40	2.34	0.10	1.49	0.03	1.04	0.01	0.66	0.00	0.44	0.00	0.32	0.00	0.25	0.00
375	4.43	0.45	2.50	0.11	1.60	0.04	1.11	0.02	0.71	0.01	0.48	0.00	0.34	0.00	0.27	0.00
400	4.72	0.51	2.67	0.13	1.71	0.04	1.19	0.02	0.76	0.01	0.51	0.00	0.37	0.00	0.29	0.00
425	5.02	0.57	2.84	0.14	1.81	0.05	1.26	0.02	0.81	0.01	0.54	0.00	0.39	0.00	0.31	0.00
450	5.31	0.63	3.00	0.16	1.92	0.05	1.33	0.02	0.85	0.01	0.57	0.00	0.41	0.00	0.33	0.00
475	5.61	0.70	3.17	0.17	2.03	0.06	1.41	0.02	0.90	0.01	0.60	0.00	0.43	0.00	0.34	0.00
500	5.90	0.77	3.34	0.19	2.13	0.06	1.48	0.03	0.95	0.01	0.64	0.00	0.46	0.00	0.36	0.00
550	6.49	0.91	3.67	0.23	2.35	0.08	1.63	0.03	1.04	0.01	0.70	0.00	0.50	0.00	0.40	0.00
600	7.08	1.07	4.00	0.27	2.56	0.09	1.78	0.04	1.14	0.01	0.76	0.00	0.55	0.00	0.43	0.00
650	7.67	1.24	4.34	0.31	2.77	0.10	1.93	0.04	1.23	0.01	0.83	0.01	0.59	0.00	0.47	0.00
700	8.26	1.43	4.67	0.36	2.99	0.12	2.08	0.05	1.33	0.02	0.89	0.01	0.64	0.00	0.51	0.00
750	8.85	1.62	5.00	0.40	3.20	0.14	2.22	0.06	1.42	0.02	0.95	0.01	0.69	0.00	0.54	0.00
800			5.34	0.46	3.42	0.15	2.37	0.06	1.52	0.02	1.02	0.01	0.73	0.00	0.58	0.00
850			5.67	0.51	3.63	0.17	2.52	0.07	1.61	0.02	1.08	0.01	0.78	0.00	0.61	0.00
900			6.00	0.57	3.84	0.19	2.67	0.08	1.71	0.03	1.14	0.01	0.82	0.00	0.65	0.00
950			6.34	0.63	4.06	0.21	2.82	0.09	1.80	0.03	1.21	0.01	0.87	0.00	0.69	0.00
1000			6.67	0.69	4.27	0.23	2.97	0.10	1.90	0.03	1.27	0.01	0.91	0.01	0.72	0.00
1100			7.34	0.82	4.70	0.28	3.26	0.11	2.09	0.04	1.40	0.01	1.01	0.01	0.79	0.00
1200			8.01	0.97	5.12	0.33	3.56	0.13	2.28	0.05	1.53	0.02	1.10	0.01	0.87	0.00
1300			8.67	1.12	5.55	0.38	3.85	0.16	2.47	0.05	1.65	0.02	1.19	0.01	0.94	0.01
1400			9.34	1.29	5.98	0.43	4.15	0.18	2.66	0.06	1.78	0.02	1.28	0.01	1.01	0.01
1500					6.40	0.49	4.45	0.20	2.85	0.07	1.91	0.03	1.37	0.01	1.08	0.01
1600					6.83	0.56	4.74	0.23	3.04	0.08	2.03	0.03	1.46	0.01	1.16	0.01
1700					7.26	0.62	5.04	0.26	3.23	0.09	2.16	0.03	1.55	0.01	1.23	0.01
1800					7.68	0.69	5.34	0.28	3.42	0.10	2.29	0.04	1.65	0.02	1.30	0.01
1900					8.11	0.76	5.63	0.31	3.61	0.11	2.41	0.04	1.74	0.02	1.37	0.01
2000					8.54	0.84	5.93	0.35	3.80	0.12	2.54	0.04	1.83	0.02	1.45	0.01
2200							6.52	0.41	4.18	0.14	2.80	0.05	2.01	0.02	1.59	0.01
2400							7.12	0.49	4.56	0.16	3.05	0.06	2.19	0.03	1.73	0.02
2600							7.71	0.56	4.94	0.19	3.30	0.07	2.38	0.03	1.88	0.02
2800							8.30	0.65	5.32	0.22	3.56	0.08	2.56	0.04	2.02	0.02
3000							8.90	0.73	5.70	0.25	3.81	0.09	2.74	0.04	2.17	0.02
3200							9.49	0.83	6.08	0.28	4.07	0.11	2.93	0.05	2.31	0.03
3400							10.08	0.93	6.46	0.31	4.32	0.12	3.11	0.05	2.46	0.03
3600							10.67	1.03	6.84	0.35	4.58	0.13	3.29	0.06	2.60	0.03
3800							11.27	1.14	7.22	0.38	4.83	0.14	3.47	0.06	2.75	0.04
4000							11.86	1.25	7.60	0.42	5.08	0.16	3.66	0.07	2.89	0.04
4200									7.98	0.46	5.34	0.17	3.84	0.08	3.03	0.04
4400									8.36	0.50	5.59	0.19	4.02	0.09	3.18	0.05
4600									8.74	0.55	5.85	0.21	4.21	0.09	3.32	0.05
4800									9.11	0.59	6.10	0.22	4.39	0.10	3.47	0.06
5000									9.49	0.64	6.35	0.24	4.57	0.11	3.61	0.06
5200											6.61	0.26	4.76	0.12	3.76	0.07
5400											6.86	0.28	4.94	0.12	3.90	0.07
5600											7.12	0.30	5.12	0.13	4.05	0.08
5800											7.37	0.32	5.30	0.14	4.19	0.08
6000											7.63	0.34	5.49	0.15	4.34	0.09
6200													5.67	0.16	4.48	0.09
6400													5.85	0.17	4.62	0.10
6600													6.04	0.18	4.77	0.10
6800													6.22	0.19	4.91	0.11
7000													6.40	0.20	5.06	0.11

Shaded area represents velocities over 5 fps.
Use with caution.

SDR-41   100 PSI   PLASTIC IRRIGATION PIPE (PIP)

ANSI/ASAE S376.2   C=150   Water Temperature 73˚F

PSI Loss per 100 Feet of Pipe

Size	6"		8"		10"		12"		15"		18"		21"		24"	
Avg. ID	5.820		7.738		9.690		11.606		14.502		17.725		20.915		23.507	
Pipe OD	6.140		8.160		10.200		12.240		15.300		18.701		22.047		24.803	
Avg.Wall	0.160		0.211		0.255		0.317		0.399		0.488		0.566		0.648	
Min.Wall	0.150		0.199		0.240		0.299		0.373		0.456		0.538		0.605	
Flow	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI	Velocity	PSI
GPM	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS	FPS	LOSS
25	0.30	0.00	0.17	0.00	0.11	0.00	0.08	0.00	0.05	0.00						
50	0.60	0.01	0.34	0.00	0.22	0.00	0.15	0.00	0.10	0.00	0.06	0.00				
75	0.90	0.02	0.51	0.01	0.33	0.00	0.23	0.00	0.15	0.00	0.10	0.00				
100	1.20	0.04	0.68	0.01	0.43	0.00	0.30	0.00	0.19	0.00	0.13	0.00	0.09	0.00	0.07	0.00
125	1.51	0.06	0.85	0.02	0.54	0.01	0.38	0.00	0.24	0.00	0.16	0.00	0.12	0.00	0.09	0.00
150	1.81	0.09	1.02	0.02	0.65	0.01	0.45	0.00	0.29	0.00	0.19	0.00	0.14	0.00	0.11	0.00
175	2.11	0.12	1.19	0.03	0.76	0.01	0.53	0.00	0.34	0.00	0.23	0.00	0.16	0.00	0.13	0.00
200	2.41	0.15	1.36	0.04	0.87	0.01	0.61	0.01	0.39	0.00	0.26	0.00	0.19	0.00	0.15	0.00
225	2.71	0.18	1.53	0.05	0.98	0.02	0.68	0.01	0.44	0.00	0.29	0.00	0.21	0.00	0.17	0.00
250	3.01	0.22	1.70	0.06	1.09	0.02	0.76	0.01	0.49	0.00	0.32	0.00	0.23	0.00	0.18	0.00
275	3.31	0.27	1.87	0.07	1.19	0.02	0.83	0.01	0.53	0.00	0.36	0.00	0.26	0.00	0.20	0.00
300	3.61	0.31	2.04	0.08	1.30	0.03	0.91	0.01	0.58	0.00	0.39	0.00	0.28	0.00	0.22	0.00
325	3.91	0.36	2.21	0.09	1.41	0.03	0.98	0.01	0.63	0.00	0.42	0.00	0.30	0.00	0.24	0.00
350	4.22	0.42	2.38	0.10	1.52	0.03	1.06	0.01	0.68	0.00	0.45	0.00	0.33	0.00	0.26	0.00
375	4.52	0.47	2.56	0.12	1.63	0.04	1.14	0.02	0.73	0.01	0.49	0.00	0.35	0.00	0.28	0.00
400	4.82	0.53	2.73	0.13	1.74	0.04	1.21	0.02	0.78	0.01	0.52	0.00	0.37	0.00	0.30	0.00
425	5.12	0.60	2.90	0.15	1.85	0.05	1.29	0.02	0.82	0.01	0.55	0.00	0.40	0.00	0.31	0.00
450	5.42	0.66	3.07	0.17	1.96	0.06	1.36	0.02	0.87	0.01	0.58	0.00	0.42	0.00	0.33	0.00
475	5.72	0.73	3.24	0.18	2.06	0.06	1.44	0.03	0.92	0.01	0.62	0.00	0.44	0.00	0.35	0.00
500	6.02	0.80	3.41	0.20	2.17	0.07	1.51	0.03	0.97	0.01	0.65	0.00	0.47	0.00	0.37	0.00
550	6.62	0.96	3.75	0.24	2.39	0.08	1.67	0.03	1.07	0.01	0.71	0.00	0.51	0.00	0.41	0.00
600	7.23	1.13	4.09	0.28	2.61	0.09	1.82	0.04	1.16	0.01	0.78	0.00	0.56	0.00	0.44	0.00
650	7.83	1.31	4.43	0.33	2.82	0.11	1.97	0.05	1.26	0.02	0.84	0.01	0.61	0.00	0.48	0.00
700	8.43	1.50	4.77	0.38	3.04	0.13	2.12	0.05	1.36	0.02	0.91	0.01	0.65	0.00	0.52	0.00
750	9.03	1.70	5.11	0.43	3.26	0.14	2.27	0.06	1.46	0.02	0.97	0.01	0.70	0.00	0.55	0.00
800			5.45	0.48	3.48	0.16	2.42	0.07	1.55	0.02	1.04	0.01	0.75	0.00	0.59	0.00
850			5.79	0.54	3.69	0.18	2.57	0.07	1.65	0.03	1.10	0.01	0.79	0.00	0.63	0.00
900			6.13	0.60	3.91	0.20	2.73	0.08	1.75	0.03	1.17	0.01	0.84	0.00	0.66	0.00
950			6.47	0.66	4.13	0.22	2.88	0.09	1.84	0.03	1.23	0.01	0.89	0.01	0.70	0.00
1000			6.81	0.73	4.35	0.24	3.03	0.10	1.94	0.03	1.30	0.01	0.93	0.01	0.74	0.00
1100			7.50	0.87	4.78	0.29	3.33	0.12	2.13	0.04	1.43	0.02	1.03	0.01	0.81	0.00
1200			8.18	1.02	5.21	0.34	3.63	0.14	2.33	0.05	1.56	0.02	1.12	0.01	0.89	0.00
1300			8.86	1.18	5.65	0.40	3.94	0.16	2.52	0.06	1.69	0.02	1.21	0.01	0.96	0.01
1400			9.54	1.35	6.08	0.45	4.24	0.19	2.72	0.06	1.82	0.02	1.31	0.01	1.03	0.01
1500					6.52	0.51	4.54	0.21	2.91	0.07	1.95	0.03	1.40	0.01	1.11	0.01
1600					6.95	0.58	4.85	0.24	3.10	0.08	2.08	0.03	1.49	0.01	1.18	0.01
1700					7.39	0.65	5.15	0.27	3.30	0.09	2.21	0.03	1.59	0.02	1.26	0.01
1800					7.82	0.72	5.45	0.30	3.49	0.10	2.34	0.04	1.68	0.02	1.33	0.01
1900					8.26	0.80	5.76	0.33	3.69	0.11	2.47	0.04	1.77	0.02	1.40	0.01
2000					8.69	0.88	6.06	0.36	3.88	0.12	2.60	0.05	1.87	0.02	1.48	0.01
2200							6.66	0.43	4.27	0.15	2.86	0.06	2.05	0.02	1.62	0.01
2400							7.27	0.51	4.66	0.17	3.12	0.07	2.24	0.03	1.77	0.02
2600							7.88	0.59	5.04	0.20	3.38	0.08	2.43	0.03	1.92	0.02
2800							8.48	0.68	5.43	0.23	3.64	0.09	2.61	0.04	2.07	0.02
3000							9.09	0.77	5.82	0.26	3.90	0.10	2.80	0.04	2.22	0.02
3200							9.69	0.87	6.21	0.29	4.16	0.11	2.98	0.05	2.36	0.03
3400							10.30	0.97	6.60	0.33	4.42	0.12	3.17	0.06	2.51	0.03
3600							10.90	1.08	6.98	0.37	4.68	0.14	3.36	0.06	2.66	0.03
3800							11.51	1.20	7.37	0.40	4.93	0.15	3.54	0.07	2.81	0.04
4000							12.12	1.32	7.76	0.45	5.19	0.17	3.73	0.07	2.95	0.04
4200									8.15	0.49	5.45	0.18	3.92	0.08	3.10	0.05
4400									8.54	0.53	5.71	0.20	4.10	0.09	3.25	0.05
4600									8.92	0.58	5.97	0.22	4.29	0.10	3.40	0.05
4800									9.31	0.62	6.23	0.24	4.48	0.11	3.54	0.06
5000									9.70	0.67	6.49	0.25	4.66	0.11	3.69	0.06
5200											6.75	0.27	4.85	0.12	3.84	0.07
5400											7.01	0.29	5.04	0.13	3.99	0.07
5600											7.27	0.31	5.22	0.14	4.13	0.08
5800											7.53	0.33	5.41	0.15	4.28	0.08
6000											7.79	0.36	5.60	0.16	4.43	0.09
6200													5.78	0.17	4.58	0.10
6400													5.97	0.18	4.73	0.10
6600													6.16	0.19	4.87	0.11
6800													6.34	0.20	5.02	0.11
7000													6.53	0.21	5.17	0.12

Shaded area represents velocities over 5 fps.
Use with caution.

SDR-32.5   125 PSI   PLASTIC IRRIGATION PIPE (PIP)

ASAE S376.1   ASTM D2241 or SCS 430-DD   C=150

PSI Loss per 100 Feet of Pipe

Size	6"		8"		10"		12"		15"		18"		21"		24"	
Avg. ID	5.740		7.630		9.530		11.440		14.300		17.480		20.610		23.190	
Pipe OD	6.140		8.160		10.200		12.240		15.300		18.701		22.047		24.803	
Avg. Wall	0.200		0.265		0.335		0.400		0.500		0.611		0.719		0.807	
Min. Wall	0.189		0.251		0.314		0.377		0.471		0.575		0.678		0.763	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
25	0.31	0.00	0.18	0.00	0.11	0.00	0.08	0.00	0.05	0.00						
50	0.62	0.01	0.35	0.00	0.22	0.00	0.16	0.00	0.10	0.00	0.07	0.00				
75	0.93	0.03	0.53	0.01	0.34	0.00	0.23	0.00	0.15	0.00	0.10	0.00				
100	1.24	0.04	0.70	0.01	0.45	0.00	0.31	0.00	0.20	0.00	0.13	0.00	0.10	0.00	0.08	0.00
125	1.55	0.07	0.88	0.02	0.56	0.01	0.39	0.00	0.25	0.00	0.17	0.00	0.12	0.00	0.09	0.00
150	1.86	0.09	1.05	0.02	0.67	0.01	0.47	0.00	0.30	0.00	0.20	0.00	0.14	0.00	0.11	0.00
175	2.17	0.12	1.23	0.03	0.79	0.01	0.55	0.00	0.35	0.00	0.23	0.00	0.17	0.00	0.13	0.00
200	2.48	0.16	1.40	0.04	0.90	0.01	0.62	0.01	0.40	0.00	0.27	0.00	0.19	0.00	0.15	0.00
225	2.79	0.20	1.58	0.05	1.01	0.02	0.70	0.01	0.45	0.00	0.30	0.00	0.22	0.00	0.17	0.00
250	3.10	0.24	1.75	0.06	1.12	0.02	0.78	0.01	0.50	0.00	0.33	0.00	0.24	0.00	0.19	0.00
275	3.41	0.28	1.93	0.07	1.24	0.02	0.86	0.01	0.55	0.00	0.37	0.00	0.26	0.00	0.21	0.00
300	3.71	0.33	2.10	0.08	1.35	0.03	0.94	0.01	0.60	0.00	0.40	0.00	0.29	0.00	0.23	0.00
325	4.02	0.39	2.28	0.10	1.46	0.03	1.01	0.01	0.65	0.00	0.43	0.00	0.31	0.00	0.25	0.00
350	4.33	0.44	2.45	0.11	1.57	0.04	1.09	0.02	0.70	0.01	0.47	0.00	0.34	0.00	0.27	0.00
375	4.64	0.51	2.63	0.13	1.68	0.04	1.17	0.02	0.75	0.01	0.50	0.00	0.36	0.00	0.28	0.00
400	4.95	0.57	2.80	0.14	1.80	0.05	1.25	0.02	0.80	0.01	0.53	0.00	0.38	0.00	0.30	0.00
425	5.26	0.64	2.98	0.16	1.91	0.05	1.32	0.02	0.85	0.01	0.57	0.00	0.41	0.00	0.32	0.00
450	5.57	0.71	3.15	0.18	2.02	0.06	1.40	0.02	0.90	0.01	0.60	0.00	0.43	0.00	0.34	0.00
475	5.88	0.78	3.33	0.20	2.13	0.07	1.48	0.03	0.95	0.01	0.63	0.00	0.46	0.00	0.36	0.00
500	6.19	0.86	3.50	0.22	2.25	0.07	1.56	0.03	1.00	0.01	0.67	0.00	0.48	0.00	0.38	0.00
550	6.81	1.03	3.85	0.26	2.47	0.09	1.71	0.04	1.10	0.01	0.73	0.00	0.53	0.00	0.42	0.00
600	7.43	1.21	4.20	0.30	2.70	0.10	1.87	0.04	1.20	0.01	0.80	0.01	0.58	0.00	0.46	0.00
650	8.05	1.40	4.56	0.35	2.92	0.12	2.03	0.05	1.30	0.02	0.87	0.01	0.62	0.00	0.49	0.00
700	8.67	1.60	4.91	0.40	3.14	0.14	2.18	0.06	1.40	0.02	0.93	0.01	0.67	0.00	0.53	0.00
750	9.29	1.82	5.26	0.46	3.37	0.15	2.34	0.06	1.50	0.02	1.00	0.01	0.72	0.00	0.57	0.00
800			5.61	0.51	3.59	0.17	2.49	0.07	1.60	0.02	1.07	0.01	0.77	0.00	0.61	0.00
850			5.96	0.58	3.82	0.20	2.65	0.08	1.70	0.03	1.14	0.01	0.82	0.00	0.64	0.00
900			6.31	0.64	4.04	0.22	2.81	0.09	1.80	0.03	1.20	0.01	0.86	0.01	0.68	0.00
950			6.66	0.71	4.27	0.24	2.96	0.10	1.90	0.03	1.27	0.01	0.91	0.01	0.72	0.00
1000			7.01	0.78	4.49	0.26	3.12	0.11	2.00	0.04	1.34	0.01	0.96	0.01	0.76	0.00
1100			7.71	0.93	4.94	0.31	3.43	0.13	2.19	0.04	1.47	0.02	1.06	0.01	0.83	0.00
1200			8.41	1.09	5.39	0.37	3.74	0.15	2.39	0.05	1.60	0.02	1.15	0.01	0.91	0.00
1300			9.11	1.26	5.84	0.43	4.05	0.18	2.59	0.06	1.74	0.02	1.25	0.01	0.99	0.01
1400			9.81	1.45	6.29	0.49	4.36	0.20	2.79	0.07	1.87	0.03	1.34	0.01	1.06	0.01
1500					6.74	0.56	4.68	0.23	2.99	0.08	2.00	0.03	1.44	0.01	1.14	0.01
1600					7.19	0.63	4.99	0.26	3.19	0.09	2.14	0.03	1.54	0.01	1.21	0.01
1700					7.64	0.70	5.30	0.29	3.39	0.10	2.27	0.04	1.63	0.02	1.29	0.01
1800					8.09	0.78	5.61	0.32	3.59	0.11	2.40	0.04	1.73	0.02	1.37	0.01
1900					8.54	0.87	5.92	0.36	3.79	0.12	2.54	0.05	1.82	0.02	1.44	0.01
2000					8.98	0.95	6.24	0.39	3.99	0.13	2.67	0.05	1.92	0.02	1.52	0.01
2200							6.86	0.47	4.39	0.16	2.94	0.06	2.11	0.03	1.67	0.01
2400							7.48	0.55	4.79	0.19	3.20	0.07	2.31	0.03	1.82	0.02
2600							8.11	0.64	5.19	0.21	3.47	0.08	2.50	0.04	1.97	0.02
2800							8.73	0.73	5.59	0.25	3.74	0.09	2.69	0.04	2.12	0.02
3000							9.35	0.83	5.99	0.28	4.01	0.11	2.88	0.05	2.28	0.03
3200							9.98	0.93	6.38	0.32	4.27	0.12	3.07	0.05	2.43	0.03
3400							10.60	1.04	6.78	0.35	4.54	0.13	3.27	0.06	2.58	0.03
3600							11.22	1.16	7.18	0.39	4.81	0.15	3.46	0.07	2.73	0.04
3800							11.85	1.28	7.58	0.43	5.07	0.16	3.65	0.07	2.88	0.04
4000							12.47	1.41	7.98	0.48	5.34	0.18	3.84	0.08	3.03	0.05
4200									8.38	0.52	5.61	0.20	4.03	0.09	3.19	0.05
4400									8.78	0.57	5.88	0.21	4.23	0.10	3.34	0.05
4600									9.18	0.62	6.14	0.23	4.42	0.10	3.49	0.06
4800									9.58	0.67	6.41	0.25	4.61	0.11	3.64	0.06
5000									9.98	0.72	6.68	0.27	4.80	0.12	3.79	0.07
5200											6.94	0.29	4.99	0.13	3.95	0.07
5400											7.21	0.31	5.19	0.14	4.10	0.08
5600											7.48	0.33	5.38	0.15	4.25	0.08
5800											7.74	0.36	5.57	0.16	4.40	0.09
6000											8.01	0.38	5.76	0.17	4.55	0.10
6200													5.96	0.18	4.70	0.10
6400													6.15	0.19	4.86	0.11
6600													6.34	0.20	5.01	0.11
6800													6.53	0.22	5.16	0.12
7000													6.72	0.23	5.31	0.13

Shaded area represents velocities over 5 fps. Use with caution.

TYPE 'K' COPPER TUBING

ASTM B88 C=140

PSI Loss per 100 Feet of Pipe

Nominal Size Pipe ID Pipe OD Avg. Wall	1/2" 0.527 0.625 0.049		5/8" 0.652 0.750 0.049		3/4" 0.745 0.875 0.065		1" 0.995 1.125 0.065		1 1/4" 1.245 1.375 0.065		1 1/2" 1.481 1.625 0.072		2" 1.959 2.125 0.083		2 1/2" 2.435 2.625 0.095		3" 2.907 3.125 0.109	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.47	1.09	0.96	0.39	0.74	0.20	0.41	0.05	0.26	0.02								
2	2.94	3.94	1.92	1.40	1.47	0.73	0.82	0.18	0.53	0.06								
3	4.41	8.35	2.88	2.97	2.21	1.55	1.24	0.38	0.79	0.13								
4	5.88	14.23	3.84	5.05	2.94	2.64	1.65	0.65	1.05	0.22								
5	7.35	21.51	4.80	7.64	3.68	3.99	2.06	0.98	1.32	0.33								
6	8.81	30.15	5.76	10.70	4.41	5.59	2.47	1.37	1.58	0.46	1.12	0.20						
7	10.28	40.12	6.72	14.24	5.15	7.44	2.88	1.82	1.84	0.61	1.30	0.26						
8	11.75	51.37	7.68	18.24	5.88	9.53	3.30	2.33	2.11	0.78	1.49	0.34						
9	13.22	63.90	8.64	22.68	6.62	11.85	3.71	2.90	2.37	0.97	1.67	0.42						
10	14.69	77.66	9.60	27.57	7.35	14.41	4.12	3.52	2.63	1.18	1.86	0.51						
12			11.52	38.64	8.82	20.20	4.95	4.94	3.16	1.66	2.23	0.71	1.28	0.18				
14			13.44	51.41	10.29	26.87	5.77	6.57	3.69	2.21	2.60	0.95	1.49	0.24				
16			15.36	65.83	11.76	34.41	6.59	8.42	4.21	2.83	2.98	1.22	1.70	0.31				
18			17.28	81.88	13.23	42.80	7.42	10.47	4.74	3.52	3.35	1.51	1.91	0.39				
20					14.70	52.02	8.24	12.72	5.26	4.28	3.72	1.84	2.13	0.47				
22					16.17	62.06	9.07	15.18	5.79	5.10	4.09	2.19	2.34	0.56	1.51	0.19	1.06	0.08
24					17.64	72.91	9.89	17.84	6.32	5.99	4.46	2.58	2.55	0.66	1.65	0.23	1.16	0.10
26							10.71	20.69	6.84	6.95	4.84	2.99	2.76	0.77	1.79	0.27	1.26	0.11
28							11.54	23.73	7.37	7.97	5.21	3.43	2.98	0.88	1.93	0.30	1.35	0.13
30							12.36	26.96	7.90	9.06	5.58	3.89	3.19	1.00	2.06	0.35	1.45	0.15
32							13.19	30.39	8.42	10.21	5.95	4.39	3.40	1.12	2.20	0.39	1.54	0.16
34							14.01	34.00	8.95	11.42	6.32	4.91	3.61	1.26	2.34	0.44	1.64	0.18
36							14.84	37.79	9.48	12.70	6.70	5.46	3.83	1.40	2.48	0.49	1.74	0.20
38							15.66	41.77	10.00	14.04	7.07	6.03	4.04	1.55	2.61	0.54	1.83	0.23
40							16.48	45.94	10.53	15.43	7.44	6.63	4.25	1.70	2.75	0.59	1.93	0.25
42							17.31	50.28	11.06	16.89	7.81	7.26	4.47	1.86	2.89	0.65	2.03	0.27
44									11.58	18.41	8.18	7.91	4.68	2.03	3.03	0.70	2.12	0.30
46									12.11	19.99	8.56	8.59	4.89	2.20	3.17	0.76	2.22	0.32
48									12.63	21.63	8.93	9.30	5.10	2.38	3.30	0.83	2.32	0.35
50									13.16	23.33	9.30	10.03	5.32	2.57	3.44	0.89	2.41	0.38
55									14.48	27.84	10.23	11.96	5.85	3.07	3.78	1.06	2.66	0.45
60									15.79	32.70	11.16	14.05	6.38	3.60	4.13	1.25	2.90	0.53
65									17.11	37.93	12.09	16.30	6.91	4.18	4.47	1.45	3.14	0.61
70									18.43	43.51	13.02	18.70	7.44	4.79	4.82	1.66	3.38	0.70
75											13.95	21.24	7.97	5.45	5.16	1.89	3.62	0.80
80											14.88	23.94	8.51	6.14	5.50	2.13	3.86	0.90
85											15.81	26.79	9.04	6.87	5.85	2.38	4.10	1.01
90											16.74	29.78	9.57	7.63	6.19	2.65	4.35	1.12
95											17.67	32.91	10.10	8.44	6.54	2.93	4.59	1.24
100											18.60	36.19	10.63	9.28	6.88	3.22	4.83	1.36
110													11.69	11.07	7.57	3.84	5.31	1.62
120													12.76	13.01	8.26	4.51	5.79	1.91
130													13.82	15.08	8.95	5.23	6.28	2.21
140													14.88	17.30	9.63	6.00	6.76	2.54
150													15.95	19.66	10.32	6.82	7.24	2.88
160													17.01	22.16	11.01	7.69	7.72	3.25
170													18.07	24.79	11.70	8.60	8.21	3.63
180															12.39	9.56	8.69	4.04
190															13.07	10.57	9.17	4.46
200															13.76	11.62	9.66	4.91
220															15.14	13.87	10.62	5.86
240															16.51	16.29	11.59	6.88
260															17.89	18.90	12.55	7.98
280															19.27	21.68	13.52	9.15
300																	14.48	10.40
320																	15.45	11.72
340																	16.42	13.11
360																	17.38	14.58
380																	18.35	16.11
400																		
420																		
440																		
460																		
480																		
500																		

Shaded area represents velocities over 7 fps.
Use with caution where water hammer is a concern.

TYPE 'L' COPPER TUBING

ASTM B88   C=140

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
Pipe ID	0.545		0.666		0.785		1.025		1.265		1.505		1.985		2.465		2.945	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg. Wall	0.040		0.042		0.045		0.050		0.055		0.060		0.070		0.080		0.090	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.37	0.93	0.92	0.35	0.66	0.16	0.39	0.04	0.25	0.02								
2	2.75	3.35	1.84	1.26	1.32	0.57	0.78	0.15	0.51	0.06								
3	4.12	7.09	2.76	2.67	1.99	1.20	1.17	0.33	0.76	0.12								
4	5.49	12.09	3.68	4.56	2.65	2.05	1.55	0.56	1.02	0.20								
5	6.87	18.27	4.60	6.89	3.31	3.09	1.94	0.85	1.27	0.30								
6	8.24	25.61	5.52	9.65	3.97	4.34	2.33	1.18	1.53	0.43	1.08	0.18						
7	9.62	34.07	6.44	12.84	4.63	5.77	2.72	1.58	1.78	0.57	1.26	0.24						
8	10.99	43.63	7.36	16.45	5.30	7.39	3.11	2.02	2.04	0.72	1.44	0.31						
9	12.36	54.26	8.28	20.45	5.96	9.19	3.50	2.51	2.29	0.90	1.62	0.39						
10	13.74	65.95	9.20	24.86	6.62	11.17	3.88	3.05	2.55	1.10	1.80	0.47						
12			11.04	34.85	7.95	15.66	4.66	4.28	3.06	1.54	2.16	0.66	1.24	0.17				
14			12.88	46.36	9.27	20.83	5.44	5.69	3.57	2.04	2.52	0.88	1.45	0.23				
16			14.72	59.37	10.59	26.68	6.21	7.28	4.08	2.62	2.88	1.12	1.66	0.29				
18			16.56	73.84	11.92	33.18	6.99	9.06	4.59	3.25	3.24	1.40	1.86	0.36				
20					13.24	40.33	7.77	11.01	5.10	3.96	3.60	1.70	2.07	0.44				
22					14.57	48.11	8.54	13.14	5.61	4.72	3.96	2.03	2.28	0.53	1.48	0.18	1.03	0.08
24					15.89	56.53	9.32	15.44	6.12	5.55	4.32	2.38	2.49	0.62	1.61	0.22	1.13	0.09
26							10.10	17.90	6.63	6.43	4.68	2.76	2.69	0.72	1.75	0.25	1.22	0.11
28							10.87	20.54	7.14	7.38	5.04	3.17	2.90	0.82	1.88	0.29	1.32	0.12
30							11.65	23.33	7.65	8.38	5.40	3.60	3.11	0.94	2.01	0.33	1.41	0.14
32							12.43	26.30	8.16	9.45	5.76	4.06	3.31	1.05	2.15	0.37	1.51	0.15
34							13.20	29.42	8.67	10.57	6.12	4.54	3.52	1.18	2.28	0.41	1.60	0.17
36							13.98	32.71	9.18	11.75	6.48	5.05	3.73	1.31	2.42	0.46	1.69	0.19
38							14.76	36.15	9.69	12.99	6.84	5.58	3.93	1.45	2.55	0.51	1.79	0.21
40							15.53	39.75	10.20	14.28	7.21	6.13	4.14	1.59	2.69	0.56	1.88	0.23
42							16.31	43.51	10.71	15.63	7.57	6.71	4.35	1.75	2.82	0.61	1.98	0.26
44									11.22	17.04	7.93	7.32	4.56	1.90	2.95	0.66	2.07	0.28
46									11.73	18.50	8.29	7.94	4.76	2.07	3.09	0.72	2.16	0.30
48									12.24	20.02	8.65	8.60	4.97	2.24	3.22	0.78	2.26	0.33
50									12.75	21.59	9.01	9.27	5.18	2.41	3.36	0.84	2.35	0.35
55									14.02	25.76	9.91	11.06	5.70	2.88	3.69	1.00	2.59	0.42
60									15.30	30.26	10.81	13.00	6.21	3.38	4.03	1.18	2.82	0.50
65									16.57	35.10	11.71	15.07	6.73	3.92	4.36	1.37	3.06	0.57
70									17.85	40.26	12.61	17.29	7.25	4.50	4.70	1.57	3.29	0.66
75											13.51	19.65	7.77	5.11	5.04	1.78	3.53	0.75
80											14.41	22.14	8.28	5.76	5.37	2.01	3.76	0.84
85											15.31	24.77	8.80	6.44	5.71	2.25	4.00	0.94
90											16.21	27.54	9.32	7.16	6.04	2.50	4.23	1.05
95											17.11	30.44	9.84	7.91	6.38	2.76	4.47	1.16
100											18.01	33.47	10.35	8.70	6.71	3.03	4.70	1.28
110													11.39	10.38	7.39	3.62	5.17	1.52
120													12.43	12.20	8.06	4.25	5.65	1.79
130													13.46	14.15	8.73	4.93	6.12	2.07
140													14.50	16.23	9.40	5.66	6.59	2.38
150													15.53	18.44	10.07	6.43	7.06	2.70
160													16.57	20.78	10.74	7.24	7.53	3.05
170													17.60	23.25	11.41	8.11	8.00	3.41
180															12.09	9.01	8.47	3.79
190															12.76	9.96	8.94	4.19
200															13.43	10.95	9.41	4.61
220															14.77	13.07	10.35	5.50
240															16.12	15.35	11.29	6.46
260															17.46	17.80	12.23	7.49
280															18.80	20.42	13.17	8.59
300																	14.11	9.76
320																	15.05	11.00
340																	15.99	12.31
360																	16.94	13.69
380																	17.88	15.13
400																		
420																		
440																		
460																		
480																		
500																		

Shaded area represents velocities over 7 fps.
Use with caution where water hammer is a concern.

TYPE 'M' COPPER TUBING

ASTM B88   C=140

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		5/8"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"	
Pipe ID	0.569		0.690		0.811		1.055		1.291		1.527		2.009		2.495		2.981	
Pipe OD	0.625		0.750		0.875		1.125		1.375		1.625		2.125		2.625		3.125	
Avg. Wall	0.028		0.030		0.032		0.035		0.042		0.049		0.058		0.065		0.072	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.26	0.75	0.86	0.29	0.62	0.13	0.37	0.04	0.24	0.01								
2	2.52	2.71	1.71	1.06	1.24	0.48	0.73	0.13	0.49	0.05								
3	3.78	5.75	2.57	2.25	1.86	1.03	1.10	0.29	0.73	0.11								
4	5.04	9.80	3.43	3.83	2.48	1.75	1.47	0.49	0.98	0.18								
5	6.30	14.81	4.28	5.80	3.10	2.64	1.83	0.73	1.22	0.27								
6	7.56	20.76	5.14	8.13	3.72	3.70	2.20	1.03	1.47	0.39	1.05	0.17						
7	8.82	27.62	6.00	10.81	4.34	4.92	2.57	1.37	1.71	0.51	1.22	0.23						
8	10.08	35.37	6.86	13.84	4.96	6.31	2.93	1.75	1.96	0.66	1.40	0.29						
9	11.34	44.00	7.71	17.22	5.58	7.84	3.30	2.18	2.20	0.82	1.57	0.36						
10	12.60	53.48	8.57	20.93	6.20	9.53	3.67	2.65	2.45	0.99	1.75	0.44						
12			10.28	29.33	7.44	13.36	4.40	3.72	2.94	1.39	2.10	0.61	1.21	0.16				
14			12.00	39.02	8.68	17.78	5.13	4.94	3.43	1.85	2.45	0.82	1.42	0.22				
16			13.71	49.97	9.93	22.77	5.87	6.33	3.92	2.37	2.80	1.05	1.62	0.28				
18			15.43	62.15	11.17	28.32	6.60	7.87	4.41	2.95	3.15	1.30	1.82	0.34				
20			17.14	75.55	12.41	34.42	7.33	9.57	4.90	3.58	3.50	1.58	2.02	0.42				
22					13.65	41.06	8.06	11.42	5.39	4.28	3.85	1.89	2.22	0.50	1.44	0.17	1.01	0.07
24					14.89	48.24	8.80	13.41	5.88	5.02	4.20	2.22	2.43	0.58	1.57	0.20	1.10	0.09
26							9.53	15.56	6.36	5.83	4.55	2.57	2.63	0.68	1.70	0.24	1.19	0.10
28							10.26	17.85	6.85	6.68	4.90	2.95	2.83	0.78	1.84	0.27	1.29	0.11
30							11.00	20.28	7.34	7.59	5.25	3.35	3.03	0.88	1.97	0.31	1.38	0.13
32							11.73	22.85	7.83	8.56	5.60	3.78	3.23	0.99	2.10	0.35	1.47	0.15
34							12.46	25.57	8.32	9.57	5.95	4.23	3.44	1.11	2.23	0.39	1.56	0.16
36							13.20	28.42	8.81	10.64	6.30	4.70	3.64	1.24	2.36	0.43	1.65	0.18
38							13.93	31.42	9.30	11.76	6.65	5.20	3.84	1.37	2.49	0.48	1.74	0.20
40							14.66	34.55	9.79	12.94	7.00	5.71	4.04	1.50	2.62	0.52	1.84	0.22
42							15.40	37.81	10.28	14.16	7.35	6.26	4.25	1.65	2.75	0.57	1.93	0.24
44									10.77	15.43	7.70	6.82	4.45	1.79	2.88	0.63	2.02	0.26
46									11.26	16.76	8.05	7.40	4.65	1.95	3.01	0.68	2.11	0.29
48									11.75	18.13	8.40	8.01	4.85	2.11	3.15	0.73	2.20	0.31
50									12.24	19.56	8.75	8.64	5.05	2.27	3.28	0.79	2.30	0.33
55									13.46	23.33	9.62	10.31	5.56	2.71	3.60	0.95	2.53	0.40
60									14.69	27.41	10.50	12.11	6.07	3.19	3.93	1.11	2.75	0.47
65									15.91	31.79	11.37	14.04	6.57	3.70	4.26	1.29	2.98	0.54
70									17.14	36.47	12.25	16.11	7.08	4.24	4.59	1.48	3.21	0.62
75											13.12	18.31	7.58	4.82	4.92	1.68	3.44	0.71
80											14.00	20.63	8.09	5.43	5.24	1.89	3.67	0.80
85											14.87	23.08	8.59	6.07	5.57	2.12	3.90	0.89
90											15.75	25.66	9.10	6.75	5.90	2.35	4.13	0.99
95											16.62	28.36	9.60	7.46	6.23	2.60	4.36	1.09
100											17.50	31.19	10.11	8.21	6.55	2.86	4.59	1.20
110													11.12	9.79	7.21	3.41	5.05	1.44
120													12.13	11.51	7.87	4.01	5.51	1.69
130													13.14	13.34	8.52	4.65	5.97	1.96
140													14.15	15.31	9.18	5.33	6.43	2.24
150													15.16	17.39	9.83	6.06	6.89	2.55
160													16.17	19.60	10.49	6.83	7.35	2.87
170													17.18	21.93	11.14	7.64	7.81	3.21
180															11.80	8.50	8.26	3.57
190															12.45	9.39	8.72	3.95
200															13.11	10.33	9.18	4.34
220															14.42	12.32	10.10	5.18
240															15.73	14.47	11.02	6.09
260															17.04	16.79	11.94	7.06
280															18.35	19.25	12.86	8.10
300																	13.77	9.20
320																	14.69	10.37
340																	15.61	11.60
360																	16.53	12.90
380																	17.45	14.26
400																		
420																		
440																		
460																		
480																		
500																		

Shaded area represents velocities over 7 fps.
Use with caution where water hammer is a concern.

SCHEDULE 40 STEEL

ASTM B53   C=100

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
Pipe ID	0.622		0.824		1.049		1.38		1.610		2.067		2.469		3.068		4.026	
Pipe OD	0.842		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500	
Avg. Wall	0.110		0.113		0.133		0.140		0.145		0.154		0.203		0.216		0.237	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.05	0.91	0.60	0.23	0.37	0.07	0.21	0.02	0.16	0.01								
2	2.11	3.28	1.20	0.84	0.74	0.26	0.43	0.07	0.31	0.03								
3	3.16	6.95	1.80	1.77	1.11	0.55	0.64	0.14	0.47	0.07								
4	4.22	11.85	2.40	3.02	1.48	0.93	0.86	0.25	0.63	0.12								
5	5.27	17.91	3.00	4.56	1.85	1.41	1.07	0.37	0.79	0.18								
6	6.33	25.10	3.61	6.39	2.22	1.97	1.29	0.52	0.94	0.25	0.57	0.07						
7	7.38	33.40	4.21	8.50	2.60	2.63	1.50	0.69	1.10	0.33	0.67	0.10						
8	8.44	42.77	4.81	10.88	2.97	3.36	1.71	0.89	1.26	0.42	0.76	0.12						
9	9.49	53.19	5.41	13.54	3.34	4.18	1.93	1.10	1.42	0.52	0.86	0.15						
10	10.55	64.65	6.01	16.45	3.71	5.08	2.14	1.34	1.57	0.63	0.95	0.19						
12	12.65	90.62	7.21	23.06	4.45	7.12	2.57	1.88	1.89	0.89	1.15	0.26	0.80	0.11				
14			8.41	30.68	5.19	9.48	3.00	2.50	2.20	1.18	1.34	0.35	0.94	0.15				
16			9.61	39.29	5.93	12.14	3.43	3.20	2.52	1.51	1.53	0.45	1.07	0.19				
18			10.82	48.87	6.67	15.10	3.86	3.97	2.83	1.88	1.72	0.56	1.20	0.23				
20			12.02	59.40	7.42	18.35	4.28	4.83	3.15	2.28	1.91	0.68	1.34	0.28				
22			13.22	70.87	8.16	21.89	4.71	5.76	3.46	2.72	2.10	0.81	1.47	0.34	0.95	0.12	0.55	0.03
24					8.90	25.72	5.14	6.77	3.78	3.20	2.29	0.95	1.61	0.40	1.04	0.14	0.60	0.04
26					9.64	29.83	5.57	7.85	4.09	3.71	2.48	1.10	1.74	0.46	1.13	0.16	0.65	0.04
28					10.38	34.22	6.00	9.01	4.41	4.25	2.67	1.26	1.87	0.53	1.21	0.18	0.70	0.05
30					11.12	38.88	6.43	10.24	4.72	4.83	2.86	1.43	2.01	0.60	1.30	0.21	0.76	0.06
32					11.86	43.81	6.86	11.54	5.04	5.45	3.06	1.62	2.14	0.68	1.39	0.24	0.81	0.06
34					12.61	49.02	7.28	12.91	5.35	6.10	3.25	1.81	2.28	0.76	1.47	0.26	0.86	0.07
36					13.35	54.49	7.71	14.35	5.67	6.78	3.44	2.01	2.41	0.85	1.56	0.29	0.91	0.08
38							8.14	15.86	5.98	7.49	3.63	2.22	2.54	0.94	1.65	0.33	0.96	0.09
40							8.57	17.44	6.30	8.24	3.82	2.44	2.68	1.03	1.73	0.36	1.01	0.10
42							9.00	19.09	6.61	9.02	4.01	2.67	2.81	1.13	1.82	0.39	1.06	0.10
44							9.43	20.81	6.93	9.83	4.20	2.91	2.94	1.23	1.91	0.43	1.11	0.11
46							9.86	22.59	7.24	10.67	4.39	3.16	3.08	1.33	1.99	0.46	1.16	0.12
48							10.28	24.44	7.56	11.55	4.58	3.42	3.21	1.44	2.08	0.50	1.21	0.13
50							10.71	26.36	7.87	12.45	4.77	3.69	3.35	1.55	2.17	0.54	1.26	0.14
55							11.78	31.45	8.66	14.86	5.25	4.40	3.68	1.85	2.38	0.64	1.38	0.17
60							12.85	36.95	9.44	17.45	5.73	5.17	4.02	2.18	2.60	0.76	1.51	0.20
65							13.93	42.86	10.23	20.24	6.21	6.00	4.35	2.53	2.82	0.88	1.64	0.23
70									11.02	23.22	6.68	6.88	4.69	2.90	3.03	1.01	1.76	0.27
75									11.81	26.39	7.16	7.82	5.02	3.29	3.25	1.14	1.89	0.31
80									12.59	29.74	7.64	8.82	5.35	3.71	3.47	1.29	2.01	0.34
85									13.38	33.27	8.12	9.86	5.69	4.15	3.68	1.44	2.14	0.38
90											8.59	10.96	6.02	4.62	3.90	1.60	2.27	0.43
95											9.07	12.12	6.36	5.10	4.12	1.77	2.39	0.47
100											9.55	13.33	6.69	5.61	4.33	1.95	2.52	0.52
110											10.50	15.90	7.36	6.70	4.77	2.33	2.77	0.62
120											11.46	18.68	8.03	7.87	5.20	2.73	3.02	0.73
130											12.41	21.66	8.70	9.12	5.63	3.17	3.27	0.85
140											13.37	24.85	9.37	10.47	6.07	3.64	3.52	0.97
150													10.04	11.89	6.50	4.13	3.78	1.10
160													10.71	13.40	6.94	4.66	4.03	1.24
170													11.38	15.00	7.37	5.21	4.28	1.39
180													12.05	16.67	7.80	5.79	4.53	1.54
190													12.72	18.43	8.24	6.40	4.78	1.71
200													13.39	20.26	8.67	7.04	5.03	1.88
220															9.54	8.40	5.54	2.24
240															10.40	9.87	6.04	2.63
260															11.27	11.45	6.54	3.05
280															12.14	13.13	7.05	3.50
300															13.00	14.92	7.55	3.98
320															13.87	16.81	8.05	4.48
340																	8.56	5.01
360																	9.06	5.57
380																	9.57	6.16
400																	10.07	6.77
420																	10.57	7.42
440																	11.08	8.08
460																	11.58	8.78
480																	12.08	9.50
500																	12.59	10.24

Shaded area represents velocities over 7 fps.
Use with caution where water hammer is a concern.

SCHEDULE 80 STEEL

ASTM B53   C=100

PSI Loss per 100 Feet of Pipe

Nominal Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"	
Pipe ID	0.546		0.742		0.957		1.278		1.500		1.939		2.323		2.900		3.826	
Pipe OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500	
Avg. Wall	0.147		0.154		0.179		0.191		0.200		0.218		0.276		0.300		0.337	
Flow GPM	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS	Velocity FPS	PSI LOSS
1	1.37	1.71	0.74	0.39	0.45	0.11	0.25	0.03	0.18	0.01								
2	2.74	6.19	1.48	1.39	0.89	0.40	0.50	0.10	0.36	0.05								
3	4.11	13.11	2.22	2.95	1.34	0.85	0.75	0.21	0.54	0.10								
4	5.47	22.34	2.96	5.02	1.78	1.46	1.00	0.36	0.73	0.16								
5	6.84	33.77	3.71	7.59	2.23	2.20	1.25	0.54	0.91	0.25								
6	8.21	47.33	4.45	10.64	2.67	3.08	1.50	0.75	1.09	0.35	0.65	0.10						
7	9.58	62.97	5.19	14.16	3.12	4.10	1.75	1.00	1.27	0.46	0.76	0.13						
8	10.95	80.63	5.93	18.13	3.56	5.26	2.00	1.29	1.45	0.59	0.87	0.17						
9			6.67	22.54	4.01	6.54	2.25	1.60	1.63	0.73	0.98	0.21						
10			7.41	27.40	4.45	7.94	2.50	1.94	1.81	0.89	1.09	0.26						
12			8.89	38.41	5.35	11.14	3.00	2.73	2.18	1.25	1.30	0.36	0.91	0.15				
14			10.37	51.10	6.24	14.81	3.50	3.63	2.54	1.66	1.52	0.48	1.06	0.20				
16			11.86	65.44	7.13	18.97	4.00	4.64	2.90	2.13	1.74	0.61	1.21	0.25				
18			13.34	81.39	8.02	23.60	4.50	5.78	3.26	2.65	1.95	0.76	1.36	0.32				
20					8.91	28.68	5.00	7.02	3.63	3.22	2.17	0.92	1.51	0.38				
22					9.80	34.22	5.50	8.37	3.99	3.84	2.39	1.10	1.66	0.46	1.07	0.16	0.61	0.04
24					10.69	40.20	6.00	9.84	4.35	4.51	2.60	1.29	1.81	0.54	1.16	0.18	0.67	0.05
26					11.58	46.62	6.49	11.41	4.71	5.23	2.82	1.50	1.97	0.62	1.26	0.21	0.72	0.05
28					12.47	53.48	6.99	13.09	5.08	6.00	3.04	1.72	2.12	0.71	1.36	0.24	0.78	0.06
30					13.36	60.77	7.49	14.87	5.44	6.82	3.26	1.96	2.27	0.81	1.46	0.28	0.84	0.07
32							7.99	16.76	5.80	7.69	3.47	2.20	2.42	0.92	1.55	0.31	0.89	0.08
34							8.49	18.75	6.17	8.60	3.69	2.47	2.57	1.02	1.65	0.35	0.95	0.09
36							8.99	20.85	6.53	9.56	3.91	2.74	2.72	1.14	1.75	0.39	1.00	0.10
38							9.49	23.04	6.89	10.57	4.12	3.03	2.87	1.26	1.84	0.43	1.06	0.11
40							9.99	25.34	7.25	11.62	4.34	3.33	3.02	1.38	1.94	0.47	1.11	0.12
42							10.49	27.74	7.62	12.72	4.56	3.65	3.18	1.51	2.04	0.51	1.17	0.13
44							10.99	30.23	7.98	13.87	4.77	3.98	3.33	1.65	2.13	0.56	1.23	0.15
46							11.49	32.83	8.34	15.06	4.99	4.32	3.48	1.79	2.23	0.61	1.28	0.16
48							11.99	35.52	8.70	16.29	5.21	4.67	3.63	1.94	2.33	0.66	1.34	0.17
50							12.49	38.31	9.07	17.57	5.43	5.04	3.78	2.09	2.43	0.71	1.39	0.18
55							13.74	45.70	9.97	20.96	5.97	6.01	4.16	2.50	2.67	0.85	1.53	0.22
60									10.88	24.63	6.51	7.06	4.54	2.93	2.91	1.00	1.67	0.26
65									11.79	28.56	7.05	8.19	4.91	3.40	3.15	1.16	1.81	0.30
70									12.69	32.77	7.60	9.40	5.29	3.90	3.40	1.33	1.95	0.34
75									13.60	37.23	8.14	10.68	5.67	4.43	3.64	1.51	2.09	0.39
80											8.68	12.03	6.05	4.99	3.88	1.70	2.23	0.44
85											9.22	13.46	6.43	5.59	4.12	1.90	2.37	0.49
90											9.77	14.97	6.80	6.21	4.37	2.11	2.51	0.55
95											10.31	16.54	7.18	6.87	4.61	2.33	2.65	0.61
100											10.85	18.19	7.56	7.55	4.85	2.57	2.79	0.67
110											11.94	21.70	8.32	9.01	5.34	3.06	3.07	0.79
120											13.02	25.50	9.07	10.58	5.82	3.60	3.34	0.93
130											14.11	29.57	9.83	12.27	6.31	4.17	3.62	1.08
140													10.58	14.08	6.79	4.78	3.90	1.24
150													11.34	16.00	7.28	5.44	4.18	1.41
160													12.10	18.03	7.76	6.13	4.46	1.59
170													12.85	20.17	8.25	6.85	4.74	1.78
180													13.61	22.43	8.73	7.62	5.02	1.98
190													14.37	24.79	9.22	8.42	5.30	2.19
200															9.70	9.26	5.57	2.40
220															10.67	11.05	6.13	2.87
240															11.64	12.98	6.69	3.37
260															12.61	15.05	7.25	3.91
280															13.58	17.27	7.80	4.48
300															14.55	19.62	8.36	5.10
320																	8.92	5.74
340																	9.48	6.42
360																	10.03	7.14
380																	10.59	7.89
400																	11.15	8.68
420																	11.71	9.50
440																	12.26	10.36
460																	12.82	11.25
480																	13.38	12.17
500																	13.94	13.12

Shaded area represents velocities over 7 fps.
Use with caution where water hammer is a concern.

CAST IRON PIPE – CLASS 150

C=100

Pressure Loss per 100 Feet (PSI)   Sizes 3" through 12"

Nominal Size	3"		4"		6"		8"		10"		12"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	3.32 3.96 0.32		4.10 4.80 0.35		6.14 6.90 0.38		8.23 9.05 0.41		10.22 11.10 0.44		12.24 13.20 0.48		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
5	0.19	0.01	0.12	0.00									5
10	0.37	0.02	0.24	0.01									10
15	0.56	0.04	0.36	0.01									15
20	0.74	0.07	0.49	0.02	0.22	0.00							20
25	0.93	0.10	0.61	0.04	0.27	0.01							25
30	1.11	0.14	0.73	0.05	0.32	0.01							30
40	1.48	0.24	0.97	0.09	0.43	0.01							40
50	1.85	0.37	1.21	0.13	0.54	0.02	0.30	0.00					50
60	2.22	0.52	1.46	0.18	0.65	0.03	0.36	0.01					60
70	2.59	0.69	1.70	0.25	0.76	0.03	0.42	0.01					70
80	2.96	0.88	1.94	0.31	0.87	0.04	0.48	0.01					80
90	3.33	1.09	2.18	0.39	0.97	0.05	0.54	0.01	0.35	0.00			90
100	3.70	1.33	2.43	0.48	1.08	0.07	0.60	0.02	0.39	0.01			100
125	4.63	2.01	3.03	0.72	1.35	0.10	0.75	0.02	0.49	0.01			125
150	5.55	2.81	3.64	1.01	1.62	0.14	0.90	0.03	0.59	0.01	0.41	0.00	150
175	6.48	3.74	4.25	1.34	1.89	0.19	1.05	0.05	0.68	0.02	0.48	0.01	175
200	7.40	4.80	4.85	1.72	2.16	0.24	1.20	0.06	0.78	0.02	0.54	0.01	200
225	8.33	5.96	5.46	2.14	2.44	0.30	1.36	0.07	0.88	0.03	0.61	0.01	225
250	9.25	7.25	6.07	2.60	2.71	0.36	1.51	0.09	0.98	0.03	0.68	0.01	250
275	10.18	8.65	6.67	3.10	2.98	0.43	1.66	0.10	1.07	0.04	0.75	0.02	275
300	11.10	10.16	7.28	3.64	3.25	0.51	1.81	0.12	1.17	0.04	0.82	0.02	300
350	12.96	13.52	8.49	4.84	3.79	0.68	2.11	0.16	1.37	0.06	0.95	0.02	350
400	14.81	17.31	9.71	6.20	4.33	0.87	2.41	0.21	1.56	0.07	1.09	0.03	400
450	16.66	21.53	10.92	7.71	4.87	1.08	2.71	0.26	1.76	0.09	1.23	0.04	450
500	18.51	26.17	12.14	9.37	5.41	1.31	3.01	0.32	1.95	0.11	1.36	0.05	500
550			13.35	11.18	5.95	1.57	3.31	0.38	2.15	0.13	1.50	0.05	550
600			14.56	13.14	6.49	1.84	3.61	0.44	2.34	0.15	1.63	0.06	600
650			15.78	15.24	7.03	2.14	3.92	0.51	2.54	0.18	1.77	0.07	650
700			16.99	17.48	7.58	2.45	4.22	0.59	2.73	0.21	1.91	0.09	700
750			18.20	19.86	8.12	2.78	4.52	0.67	2.93	0.23	2.04	0.10	750
800			19.42	22.38	8.66	3.14	4.82	0.75	3.12	0.26	2.18	0.11	800
900					9.74	3.90	5.42	0.94	3.52	0.33	2.45	0.14	900
1000					10.82	4.74	6.02	1.14	3.91	0.40	2.72	0.17	1000
1100					11.90	5.66	6.63	1.36	4.30	0.47	3.00	0.20	1100
1200					12.99	6.65	7.23	1.60	4.69	0.56	3.27	0.23	1200
1300					14.07	7.71	7.83	1.85	5.08	0.65	3.54	0.27	1300
1400					15.15	8.84	8.43	2.13	5.47	0.74	3.81	0.31	1400
1500					16.23	10.05	9.04	2.42	5.86	0.84	4.08	0.35	1500
1600					17.32	11.32	9.64	2.72	6.25	0.95	4.36	0.39	1600
1700					18.40	12.67	10.24	3.05	6.64	1.06	4.63	0.44	1700
1800					19.48	14.08	10.84	3.39	7.03	1.18	4.90	0.49	1800
2000							12.05	4.11	7.81	1.43	5.45	0.60	2000
2200							13.25	4.91	8.59	1.71	5.99	0.71	2200
2400							14.46	5.77	9.37	2.01	6.54	0.84	2400
2600							15.66	6.69	10.16	2.33	7.08	0.97	2600
2800							16.87	7.67	10.94	2.68	7.63	1.11	2800
3000							18.07	8.72	11.72	3.04	8.17	1.26	3000
3200							19.28	9.83	12.50	3.43	8.71	1.42	3200
3400									13.28	3.83	9.26	1.59	3400
3600									14.06	4.26	9.80	1.77	3600
3800									14.84	4.71	10.35	1.96	3800
4000									15.62	5.18	10.89	2.15	4000
4500									17.58	6.44	12.25	2.68	4500
5000									19.53	7.83	13.62	3.25	5000
5500											14.98	3.88	5500
6000											16.34	4.56	6000
6500											17.70	5.29	6500
7000											19.06	6.07	7000

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

CAST IRON PIPE – CLASS 150

C=100

Pressure Loss per 100 Feet of Pipe (PSI)   Sizes 14" through 24"

Nominal Size	14"		16"		18"		20"		24"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	14.28 15.30 0.51		16.32 17.40 0.54		18.34 19.50 0.58		20.36 21.60 0.62		24.34 25.80 0.73		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
200	0.40	0.00									200
300	0.60	0.01	0.46	0.00							300
400	0.80	0.01	0.61	0.01	0.49	0.00					400
500	1.00	0.02	0.77	0.01	0.61	0.01	0.49	0.00			500
600	1.20	0.03	0.92	0.02	0.73	0.01	0.59	0.01			600
700	1.40	0.04	1.07	0.02	0.85	0.01	0.69	0.01			700
800	1.60	0.05	1.23	0.03	0.97	0.02	0.79	0.01			800
900	1.80	0.06	1.38	0.03	1.09	0.02	0.89	0.01	0.62	0.00	900
1000	2.00	0.08	1.53	0.04	1.21	0.02	0.98	0.01	0.69	0.01	1000
1100	2.20	0.09	1.69	0.05	1.33	0.03	1.08	0.02	0.76	0.01	1100
1200	2.40	0.11	1.84	0.06	1.46	0.03	1.18	0.02	0.83	0.01	1200
1300	2.60	0.13	1.99	0.07	1.58	0.04	1.28	0.02	0.90	0.01	1300
1400	2.80	0.15	2.14	0.08	1.70	0.04	1.38	0.03	0.96	0.01	1400
1500	3.00	0.17	2.30	0.09	1.82	0.05	1.48	0.03	1.03	0.01	1500
1600	3.20	0.19	2.45	0.10	1.94	0.06	1.57	0.03	1.10	0.01	1600
1700	3.40	0.21	2.60	0.11	2.06	0.06	1.67	0.04	1.17	0.02	1700
1800	3.60	0.23	2.76	0.12	2.18	0.07	1.77	0.04	1.24	0.02	1800
1900	3.80	0.26	2.91	0.13	2.30	0.08	1.87	0.05	1.31	0.02	1900
2000	4.00	0.28	3.06	0.15	2.43	0.08	1.97	0.05	1.38	0.02	2000
2250	4.50	0.35	3.45	0.18	2.73	0.10	2.21	0.06	1.55	0.03	2250
2500	5.00	0.43	3.83	0.22	3.03	0.13	2.46	0.08	1.72	0.03	2500
2750	5.50	0.51	4.21	0.27	3.34	0.15	2.71	0.09	1.89	0.04	2750
3000	6.00	0.60	4.60	0.31	3.64	0.18	2.95	0.11	2.07	0.04	3000
3250	6.50	0.69	4.98	0.36	3.94	0.20	3.20	0.12	2.24	0.05	3250
3500	7.00	0.79	5.36	0.41	4.25	0.24	3.44	0.14	2.41	0.06	3500
3750	7.50	0.90	5.74	0.47	4.55	0.27	3.69	0.16	2.58	0.07	3750
4000	8.00	1.02	6.13	0.53	4.85	0.30	3.94	0.18	2.75	0.08	4000
4250	8.50	1.14	6.51	0.59	5.16	0.34	4.18	0.20	2.93	0.08	4250
4500	9.00	1.26	6.89	0.66	5.46	0.37	4.43	0.23	3.10	0.09	4500
4750	9.50	1.40	7.28	0.73	5.76	0.41	4.68	0.25	3.27	0.10	4750
5000	10.00	1.54	7.66	0.80	6.07	0.45	4.92	0.27	3.44	0.11	5000
5250	10.50	1.68	8.04	0.88	6.37	0.50	5.17	0.30	3.62	0.13	5250
5500	11.00	1.83	8.43	0.96	6.67	0.54	5.41	0.33	3.79	0.14	5500
5750	11.50	1.99	8.81	1.04	6.97	0.59	5.66	0.35	3.96	0.15	5750
6000	12.00	2.15	9.19	1.13	7.28	0.64	5.91	0.38	4.13	0.16	6000
6500	13.01	2.50	9.96	1.30	7.88	0.74	6.40	0.44	4.48	0.19	6500
7000	14.01	2.87	10.72	1.50	8.49	0.85	6.89	0.51	4.82	0.21	7000
7500	15.01	3.26	11.49	1.70	9.10	0.96	7.38	0.58	5.17	0.24	7500
8000	16.01	3.67	12.25	1.92	9.70	1.09	7.87	0.65	5.51	0.27	8000
8500	17.01	4.11	13.02	2.14	10.31	1.22	8.37	0.73	5.85	0.31	8500
9000	18.01	4.57	13.79	2.38	10.92	1.35	8.86	0.81	6.20	0.34	9000
10000			15.32	2.90	12.13	1.64	9.84	0.99	6.89	0.41	10000
11000			16.85	3.46	13.34	1.96	10.83	1.18	7.58	0.49	11000
12000			18.38	4.06	14.56	2.30	11.81	1.38	8.26	0.58	12000
13000			19.91	4.71	15.77	2.67	12.80	1.61	8.95	0.67	13000
14000					16.98	3.06	13.78	1.84	9.64	0.77	14000
15000					18.20	3.48	14.76	2.09	10.33	0.88	15000
16000					19.41	3.92	15.75	2.36	11.02	0.99	16000
17000							16.73	2.64	11.71	1.11	17000
18000							17.72	2.93	12.40	1.23	18000
19000							18.70	3.24	13.08	1.36	19000
20000							19.68	3.57	13.77	1.50	20000
21000									14.46	1.64	21000
22000									15.15	1.78	22000
23000									15.84	1.94	23000
24000									16.53	2.10	24000
25000									17.22	2.26	25000
26000									17.91	2.43	26000
27000									18.59	2.61	27000
28000									19.28	2.79	28000
29000									19.97	2.98	29000

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

CLASS 150 ASBESTOS-CEMENT

K = 0.32

Pressure Loss per 100 Feet of Pipe (PSI)   Sizes 3"through 14"

Nominal Size	3"		4"		6"		8"		10"		12"		14"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	3.00 4.03 0.515		3.95 5.15 0.600		5.85 7.13 0.640		7.85 9.45 0.800		10.00 11.85 0.925		12.00 14.12 0.106		14.00 16.40 1.200		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
2	0.09	0.00													2
4	0.18	0.01													4
6	0.27	0.01	0.16	0.00											6
8	0.36	0.02	0.21	0.01											8
10	0.45	0.03	0.26	0.01											10
15	0.68	0.07	0.39	0.02											15
20	0.91	0.12	0.52	0.03	0.24	0.00									20
25	1.13	0.19	0.65	0.05	0.30	0.01									25
30	1.36	0.26	0.78	0.07	0.36	0.01									30
35	1.59	0.35	0.92	0.09	0.42	0.01									35
40	1.81	0.46	1.05	0.12	0.48	0.02	0.26	0.00							40
50	2.27	0.70	1.31	0.18	0.60	0.03	0.33	0.01							50
60	2.72	0.98	1.57	0.26	0.72	0.04	0.40	0.01							60
70	3.17	1.32	1.83	0.34	0.83	0.05	0.46	0.01							70
80	3.63	1.70	2.09	0.44	0.95	0.06	0.53	0.01	0.33	0.00					80
90	4.08	2.13	2.35	0.55	1.07	0.08	0.60	0.02	0.37	0.01					90
100	4.53	2.60	2.61	0.67	1.19	0.10	0.66	0.02	0.41	0.01					100
110	4.99	3.11	2.88	0.81	1.31	0.12	0.73	0.03	0.45	0.01					110
120	5.44	3.67	3.14	0.95	1.43	0.14	0.79	0.03	0.49	0.01					120
130	5.89	4.28	3.40	1.11	1.55	0.16	0.86	0.04	0.53	0.01	0.37	0.00			130
140	6.35	4.92	3.66	1.28	1.67	0.19	0.93	0.04	0.57	0.01	0.40	0.01			140
160	7.25	6.35	4.18	1.65	1.91	0.24	1.06	0.06	0.65	0.02	0.45	0.01			160
180	8.16	7.94	4.71	2.06	2.15	0.30	1.19	0.07	0.73	0.19	0.51	0.01	0.37	0.00	180
200	9.07	9.70	5.23	2.52	2.38	0.37	1.32	0.09	0.82	0.03	0.57	0.01	0.42	0.01	200
220	9.97	11.62	5.75	3.02	2.62	0.44	1.46	0.10	0.90	0.03	0.62	0.01	0.46	0.01	220
240	10.88	13.71	6.28	3.56	2.86	0.52	1.59	0.12	0.98	0.04	0.68	0.02	0.50	0.01	240
260	11.79	15.96	6.80	4.15	3.10	0.61	1.72	0.14	1.06	0.04	0.74	0.02	0.54	0.01	260
280	12.69	18.37	7.32	4.77	3.34	0.70	1.85	0.16	1.14	0.05	0.79	0.02	0.58	0.01	280
300	13.60	20.95	7.84	5.44	3.58	0.79	1.99	0.19	1.22	0.06	0.85	0.02	0.62	0.01	300
350	15.87	28.08	9.15	7.29	4.17	1.06	2.32	0.25	1.43	0.08	0.99	0.03	0.73	0.01	350
400	18.13	36.18	10.46	9.40	4.77	1.37	2.65	0.32	1.63	0.10	1.13	0.04	0.83	0.02	400
450			11.77	11.76	5.36	1.72	2.98	0.41	1.84	0.12	1.28	0.05	0.94	0.02	450
500			13.07	14.36	5.96	2.10	3.31	0.50	2.04	0.15	1.42	0.06	1.04	0.03	500
550			14.38	17.21	6.56	2.51	3.64	0.59	2.24	0.18	1.56	0.07	1.14	0.03	550
600			15.69	20.31	7.15	2.96	3.97	0.70	2.45	0.21	1.70	0.09	1.25	0.04	600
650			17.00	23.64	7.75	3.45	4.30	0.82	2.65	0.25	1.84	0.10	1.35	0.05	650
700			18.30	27.22	8.35	3.97	4.63	0.94	2.86	0.29	1.98	0.12	1.46	0.06	700
750			19.61	31.03	8.94	4.53	4.97	1.07	3.06	0.33	2.13	0.13	1.56	0.06	750
800					9.54	5.12	5.30	1.21	3.26	0.37	2.27	0.15	1.67	0.07	800
900					10.73	6.40	5.96	1.52	3.67	0.46	2.55	0.19	1.87	0.09	900
1000					11.92	7.82	6.62	1.85	4.08	0.57	2.83	0.23	2.08	0.11	1000
1100					13.11	9.38	7.28	2.22	4.49	0.68	3.12	0.28	2.29	0.13	1100
1200					14.31	11.06	7.95	2.62	4.90	0.80	3.40	0.33	2.50	0.15	1200
1300					15.50	12.88	8.61	3.05	5.30	0.93	3.68	0.38	2.71	0.18	1300
1400					16.69	14.83	9.27	3.51	5.71	1.07	3.97	0.44	2.91	0.21	1400
1500					17.88	16.90	9.93	4.00	6.12	1.22	4.25	0.50	3.12	0.23	1500
1600					19.08	19.11	10.59	4.52	6.53	1.38	4.53	0.57	3.33	0.27	1600
1700							11.26	5.08	6.94	1.55	4.82	0.63	3.54	0.30	1700
1800							11.92	5.66	7.34	1.73	5.10	0.71	3.75	0.33	1800
1900							12.58	6.27	7.75	1.91	5.38	0.78	3.96	0.37	1900
2000							13.24	6.91	8.16	2.11	5.67	0.86	4.16	0.41	2000
2200							14.57	8.28	8.98	2.53	6.23	1.04	4.58	0.49	2200
2400							15.89	9.77	9.79	2.98	6.80	1.22	5.00	0.57	2400
2600							17.21	11.38	10.61	3.47	7.37	1.42	5.41	0.67	2600
2800							18.54	13.10	11.42	4.00	7.93	1.64	5.83	0.77	2800
3000							19.86	14.93	12.24	4.56	8.50	1.87	6.24	0.88	3000
3500									14.28	6.11	9.92	2.50	7.29	1.18	3500
4000									16.32	7.88	11.33	3.22	8.33	1.51	4000
4500									18.36	9.85	12.75	4.03	9.37	1.89	4500
5000											14.17	4.93	10.41	2.31	5000
5500											15.58	5.90	11.45	2.77	5500
6500											18.42	8.11	13.53	3.81	6500
7500													15.61	5.00	7500
8500													17.69	6.34	8500
9500													19.78	7.84	9500

Friction losses calculated using the Scobey Formula.

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

CLASS 150 ASBESTOS-CEMENT

K = 0.32

Pressure Loss per 100 Feet of Pipe (PSI) Sizes 15" through 24"

Nominal Size	15"		16"		18		20"		21"		24"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	15.00 17.91 1.455		16.00 18.65 1.325		18.00 21.21 1.605		20.00 23.55 1.775		21.00 24.94 1.990		24.00 28.21 2.105		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
200	0.36	0.00	0.32	0.00									200
300	0.54	0.01	0.48	0.01	0.38	0.00							300
400	0.73	0.01	0.64	0.01	0.50	0.01	0.41	0.00					400
500	0.91	0.02	0.80	0.02	0.63	0.01	0.51	0.01	0.46	0.00			500
600	1.09	0.03	0.96	0.02	0.76	0.01	0.61	0.01	0.56	0.01			600
700	1.27	0.04	1.12	0.03	0.88	0.02	0.71	0.01	0.65	0.01	0.50	0.00	700
800	1.45	0.05	1.28	0.04	1.01	0.02	0.82	0.01	0.74	0.01	0.57	0.01	800
900	1.63	0.06	1.43	0.05	1.13	0.03	0.92	0.02	0.83	0.01	0.64	0.01	900
1000	1.81	0.08	1.59	0.06	1.26	0.03	1.02	0.02	0.93	0.01	0.71	0.01	1000
1200	2.18	0.11	1.91	0.06	1.51	0.04	1.22	0.03	1.11	0.02	0.85	0.01	1200
1400	2.54	0.15	2.23	0.11	1.76	0.06	1.43	0.04	1.30	0.03	0.99	0.01	1400
1600	2.90	0.19	2.55	0.14	2.01	0.08	1.63	0.05	1.48	0.04	1.13	0.02	1600
1800	3.26	0.24	2.87	0.17	2.27	0.10	1.84	0.06	1.67	0.05	1.28	0.02	1800
2000	3.63	0.29	3.19	0.21	2.52	0.12	2.04	0.07	1.85	0.06	1.42	0.03	2000
2200	3.99	0.35	3.51	0.21	2.77	0.14	2.24	0.08	2.04	0.07	1.56	0.03	2200
2400	4.35	0.41	3.83	0.30	3.02	0.17	2.45	0.10	2.22	0.08	1.70	0.04	2400
2600	4.71	0.48	4.14	0.35	3.27	0.20	2.65	0.12	2.41	0.09	1.84	0.05	2600
2800	5.08	0.55	4.46	0.40	3.53	0.22	2.86	0.13	2.59	0.11	1.98	0.05	2800
3000	5.44	0.63	4.78	0.46	3.78	0.26	3.06	0.15	2.78	0.12	2.13	0.06	3000
3200	5.80	0.71	5.10	0.46	4.03	0.29	3.26	0.17	2.96	0.14	2.27	0.07	3200
3400	6.17	0.79	5.42	0.58	4.28	0.32	3.47	0.19	3.15	0.15	2.41	0.08	3400
3600	6.53	0.88	5.74	0.64	4.53	0.36	3.67	0.22	3.33	0.17	2.55	0.09	3600
3800	6.89	0.98	6.06	0.71	4.79	0.40	3.88	0.24	3.52	0.19	2.69	0.10	3800
4000	7.25	1.08	6.38	0.79	5.04	0.44	4.08	0.26	3.70	0.21	2.83	0.11	4000
4500	8.16	1.35	7.17	0.79	5.67	0.55	4.59	0.33	4.16	0.26	3.19	0.14	4500
5000	9.07	1.65	7.97	1.20	6.30	0.68	5.10	0.40	4.63	0.32	3.54	0.17	5000
5500	9.97	1.98	8.77	1.44	6.93	0.81	5.61	0.48	5.09	0.38	3.90	0.20	5500
6000	10.88	2.33	9.56	1.70	7.56	0.96	6.12	0.57	5.55	0.45	4.25	0.23	6000
6500	11.79	2.72	10.36	1.98	8.19	1.11	6.63	0.66	6.01	0.52	4.60	0.27	6500
7000	12.69	3.13	11.16	1.98	8.81	1.28	7.14	0.76	6.48	0.60	4.96	0.31	7000
7500	13.60	3.57	11.95	2.60	9.44	1.46	7.65	0.87	6.94	0.69	5.31	0.36	7500
8000	14.51	4.03	12.75	2.94	10.07	1.65	8.16	0.98	7.40	0.78	5.67	0.40	8000
8500	15.41	4.52	13.55	3.30	10.70	1.85	8.67	1.10	7.86	0.87	6.02	0.45	8500
9000	16.32	5.04	14.34	3.68	11.33	2.06	9.18	1.23	8.33	0.97	6.38	0.50	9000
9500	17.23	5.59	15.14	3.68	11.96	2.29	9.69	1.36	8.79	1.07	6.73	0.56	9500
10000	18.13	6.16	15.94	4.49	12.59	2.52	10.20	1.50	9.25	1.18	7.08	0.62	10000
10500	19.04	6.76	16.73	4.93	13.22	2.77	10.71	1.65	9.71	1.30	7.44	0.68	10500
11000	19.95	7.38	17.53	5.38	13.85	3.02	11.22	1.80	10.18	1.42	7.79	0.74	11000
11500			18.33	5.86	14.48	3.29	11.73	1.96	10.64	1.55	8.15	0.80	11500
12000			19.13	5.86	15.11	3.57	12.24	2.13	11.10	1.68	8.50	0.87	12000
12500			19.92	6.86	15.74	3.85	12.75	2.30	11.56	1.81	8.85	0.94	12500
13000					16.37	4.15	13.26	2.48	12.03	1.95	9.21	1.01	13000
13500					17.00	4.46	13.77	2.66	12.49	2.10	9.56	1.09	13500
14000					17.63	4.78	14.28	2.85	12.95	2.25	9.92	1.17	14000
14500					18.26	5.11	14.79	3.05	13.41	2.40	10.27	1.25	14500
15000					18.89	5.45	15.30	3.25	13.88	2.56	10.63	1.33	15000
15500					19.52	5.80	15.81	3.46	14.34	2.72	10.98	1.42	15500
16000							16.32	3.68	14.80	2.89	11.33	1.50	16000
16500							16.83	3.90	15.27	3.07	11.69	1.59	16500
17000							17.34	4.12	15.73	3.25	12.04	1.69	17000
17500							17.85	4.36	16.19	3.43	12.40	1.78	17500
18000							18.36	4.60	16.65	3.62	12.75	1.88	18000
18500							18.87	4.84	17.12	3.81	13.10	1.98	18500
19000							19.38	5.09	17.58	4.01	13.46	2.08	19000
19500							19.89	5.35	18.04	4.21	13.81	2.19	19500
20000									18.50	4.42	14.17	2.30	20000
21000									19.43	4.85	14.88	2.52	21000
22000											15.58	2.75	22000
23000											16.29	3.00	23000
24000											17.00	3.25	24000
25000											17.71	3.51	25000
26000											18.42	3.78	26000
27000											19.13	4.06	27000
28000											19.83	4.36	28000

Friction losses calculated using the Scobey Formula.

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

PORTABLE ALUMINUM PIPE WITH COUPLINGS

K = 0.40

Pressure Loss per 100 Feet of Pipe (PSI)   Sizes 3" through 10"

Nominal Size	3"		4"		6"		7"		8"		10"		Nominal Size
Pipe ID Pipe O.D. Wall Thick	2.91 3.00 0.045		3.91 4.00 0.045		5.88 6.00 0.060		6.87 7.00 0.065		7.86 8.00 0.070		9.82 10.00 0.090		Pipe ID Pipe O.D. Wall Thick
Flow GPM	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Velocity FPS	PSI Loss	Flow GPM
5	0.24	0.01	0.13	0.00									5
10	0.48	0.04	0.27	0.01									10
15	0.72	0.08	0.40	0.02									15
20	0.96	0.14	0.53	0.03	0.24	0.00							20
25	1.20	0.22	0.67	0.03	0.29	0.01							25
30	1.44	0.30	0.80	0.07	0.35	0.01	0.26	0.00					30
35	1.68	0.41	0.94	0.10	0.41	0.01	0.30	0.01					35
40	1.92	0.53	1.07	0.13	0.47	0.02	0.35	0.01	0.26	0.00			40
45	2.16	0.66	1.20	0.16	0.53	0.02	0.39	0.01	0.30	0.01			45
50	2.40	0.80	1.34	0.16	0.59	0.03	0.43	0.01	0.33	0.01			50
60	2.88	1.13	1.60	0.27	0.71	0.04	0.52	0.02	0.40	0.01			60
70	3.36	1.52	1.87	0.36	0.82	0.05	0.60	0.02	0.46	0.01	0.30	0.00	70
80	3.84	1.96	2.14	0.47	0.94	0.06	0.69	0.03	0.53	0.02	0.34	0.01	80
90	4.32	2.45	2.41	0.58	1.06	0.08	0.78	0.04	0.59	0.02	0.38	0.01	90
100	4.80	3.00	2.67	0.58	1.18	0.10	0.86	0.04	0.66	0.02	0.42	0.01	100
110	5.29	3.59	2.94	0.85	1.30	0.11	0.95	0.05	0.73	0.03	0.47	0.01	110
120	5.77	4.24	3.21	1.01	1.41	0.14	1.04	0.06	0.79	0.03	0.51	0.01	120
130	6.25	4.93	3.48	1.17	1.53	0.16	1.12	0.07	0.86	0.04	0.55	0.01	130
140	6.73	5.68	3.74	1.35	1.65	0.18	1.21	0.08	0.93	0.04	0.59	0.01	140
150	7.21	6.47	4.01	1.35	1.77	0.21	1.30	0.10	0.99	0.05	0.63	0.02	150
160	7.69	7.32	4.28	1.74	1.89	0.23	1.38	0.11	1.06	0.06	0.68	0.02	160
170	8.17	8.21	4.55	1.95	2.00	0.26	1.47	0.12	1.12	0.06	0.72	0.02	170
180	8.65	9.15	4.81	2.18	2.12	0.29	1.56	0.14	1.19	0.07	0.76	0.02	180
190	9.13	10.14	5.08	2.41	2.24	0.32	1.64	0.15	1.26	0.08	0.80	0.03	190
200	9.61	11.18	5.35	2.41	2.36	0.36	1.73	0.17	1.32	0.09	0.85	0.03	200
225	10.81	13.98	6.02	3.33	2.65	0.45	1.94	0.21	1.49	0.11	0.95	0.04	225
250	12.01	17.08	6.69	4.07	2.95	0.55	2.16	0.26	1.65	0.13	1.06	0.04	250
275	13.21	20.48	7.35	4.87	3.24	0.65	2.38	0.31	1.82	0.16	1.16	0.05	275
300	14.41	24.16	8.02	5.75	3.54	0.77	2.59	0.36	1.98	0.19	1.27	0.06	300
325	15.62	28.12	8.69	5.75	3.83	0.90	2.81	0.42	2.15	0.22	1.38	0.07	325
350	16.82	32.38	9.36	7.70	4.12	1.03	3.02	0.48	2.31	0.25	1.48	0.08	350
375	18.02	36.91	10.03	8.78	4.42	1.18	3.24	0.55	2.48	0.29	1.59	0.10	375
400	19.22	41.73	10.70	9.93	4.71	1.33	3.46	0.62	2.64	0.32	1.69	0.11	400
425			11.37	11.14	5.01	1.50	3.67	0.70	2.81	0.36	1.80	0.12	425
450			12.03	11.14	5.30	1.67	3.89	0.78	2.97	0.40	1.90	0.14	450
475			12.70	13.76	5.60	1.85	4.10	0.86	3.14	0.45	2.01	0.15	475
500			13.37	15.17	5.89	2.04	4.32	0.95	3.31	0.49	2.12	0.17	500
550			14.71	18.18	6.48	2.44	4.75	1.14	3.64	0.59	2.33	0.20	550
600			16.05	21.45	7.07	2.88	5.18	1.35	3.97	0.70	2.54	0.23	600
650			17.38	21.45	7.66	3.35	5.62	1.57	4.30	0.81	2.75	0.27	650
700			18.72	28.75	8.25	3.86	6.05	1.81	4.63	0.94	2.96	0.31	700
750					8.84	4.40	6.48	2.06	4.96	1.07	3.17	0.36	750
800					9.43	4.98	6.91	2.33	5.29	1.21	3.39	0.41	800
850					10.02	5.58	7.34	2.61	5.62	1.35	3.60	0.45	850
900					10.61	6.23	7.78	2.91	5.95	1.51	3.81	0.51	900
1000					11.78	7.61	8.64	3.55	6.61	1.85	4.23	0.62	1000
1100					12.96	9.11	9.50	4.26	7.27	2.21	4.66	0.74	1100
1200					14.14	10.75	10.37	5.03	7.93	2.61	5.08	0.88	1200
1300					15.32	12.52	11.23	5.85	8.59	3.04	5.50	1.02	1300
1400					16.50	14.41	12.10	6.74	9.26	3.50	5.93	1.17	1400
1500					17.68	16.43	12.96	7.68	9.92	3.99	6.35	1.34	1500
1600					18.86	18.58	13.82	8.68	10.58	4.51	6.77	1.51	1600
1700							14.69	9.74	11.24	5.06	7.20	1.70	1700
1800							15.55	10.86	11.90	5.64	7.62	1.89	1800
1900							16.42	12.03	12.56	6.25	8.04	2.10	1900
2000							17.28	13.27	13.22	6.89	8.47	2.31	2000
2250							19.44	16.59	14.87	8.61	9.52	2.89	2250
2500									16.53	10.52	10.58	3.53	2500
2750									18.18	12.61	11.64	4.23	2750
3000									19.83	14.88	12.70	4.99	3000
3250											13.76	5.81	3250
3500											14.81	6.69	3500
3750											15.87	7.63	3750
4000											16.93	8.62	4000
4250											17.99	9.67	4250

Friction losses calculated using the Scobey Formula.

Shaded area represents velocities over 5 fps. Use with caution where water hammer is a concern.

AUSTRALIAN STANDARD PVC PN 6 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 100 mm through 375 mm

Nominal Size	100 mm		150 mm		200 mm		225 mm		250 mm		300 mm		375 mm		Nominal Size	
Pipe ID / Pipe O.D. / Wall Thick	107.8 / 114.3 / 3.25		151.3 / 160.3 / 4.50		213.8 / 225.3 / 5.25		236.4 / 250.4 / 7.00		266.2 / 280.4 / 7.10		299.5 / 315.5 / 8.00		380.3 / 400.5 / 10.10		Pipe ID / Pipe O.D. / Wall Thick	
Flow L/min	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Flow Cu. M/ Hr	Flow L/ sec
100	0.18	0.00													6.0	1.67
125	0.23	0.01													7.5	2.08
150	0.27	0.01													9.0	2.50
175	0.32	0.01													10.5	2.92
200	0.36	0.01													12.0	3.33
225	0.41	0.02													13.5	3.75
250	0.46	0.02													15.0	4.17
275	0.50	0.02	0.25	0.00											16.5	4.58
300	0.55	0.03	0.28	0.01											18.0	5.00
325	0.59	0.03	0.30	0.01											19.5	5.42
350	0.64	0.04	0.32	0.01											21.0	5.83
375	0.68	0.04	0.35	0.01											22.5	6.25
400	0.73	0.05	0.37	0.01											24.0	6.67
475	0.87	0.07	0.44	0.01											28.5	7.92
500	0.91	0.07	0.46	0.01											30.0	8.33
550	1.00	0.09	0.51	0.02											33.0	9.17
600	1.09	0.10	0.56	0.02											36.0	10.0
650	1.19	0.12	0.60	0.02											39.0	10.8
700	1.28	0.13	0.65	0.03	0.32	0.00									42.0	11.7
750	1.37	0.15	0.69	0.03	0.35	0.01									45.0	12.5
800	1.46	0.17	0.74	0.03	0.37	0.01									48.0	13.3
900	1.64	0.21	0.83	0.04	0.42	0.01	0.34	0.00							54.0	15.0
1000	1.82	0.26	0.93	0.05	0.46	0.01	0.38	0.01							60.0	16.7
1100	2.01	0.31	1.02	0.06	0.51	0.01	0.41	0.01							66.0	18.3
1200	2.19	0.36	1.11	0.07	0.56	0.01	0.45	0.01	0.36	0.00					72.0	20.0
1300	2.37	0.42	1.20	0.08	0.60	0.02	0.49	0.01	0.39	0.01					78.0	21.7
1400	2.55	0.48	1.30	0.09	0.65	0.02	0.53	0.01	0.42	0.01					84.0	23.3
1500	2.74	0.55	1.39	0.11	0.70	0.02	0.56	0.01	0.45	0.01					90.0	25.0
1600	2.92	0.62	1.48	0.12	0.74	0.02	0.60	0.01	0.48	0.01	0.38	0.00			96.0	26.7
1800	3.28	0.77	1.67	0.15	0.83	0.03	0.68	0.02	0.54	0.01	0.43	0.01			108	30.0
2000	3.65	0.94	1.85	0.18	0.93	0.03	0.75	0.02	0.60	0.01	0.47	0.01			120	33.3
2200	4.01	1.12	2.04	0.21	1.02	0.04	0.83	0.02	0.66	0.01	0.52	0.01			132	36.7
2400	4.38	1.31	2.22	0.25	1.11	0.05	0.90	0.03	0.72	0.02	0.57	0.01			144	40.0
2600	4.74	1.52	2.41	0.29	1.21	0.05	0.98	0.03	0.78	0.02	0.61	0.01			156	43.3
2800	5.11	1.75	2.59	0.34	1.30	0.06	1.05	0.04	0.84	0.02	0.66	0.01			168	46.7
3000	5.47	1.98	2.78	0.38	1.39	0.07	1.13	0.04	0.90	0.02	0.71	0.01	0.44	0.00	180	50.0
3500			3.24	0.51	1.62	0.09	1.31	0.06	1.05	0.03	0.83	0.02	0.51	0.01	210	58.3
4000			3.70	0.65	1.85	0.12	1.50	0.07	1.20	0.04	0.95	0.02	0.59	0.01	240	66.7
4500			4.17	0.81	2.09	0.15	1.69	0.09	1.35	0.05	1.06	0.03	0.66	0.01	270	75.0
5000			4.63	0.98	2.32	0.18	1.88	0.11	1.50	0.06	1.18	0.04	0.73	0.01	300	83.3
5500			5.09	1.17	2.55	0.22	2.06	0.13	1.65	0.07	1.30	0.04	0.81	0.01	330	91.7
6000			5.56	1.38	2.78	0.26	2.25	0.15	1.79	0.09	1.42	0.05	0.88	0.02	360	100.0
6500					3.01	0.30	2.44	0.18	1.94	0.10	1.54	0.06	0.95	0.02	390	108.3
7000					3.25	0.34	2.63	0.20	2.09	0.12	1.65	0.07	1.03	0.02	420	116.7
7500					3.48	0.39	2.81	0.23	2.24	0.13	1.77	0.07	1.10	0.02	450	125.0
8000					3.71	0.44	3.00	0.26	2.39	0.15	1.89	0.08	1.17	0.03	480	133.3
8500					3.94	0.49	3.19	0.29	2.54	0.17	2.01	0.09	1.25	0.03	510	141.7
9000					4.17	0.54	3.38	0.32	2.69	0.19	2.13	0.11	1.32	0.03	540	150.0
9500					4.41	0.60	3.56	0.36	2.84	0.21	2.24	0.12	1.39	0.04	570	158.3
10000					4.64	0.66	3.75	0.39	2.99	0.23	2.36	0.13	1.47	0.04	600	166.7
11000					5.10	0.79	4.13	0.47	3.29	0.27	2.60	0.15	1.61	0.05	660	183.3
12000					5.56	0.92	4.50	0.55	3.59	0.32	2.84	0.18	1.76	0.06	720	200.0
13000							4.88	0.64	3.89	0.37	3.07	0.21	1.91	0.06	780	216.7
14000							5.25	0.73	4.19	0.42	3.31	0.24	2.05	0.07	840	233.3
15000							5.63	0.83	4.49	0.48	3.54	0.27	2.20	0.08	900	250.0
16000							6.00	0.94	4.79	0.54	3.78	0.31	2.34	0.10	960	266.7
17000									5.08	0.61	4.02	0.34	2.49	0.11	1020	283.3
18000									5.38	0.67	4.25	0.38	2.64	0.12	1080	300.0
19000									5.68	0.74	4.49	0.42	2.78	0.13	1140	316.7
20000									5.98	0.82	4.73	0.46	2.93	0.14	1200	333.3
22000											5.20	0.55	3.22	0.17	1320	366.7
24000											5.67	0.65	3.52	0.20	1440	400.0
26000													3.81	0.23	1560	433.3
28000													4.10	0.27	1680	466.7
30000													4.40	0.31	1800	500.0
32000													4.69	0.34	1920	533.3
34000													4.98	0.39	2040	566.7
36000													5.28	0.43	2160	600.0
38000													5.57	0.47	2280	633.3
40000													5.86	0.52	2400	666.7

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

AUSTRALIAN STANDARD PVC PN 9 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 25 mm through 80 mm

Nominal Size Pipe ID Pipe OD Wall Thick	25 mm 30.5 33.5 1.50		32 mm 38.4 42.2 1.90		40 mm 44.0 48.2 2.10		50 mm 55.1 60.3 2.60		80 mm 81.3 88.9 3.80		Nominal Size Pipe ID Pipe OD Wall Thick	
Flow L/min	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Flow Cu. M/Hr	Flow L/sec
4	0.09	0.00									0.24	0.07
5	0.11	0.01									0.30	0.08
6	0.14	0.01									0.36	0.10
7	0.16	0.01	0.10	0.00							0.42	0.12
8	0.18	0.02	0.11	0.01							0.48	0.13
9	0.21	0.02	0.13	0.01							0.54	0.15
10	0.23	0.02	0.14	0.01	0.11	0.00					0.60	0.17
12	0.27	0.03	0.17	0.01	0.13	0.01					0.72	0.20
14	0.32	0.04	0.20	0.01	0.15	0.01					0.84	0.23
15	0.34	0.05	0.21	0.02	0.16	0.01					0.90	0.25
16	0.36	0.06	0.23	0.02	0.17	0.01					0.96	0.27
18	0.41	0.07	0.26	0.02	0.20	0.01					1.08	0.30
20	0.46	0.09	0.29	0.03	0.22	0.01	0.14	0.00			1.20	0.33
22	0.50	0.10	0.31	0.03	0.24	0.02	0.15	0.01			1.32	0.37
24	0.55	0.12	0.34	0.04	0.26	0.02	0.17	0.01			1.44	0.40
26	0.59	0.14	0.37	0.05	0.28	0.02	0.18	0.01			1.56	0.43
28	0.64	0.16	0.40	0.05	0.31	0.03	0.19	0.01			1.68	0.47
30	0.68	0.18	0.43	0.06	0.33	0.03	0.21	0.01			1.80	0.50
32	0.73	0.21	0.46	0.07	0.35	0.03	0.22	0.01			1.92	0.53
34	0.77	0.23	0.49	0.07	0.37	0.04	0.24	0.01			2.04	0.57
36	0.82	0.26	0.51	0.08	0.39	0.04	0.25	0.01			2.16	0.60
38	0.87	0.28	0.54	0.09	0.41	0.05	0.26	0.02			2.28	0.63
40	0.91	0.31	0.57	0.10	0.44	0.05	0.28	0.02			2.40	0.67
42	0.96	0.34	0.60	0.11	0.46	0.06	0.29	0.02			2.52	0.70
44	1.00	0.37	0.63	0.12	0.48	0.06	0.31	0.02			2.64	0.73
46	1.05	0.40	0.66	0.13	0.50	0.07	0.32	0.02			2.76	0.77
48	1.09	0.44	0.69	0.14	0.52	0.07	0.33	0.02			2.88	0.80
50	1.14	0.47	0.71	0.15	0.54	0.08	0.35	0.03			3.00	0.83
55	1.25	0.56	0.79	0.18	0.60	0.09	0.38	0.03	0.18	0.00	3.30	0.92
60	1.37	0.66	0.86	0.21	0.65	0.11	0.42	0.04	0.19	0.01	3.60	1.00
65	1.48	0.76	0.93	0.25	0.71	0.13	0.45	0.04	0.21	0.01	3.90	1.08
70	1.59	0.88	1.00	0.28	0.76	0.15	0.49	0.05	0.22	0.01	4.20	1.17
75	1.71	1.00	1.07	0.32	0.82	0.17	0.52	0.06	0.24	0.01	4.50	1.25
80	1.82	1.12	1.14	0.36	0.87	0.19	0.56	0.06	0.26	0.01	4.80	1.33
85	1.94	1.26	1.22	0.40	0.93	0.21	0.59	0.07	0.27	0.01	5.10	1.42
90	2.05	1.40	1.29	0.45	0.98	0.23	0.63	0.08	0.29	0.01	5.40	1.50
95	2.16	1.54	1.36	0.50	1.04	0.26	0.66	0.09	0.30	0.01	5.70	1.58
100	2.28	1.70	1.43	0.55	1.09	0.28	0.70	0.09	0.32	0.01	6.00	1.67
110	2.51	2.03	1.57	0.65	1.20	0.34	0.77	0.11	0.35	0.02	6.60	1.83
120	2.73	2.38	1.72	0.77	1.31	0.40	0.83	0.13	0.38	0.02	7.20	2.00
130	2.96	2.76	1.86	0.89	1.42	0.46	0.90	0.15	0.42	0.02	7.80	2.17
140	3.19	3.17	2.00	1.02	1.53	0.53	0.97	0.18	0.45	0.03	8.40	2.33
150	3.42	3.60	2.14	1.16	1.63	0.60	1.04	0.20	0.48	0.03	9.00	2.50
175	3.99	4.79	2.50	1.54	1.91	0.80	1.22	0.27	0.56	0.04	10.5	2.92
200	4.56	6.13	2.86	1.97	2.18	1.02	1.39	0.34	0.64	0.05	12.0	3.33
225	5.13	7.62	3.22	2.45	2.45	1.27	1.57	0.43	0.72	0.06	13.5	3.75
250	5.70	9.27	3.57	2.98	2.72	1.54	1.74	0.52	0.80	0.08	15.0	4.17
275			3.93	3.56	3.00	1.84	1.91	0.62	0.88	0.09	16.5	4.58
300			4.29	4.18	3.27	2.16	2.09	0.72	0.96	0.11	18.0	5.00
325			4.65	4.85	3.54	2.50	2.26	0.84	1.04	0.13	19.5	5.42
350			5.00	5.56	3.81	2.87	2.43	0.96	1.12	0.15	21.0	5.83
375			5.36	6.32	4.09	3.26	2.61	1.09	1.20	0.17	22.5	6.25
400			5.72	7.12	4.36	3.68	2.78	1.23	1.28	0.19	24.0	6.67
450					4.90	4.58	3.13	1.53	1.44	0.23	27.0	7.50
500					5.45	5.56	3.48	1.87	1.60	0.28	30.0	8.33
550					5.99	6.64	3.83	2.23	1.76	0.34	33.0	9.17
600							4.17	2.61	1.92	0.40	36.0	10.0
650							4.52	3.03	2.08	0.46	39.0	10.8
700							4.87	3.48	2.24	0.53	42.0	11.7
750							5.22	3.95	2.41	0.60	45.0	12.5
800							5.56	4.45	2.57	0.68	48.0	13.3
900									2.89	0.84	54.0	15.0
1000									3.21	1.02	60.0	16.7
1100									3.53	1.22	66.0	18.3
1200									3.85	1.43	72.0	20.0
1300									4.17	1.66	78.0	21.7
1400									4.49	1.91	84.0	23.3
1500									4.81	2.17	90.0	25.0
1600									5.13	2.44	96.0	26.7
1700									5.45	2.73	102.0	28.3

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

AUSTRALIAN STANDARD PVC PN 9 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 100 mm through 375 mm

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

Nominal Size / Flow L/min	100 mm 104.7 / 114.3 / 4.8 Velocity MPS	Bars/100 M Loss	150 mm 146.9 / 160.3 / 6.7 Velocity MPS	Bars/100 M Loss	200 mm 208.5 / 225.3 / 8.4 Velocity MPS	Bars/100 M Loss	225 mm 231.7 / 250.4 / 9.3 Velocity MPS	Bars/100 M Loss	250 mm 259.4 / 280.4 / 10.5 Velocity MPS	Bars/100 M Loss	300 mm 292.0 / 315.5 / 11.7 Velocity MPS	Bars/100 M Loss	375 mm 370.7 / 400.5 / 14.9 Velocity MPS	Bars/100 M Loss	Flow Cu. M/Hr	Flow L/sec
100	0.19	0.00													6.0	1.67
125	0.24	0.01													7.5	2.08
150	0.29	0.01													9.0	2.50
175	0.34	0.01													10.5	2.92
200	0.39	0.02													12.0	3.33
225	0.44	0.02													13.5	3.75
250	0.48	0.02	0.25	0.00											15.0	4.17
275	0.53	0.03	0.27	0.01											16.5	4.58
300	0.58	0.03	0.29	0.01											18.0	5.00
325	0.63	0.04	0.32	0.01											19.5	5.42
350	0.68	0.04	0.34	0.01											21.0	5.83
375	0.73	0.05	0.37	0.01											22.5	6.25
400	0.77	0.06	0.39	0.01											24.0	6.67
475	0.92	0.08	0.47	0.01											28.5	7.92
500	0.97	0.08	0.49	0.02											30.0	8.33
550	1.07	0.10	0.54	0.02											33.0	9.17
600	1.16	0.12	0.59	0.02											36.0	10.0
650	1.26	0.14	0.64	0.03	0.32	0.00									39.0	10.8
700	1.36	0.16	0.69	0.03	0.34	0.01									42.0	11.7
750	1.45	0.18	0.74	0.03	0.37	0.01									45.0	12.5
800	1.55	0.20	0.79	0.04	0.39	0.01									48.0	13.3
850	1.65	0.22	0.83	0.04	0.41	0.01	0.34	0.00							51.0	14.2
900	1.74	0.25	0.88	0.05	0.44	0.01	0.36	0.01							54.0	15.0
950	1.84	0.27	0.93	0.05	0.46	0.01	0.38	0.01							57.0	15.8
1000	1.94	0.30	0.98	0.06	0.49	0.01	0.39	0.01							60.0	16.7
1100	2.13	0.36	1.08	0.07	0.54	0.01	0.43	0.01	0.35	0.00					66.0	18.3
1200	2.32	0.42	1.18	0.08	0.59	0.01	0.47	0.01	0.38	0.01					72.0	20.0
1300	2.52	0.49	1.28	0.09	0.63	0.02	0.51	0.01	0.41	0.01					78.0	21.7
1400	2.71	0.56	1.38	0.11	0.68	0.02	0.55	0.01	0.44	0.01					84.0	23.3
1500	2.91	0.64	1.47	0.12	0.73	0.02	0.59	0.01	0.47	0.01					90.0	25.0
1600	3.10	0.72	1.57	0.14	0.78	0.02	0.63	0.01	0.50	0.01	0.40	0.00			96.0	26.7
1700	3.29	0.80	1.67	0.15	0.83	0.03	0.67	0.02	0.54	0.01	0.42	0.01			102	28.3
1800	3.49	0.89	1.77	0.17	0.88	0.03	0.71	0.02	0.57	0.01	0.45	0.01			108	30.0
1900	3.68	0.99	1.87	0.19	0.93	0.03	0.75	0.02	0.60	0.01	0.47	0.01			114	31.7
2000	3.87	1.08	1.96	0.21	0.98	0.04	0.79	0.02	0.63	0.01	0.50	0.01			120	33.3
2200	4.26	1.29	2.16	0.25	1.07	0.05	0.87	0.03	0.69	0.02	0.55	0.01			132	36.7
2400	4.65	1.52	2.36	0.29	1.17	0.05	0.95	0.03	0.76	0.02	0.60	0.01			144	40.0
2600	5.04	1.76	2.55	0.34	1.27	0.06	1.03	0.04	0.82	0.02	0.65	0.01			156	43.3
2800	5.42	2.02	2.75	0.39	1.37	0.07	1.11	0.04	0.88	0.02	0.70	0.01			168	46.7
3000	5.81	2.30	2.95	0.44	1.46	0.08	1.18	0.05	0.94	0.03	0.75	0.02	0.46	0.00	180	50.0
3200			3.14	0.50	1.56	0.09	1.26	0.05	1.01	0.03	0.80	0.02	0.49	0.01	192	53.3
3400			3.34	0.55	1.66	0.10	1.34	0.06	1.07	0.03	0.85	0.02	0.52	0.01	204	56.7
3600			3.54	0.62	1.76	0.11	1.42	0.07	1.13	0.04	0.89	0.02	0.56	0.01	216	60.0
3800			3.73	0.68	1.85	0.12	1.50	0.07	1.20	0.04	0.94	0.02	0.59	0.01	228	63.3
4000			3.93	0.75	1.95	0.14	1.58	0.08	1.26	0.05	0.99	0.03	0.62	0.01	240	66.7
4500			4.42	0.93	2.19	0.17	1.78	0.10	1.42	0.06	1.12	0.03	0.69	0.01	270	75.0
5000			4.91	1.13	2.44	0.21	1.97	0.12	1.57	0.07	1.24	0.04	0.77	0.01	300	83.3
5500			5.40	1.35	2.68	0.25	2.17	0.15	1.73	0.08	1.37	0.05	0.85	0.01	330	91.7
6000			5.89	1.59	2.93	0.29	2.37	0.17	1.89	0.10	1.49	0.06	0.93	0.02	360	100.0
6500					3.17	0.34	2.57	0.20	2.05	0.12	1.62	0.07	1.00	0.02	390	108.3
7000					3.41	0.38	2.76	0.23	2.20	0.13	1.74	0.07	1.08	0.02	420	116.7
8000					3.90	0.49	3.16	0.29	2.52	0.17	1.99	0.10	1.23	0.03	480	133.3
9000					4.39	0.61	3.55	0.37	2.83	0.21	2.24	0.12	1.39	0.04	540	150.0
10000					4.88	0.74	3.95	0.45	3.15	0.26	2.49	0.14	1.54	0.05	600	166.7
11000					5.36	0.89	4.34	0.53	3.46	0.31	2.73	0.17	1.70	0.05	660	183.3
12000					5.85	1.04	4.74	0.62	3.78	0.36	2.98	0.20	1.85	0.06	720	200.0
14000							5.53	0.83	4.41	0.48	3.48	0.27	2.16	0.08	840	233.3
16000									5.04	0.61	3.98	0.35	2.47	0.11	960	266.7
18000									5.67	0.76	4.47	0.43	2.78	0.13	1080	300.0
20000											4.97	0.52	3.08	0.16	1200	333.3
22000											5.47	0.62	3.39	0.19	1320	366.7
26000													4.01	0.27	1560	433.3
30000													4.63	0.35	1800	500.0
34000													5.24	0.44	2040	566.7
38000													5.86	0.54	2280	633.3

AUSTRALIAN STANDARD PVC PN 12 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 20 mm through 80 mm

Nominal Size Pipe ID Pipe O.D. Wall Thick	20 mm 23.7 26.7 1.5		25 mm 29.7 33.5 1.9		32 mm 37.4 42.2 2.4		40 mm 42.8 48.2 2.7		50 mm 53.7 60.3 3.3		80 mm 79.1 88.9 4.9		Nominal Size Pipe ID Pipe OD Wall Thick	
Flow L/min	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Velocity MPS	Bars/ 100 M Loss	Flow Cu. M/Hr	Flow L/sec
1													0.06	0.02
2	0.08	0.00											0.12	0.03
3	0.11	0.01											0.18	0.05
4	0.15	0.01	0.10	0.00									0.24	0.07
5	0.19	0.02	0.12	0.01									0.30	0.08
6	0.23	0.03	0.14	0.01									0.36	0.10
7	0.26	0.04	0.17	0.01	0.11	0.00							0.42	0.12
8	0.30	0.05	0.19	0.02	0.12	0.01							0.48	0.13
9	0.34	0.07	0.21	0.02	0.14	0.01							0.54	0.15
10	0.38	0.08	0.24	0.03	0.15	0.01	0.12	0.00					0.60	0.17
12	0.45	0.11	0.29	0.04	0.18	0.01	0.14	0.01					0.72	0.20
14	0.53	0.15	0.33	0.05	0.21	0.02	0.16	0.01					0.84	0.23
16	0.60	0.19	0.38	0.06	0.24	0.02	0.19	0.01					0.96	0.27
18	0.68	0.24	0.43	0.08	0.27	0.03	0.21	0.01	0.13	0.00			1.08	0.30
20	0.75	0.29	0.48	0.10	0.30	0.03	0.23	0.02	0.15	0.01			1.20	0.33
22	0.83	0.35	0.53	0.12	0.33	0.04	0.25	0.02	0.16	0.01			1.32	0.37
24	0.91	0.41	0.57	0.14	0.36	0.04	0.28	0.02	0.18	0.01			1.44	0.40
26	0.98	0.48	0.62	0.16	0.39	0.05	0.30	0.03	0.19	0.01			1.56	0.43
28	1.06	0.55	0.67	0.18	0.42	0.06	0.32	0.03	0.21	0.01			1.68	0.47
30	1.13	0.62	0.72	0.20	0.45	0.07	0.35	0.04	0.22	0.01			1.80	0.50
32	1.21	0.70	0.76	0.23	0.48	0.08	0.37	0.04	0.24	0.01			1.92	0.53
34	1.28	0.79	0.81	0.26	0.51	0.08	0.39	0.04	0.25	0.01			2.04	0.57
36	1.36	0.87	0.86	0.29	0.54	0.09	0.42	0.05	0.26	0.02			2.16	0.60
38	1.43	0.97	0.91	0.32	0.57	0.10	0.44	0.05	0.28	0.02			2.28	0.63
40	1.51	1.06	0.95	0.35	0.60	0.11	0.46	0.06	0.29	0.02			2.40	0.67
42	1.58	1.16	1.00	0.38	0.63	0.12	0.49	0.07	0.31	0.02			2.52	0.70
44	1.66	1.27	1.05	0.42	0.66	0.14	0.51	0.07	0.32	0.02			2.64	0.73
46	1.74	1.38	1.10	0.45	0.69	0.15	0.53	0.08	0.34	0.03			2.76	0.77
48	1.81	1.49	1.15	0.49	0.72	0.16	0.56	0.08	0.35	0.03			2.88	0.80
50	1.89	1.61	1.19	0.53	0.75	0.17	0.58	0.09	0.37	0.03	0.17	0.00	3.00	0.83
55	2.08	1.92	1.31	0.63	0.83	0.21	0.64	0.11	0.40	0.04	0.19	0.01	3.30	0.92
60	2.26	2.25	1.43	0.74	0.90	0.24	0.69	0.13	0.44	0.02	0.20	0.01	3.60	1.00
65	2.45	2.61	1.55	0.86	0.98	0.28	0.75	0.15	0.48	0.05	0.22	0.01	3.90	1.08
70	2.64	2.99	1.67	0.98	1.06	0.32	0.81	0.17	0.51	0.06	0.24	0.01	4.20	1.17
75	2.83	3.40	1.79	1.12	1.13	0.36	0.87	0.19	0.55	0.06	0.25	0.01	4.50	1.25
80	3.02	3.83	1.91	1.26	1.21	0.41	0.93	0.22	0.59	0.07	0.27	0.01	4.80	1.33
85	3.21	4.29	2.03	1.41	1.28	0.46	0.98	0.24	0.62	0.08	0.29	0.01	5.10	1.42
90	3.40	4.77	2.15	1.56	1.36	0.51	1.04	0.27	0.66	0.09	0.31	0.01	5.40	1.50
95	3.58	5.27	2.27	1.73	1.43	0.57	1.10	0.30	0.70	0.10	0.32	0.02	5.70	1.58
100	3.77	5.79	2.39	1.90	1.51	0.62	1.16	0.33	0.74	0.11	0.34	0.02	6.00	1.67
110	4.15	6.91	2.63	2.27	1.66	0.74	1.27	0.39	0.81	0.13	0.37	0.02	6.60	1.83
120	4.53	8.12	2.86	2.66	1.81	0.87	1.39	0.46	0.88	0.15	0.41	0.02	7.20	2.00
130	4.91	9.42	3.10	3.09	1.96	1.01	1.50	0.53	0.96	0.18	0.44	0.03	7.80	2.17
140	5.28	10.81	3.34	3.55	2.11	1.16	1.62	0.61	1.03	0.20	0.48	0.03	8.40	2.33
150	5.66	12.28	3.58	4.03	2.26	1.32	1.74	0.69	1.10	0.23	0.51	0.04	9.00	2.50
175			4.18	5.36	2.64	1.75	2.02	0.92	1.29	0.31	0.59	0.05	10.5	2.92
200			4.77	6.86	3.01	2.24	2.31	1.18	1.47	0.39	0.68	0.06	12.0	3.33
225			5.37	8.54	3.39	2.79	2.60	1.47	1.65	0.49	0.76	0.07	13.5	3.75
250			5.97	10.38	3.77	3.39	2.89	1.78	1.84	0.59	0.85	0.09	15.0	4.17
275					4.14	4.05	3.18	2.13	2.02	0.70	0.93	0.11	16.5	4.58
300					4.52	4.75	3.47	2.50	2.21	0.83	1.02	0.13	18.0	5.00
325					4.90	5.51	3.76	2.90	2.39	0.96	1.10	0.15	19.5	5.42
350					5.28	6.32	4.05	3.32	2.57	1.10	1.19	0.17	21.0	5.83
375					5.65	7.19	4.34	3.78	2.76	1.25	1.27	0.19	22.5	6.25
400							4.63	4.26	2.94	1.41	1.36	0.22	24.0	6.67
450							5.21	5.29	3.31	1.75	1.53	0.27	27.0	7.50
500							5.79	6.43	3.68	2.13	1.70	0.33	30.0	8.33
550									4.04	2.54	1.87	0.39	33.0	9.17
600									4.41	2.99	2.04	0.46	36.0	10.0
650									4.78	3.47	2.21	0.53	39.0	10.8
700									5.15	3.98	2.38	0.61	42.0	11.7
750									5.51	4.52	2.55	0.69	45.0	12.5
800									5.88	5.09	2.72	0.78	48.0	13.3
900											3.06	0.97	54.0	15.0
1000											3.40	1.18	60.0	16.7
1100											3.74	1.40	66.0	18.3
1200											4.08	1.65	72.0	20.0
1300											4.42	1.91	78.0	21.7
1400											4.75	2.19	84.0	23.3
1600											5.43	2.81	96.0	26.7

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

AUSTRALIAN STANDARD PVC PN 12 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 100 mm through 375 mm

Shaded area represents velocities over 1.5 MPS. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

Nominal Size Flow L/min	100 mm 101.7 / 114.3 / 6.3 Velocity MPS	Bars/100 M Loss	150 mm 142.7 / 160.3 / 8.8 Velocity MPS	Bars/100 M Loss	200 mm 203.1 / 225.3 / 11.1 Velocity MPS	Bars/100 M Loss	225 mm 225.8 / 250.4 / 12.3 Velocity MPS	Bars/100 M Loss	250 mm 252.9 / 280.4 / 13.7 Velocity MPS	Bars/100 M Loss	300 mm 284.5 / 315.5 / 15.5 Velocity MPS	Bars/100 M Loss	375 mm 361.2 / 400.5 / 19.7 Velocity MPS	Bars/100 M Loss	Flow Cu. M/Hr	Flow L/sec
100	0.20	0.00													6.0	1.67
125	0.26	0.01													7.5	2.08
150	0.31	0.01													9.0	2.50
175	0.36	0.01													10.5	2.92
200	0.41	0.02													12.0	3.33
225	0.46	0.02	0.23	0.00											13.5	3.75
250	0.51	0.03	0.26	0.01											15.0	4.17
275	0.56	0.03	0.29	0.01											16.5	4.58
300	0.61	0.04	0.31	0.01											18.0	5.00
325	0.67	0.04	0.34	0.01											19.5	5.42
350	0.72	0.05	0.36	0.01											21.0	5.83
375	0.77	0.06	0.39	0.01											22.5	6.25
400	0.82	0.06	0.42	0.01											24.0	6.67
475	0.97	0.09	0.49	0.02											28.5	7.92
500	1.02	0.10	0.52	0.02											30.0	8.33
550	1.13	0.11	0.57	0.02											33.0	9.17
600	1.23	0.13	0.62	0.03	0.31	0.00									36.0	10.0
650	1.33	0.16	0.68	0.03	0.33	0.01									39.0	10.8
700	1.43	0.18	0.73	0.03	0.36	0.01									42.0	11.7
750	1.54	0.20	0.78	0.04	0.39	0.01									45.0	12.5
800	1.64	0.23	0.83	0.04	0.41	0.01	0.33	0.00							48.0	13.3
900	1.84	0.28	0.94	0.05	0.46	0.01	0.37	0.01							54.0	15.0
1000	2.05	0.34	1.04	0.07	0.51	0.01	0.42	0.01							60.0	16.7
1100	2.25	0.41	1.14	0.08	0.57	0.01	0.46	0.01	0.36	0.00					66.0	18.3
1200	2.46	0.48	1.25	0.09	0.62	0.02	0.50	0.01	0.40	0.01					72.0	20.0
1400	2.87	0.64	1.46	0.12	0.72	0.02	0.58	0.01	0.46	0.01	0.37	0.00			84.0	23.3
1600	3.28	0.82	1.67	0.16	0.82	0.03	0.67	0.02	0.53	0.01	0.42	0.01			96.0	26.7
1800	3.69	1.02	1.87	0.20	0.92	0.04	0.75	0.02	0.60	0.01	0.47	0.01			108.0	30.0
2000	4.10	1.24	2.08	0.24	1.03	0.04	0.83	0.03	0.66	0.01	0.52	0.01			120.0	33.3
2200	4.51	1.48	2.29	0.29	1.13	0.05	0.91	0.03	0.73	0.02	0.58	0.01			132.0	36.7
2400	4.92	1.74	2.50	0.34	1.23	0.06	1.00	0.04	0.80	0.02	0.63	0.01			144.0	40.0
2600	5.33	2.02	2.71	0.39	1.34	0.07	1.08	0.04	0.86	0.02	0.68	0.01			156	43.3
2800	5.74	2.32	2.91	0.45	1.44	0.08	1.16	0.05	0.93	0.03	0.73	0.02	0.45	0.00	168	46.7
3000			3.12	0.51	1.54	0.09	1.25	0.05	0.99	0.03	0.79	0.02	0.49	0.01	180	50.0
3200			3.33	0.57	1.64	0.10	1.33	0.06	1.06	0.04	0.84	0.02	0.52	0.01	192	53.3
3500			3.64	0.67	1.80	0.12	1.45	0.07	1.16	0.04	0.92	0.02	0.57	0.01	210	58.3
4000			4.16	0.86	2.06	0.15	1.66	0.09	1.33	0.05	1.05	0.03	0.65	0.01	240	66.7
4500			4.68	1.07	2.31	0.19	1.87	0.12	1.49	0.07	1.18	0.04	0.73	0.01	270	75.0
5000			5.20	1.31	2.57	0.23	2.08	0.14	1.66	0.08	1.31	0.05	0.81	0.01	300	83.3
5500			5.72	1.56	2.83	0.28	2.29	0.17	1.82	0.10	1.44	0.05	0.89	0.02	330	91.7
6000					3.08	0.33	2.49	0.20	1.99	0.11	1.57	0.06	0.97	0.02	360	100.0
6500					3.34	0.38	2.70	0.23	2.15	0.13	1.70	0.07	1.06	0.02	390	108.3
7000					3.60	0.44	2.91	0.26	2.32	0.15	1.83	0.08	1.14	0.03	420	116.7
7500					3.85	0.50	3.12	0.30	2.49	0.17	1.96	0.10	1.22	0.03	450	125.0
8000					4.11	0.56	3.33	0.33	2.65	0.19	2.09	0.11	1.30	0.03	480	133.3
8500					4.37	0.63	3.53	0.37	2.82	0.22	2.23	0.12	1.38	0.04	510	141.7
9000					4.62	0.70	3.74	0.42	2.98	0.24	2.36	0.13	1.46	0.04	540	150.0
9500					4.88	0.77	3.95	0.46	3.15	0.26	2.49	0.15	1.54	0.05	570	158.3
10000					5.14	0.85	4.16	0.51	3.31	0.29	2.62	0.16	1.62	0.05	600	166.7
10500					5.40	0.93	4.36	0.55	3.48	0.32	2.75	0.18	1.71	0.06	630	175.0
11000					5.65	1.01	4.57	0.60	3.65	0.35	2.88	0.20	1.79	0.06	660	183.3
12000							4.99	0.71	3.98	0.41	3.14	0.23	1.95	0.07	720	200.0
13000							5.40	0.82	4.31	0.47	3.40	0.27	2.11	0.08	780	216.7
14000							5.82	0.94	4.64	0.54	3.67	0.31	2.27	0.10	840	233.3
15000									4.97	0.62	3.93	0.35	2.44	0.11	900	250.0
16000									5.30	0.69	4.19	0.39	2.60	0.12	960	266.7
17000									5.63	0.78	4.45	0.44	2.76	0.14	1020	283.3
18000									5.97	0.86	4.71	0.49	2.92	0.15	1080	300.0
19000											4.98	0.54	3.09	0.17	1140	316.7
20000											5.24	0.59	3.25	0.19	1200	333.3
21000											5.50	0.65	3.41	0.20	1260	350.0
22000											5.76	0.71	3.57	0.22	1320	366.7
24000													3.90	0.26	1440	400.0
26000													4.22	0.30	1560	433.3
28000													4.55	0.35	1680	466.7
30000													4.87	0.39	1800	500.0
32000													5.20	0.44	1920	533.3
34000													5.52	0.50	2040	566.7
36000													5.85	0.55	2160	600.0

AUSTRALIAN STANDARD PVC PN 15 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Sizes 15 mm through 50 mm

Nominal Size / Pipe ID / Pipe O.D. / Wall Thick	15 mm 18.3 21.3 1.5		20 mm 22.9 26.7 1.9		25 mm 28.9 33.5 2.3		32 mm 36.4 42.2 2.9		40 mm 41.6 48.2 3.3		50 mm 52.1 60.3 4.1		Nominal Size / Pipe ID / Pipe O.D. / Wall Thick	
Flow L/min	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Flow Cu. M/Hr	Flow L/sec
1	0.06	0.00											0.06	0.02
2	0.13	0.01	0.08	0.00									0.12	0.03
3	0.19	0.03	0.12	0.01	0.08	0.00							0.18	0.05
4	0.25	0.05	0.16	0.02	0.10	0.01							0.24	0.07
5	0.32	0.08	0.20	0.03	0.13	0.01							0.30	0.08
6	0.38	0.11	0.24	0.04	0.15	0.01	0.10	0.00					0.36	0.10
7	0.44	0.15	0.28	0.05	0.18	0.02	0.11	0.01					0.42	0.12
8	0.51	0.19	0.32	0.06	0.20	0.02	0.13	0.01					0.48	0.13
9	0.57	0.24	0.36	0.08	0.23	0.03	0.14	0.01	0.11	0.00			0.54	0.15
10	0.63	0.29	0.40	0.09	0.25	0.03	0.16	0.01	0.12	0.01			0.60	0.17
12	0.76	0.40	0.48	0.13	0.30	0.04	0.19	0.01	0.15	0.01			0.72	0.20
14	0.89	0.53	0.56	0.18	0.35	0.06	0.22	0.02	0.17	0.01			0.84	0.23
16	1.01	0.68	0.64	0.23	0.40	0.07	0.26	0.02	0.20	0.01	0.12	0.00	0.96	0.27
18	1.14	0.85	0.72	0.28	0.45	0.09	0.29	0.03	0.22	0.02	0.14	0.01	1.08	0.30
20	1.27	1.04	0.80	0.34	0.50	0.11	0.32	0.04	0.24	0.02	0.16	0.01	1.20	0.33
22	1.39	1.23	0.88	0.41	0.55	0.13	0.35	0.04	0.27	0.02	0.17	0.01	1.32	0.37
24	1.52	1.45	0.96	0.48	0.60	0.15	0.38	0.05	0.29	0.03	0.19	0.01	1.44	0.40
26	1.65	1.68	1.04	0.55	0.66	0.18	0.42	0.06	0.32	0.03	0.20	0.01	1.56	0.43
28	1.77	1.93	1.12	0.63	0.71	0.21	0.45	0.07	0.34	0.04	0.22	0.01	1.68	0.47
30	1.90	2.19	1.20	0.72	0.76	0.23	0.48	0.08	0.37	0.04	0.23	0.01	1.80	0.50
32	2.03	2.47	1.28	0.81	0.81	0.26	0.51	0.09	0.39	0.05	0.25	0.02	1.92	0.53
34	2.15	2.77	1.36	0.91	0.86	0.29	0.54	0.10	0.42	0.05	0.26	0.02	2.04	0.57
36	2.28	3.07	1.44	1.01	0.91	0.33	0.58	0.11	0.44	0.06	0.28	0.02	2.16	0.60
38	2.41	3.40	1.52	1.12	0.96	0.36	0.61	0.12	0.47	0.06	0.30	0.02	2.28	0.63
40	2.53	3.74	1.60	1.23	1.01	0.40	0.64	0.13	0.49	0.07	0.31	0.02	2.40	0.67
42	2.66	4.09	1.68	1.34	1.06	0.44	0.67	0.14	0.51	0.08	0.33	0.02	2.52	0.70
44	2.78	4.46	1.76	1.47	1.11	0.47	0.70	0.16	0.54	0.08	0.34	0.03	2.64	0.73
46	2.91	4.84	1.84	1.59	1.16	0.52	0.74	0.17	0.56	0.09	0.36	0.03	2.76	0.77
48	3.04	5.24	1.92	1.72	1.21	0.56	0.77	0.18	0.59	0.10	0.37	0.03	2.88	0.80
50	3.16	5.65	2.00	1.86	1.26	0.60	0.80	0.20	0.61	0.10	0.39	0.03	3.00	0.83
55	3.48	6.74	2.20	2.22	1.39	0.72	0.88	0.24	0.67	0.12	0.43	0.04	3.30	0.92
60	3.80	7.92	2.40	2.60	1.51	0.84	0.96	0.28	0.73	0.15	0.47	0.05	3.60	1.00
65	4.11	9.18	2.60	3.02	1.64	0.98	1.04	0.32	0.80	0.17	0.51	0.06	3.90	1.08
70	4.43	10.53	2.80	3.46	1.76	1.12	1.12	0.37	0.86	0.19	0.54	0.06	4.20	1.17
75	4.75	11.97	3.01	3.94	1.89	1.27	1.20	0.42	0.92	0.22	0.58	0.07	4.50	1.25
80	5.06	13.49	3.21	4.44	2.02	1.44	1.28	0.48	0.98	0.25	0.62	0.08	4.80	1.33
85	5.38	15.09	3.41	4.96	2.14	1.61	1.36	0.53	1.04	0.28	0.66	0.09	5.10	1.42
90	5.70	16.78	3.61	5.52	2.27	1.79	1.44	0.59	1.10	0.31	0.70	0.10	5.40	1.50
95			3.81	6.10	2.39	1.97	1.52	0.65	1.16	0.34	0.74	0.11	5.70	1.58
100			4.01	6.70	2.52	2.17	1.60	0.72	1.22	0.38	0.78	0.12	6.00	1.67
110			4.41	8.00	2.77	2.59	1.76	0.86	1.35	0.45	0.86	0.15	6.60	1.83
120			4.81	9.40	3.02	3.04	1.92	1.01	1.47	0.53	0.93	0.17	7.20	2.00
130			5.21	10.90	3.28	3.53	2.08	1.17	1.59	0.61	1.01	0.20	7.80	2.17
140			5.61	12.50	3.53	4.05	2.24	1.34	1.71	0.70	1.09	0.23	8.40	2.33
150					3.78	4.60	2.40	1.52	1.84	0.79	1.17	0.26	9.00	2.50
175					4.41	6.12	2.80	2.02	2.14	1.06	1.36	0.35	10.5	2.92
200					5.04	7.84	3.20	2.59	2.45	1.35	1.56	0.45	12.0	3.33
225					5.67	9.74	3.60	3.22	2.76	1.68	1.75	0.56	13.5	3.75
250							4.00	3.92	3.06	2.05	1.94	0.68	15.0	4.17
275							4.40	4.68	3.37	2.44	2.14	0.81	16.5	4.58
300							4.80	5.49	3.67	2.87	2.33	0.95	18.0	5.00
325							5.20	6.37	3.98	3.33	2.53	1.10	19.5	5.42
350							5.60	7.31	4.29	3.82	2.72	1.26	21.0	5.83
375									4.59	4.34	2.92	1.44	22.5	6.25
400									4.90	4.89	3.11	1.62	24.0	6.67
450									5.51	6.08	3.50	2.01	27.0	7.50
500											3.89	2.45	30.0	8.33
550											4.28	2.92	33.0	9.17
600											4.67	3.43	36.0	10.0
650											5.06	3.98	39.0	10.8
700											5.45	4.57	42.0	11.7
750											5.83	5.19	45.0	12.5

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:

Bars/100 M x 100 = kPa/100 M

Bars/100 M x 10.21 = Metres/100 M

Bars/100 M x 4.42 = PSI/100 ft.

AUSTRALIAN STANDARD PVC PN 15 PLASTIC PIPE

C = 150

Pressure Loss in Bars per 100 m   Slizes 80 mm through 300 mm

Nominal Size Pipe ID Pipe O.D. Wall Thick	80 mm 76.7 88.9 6.1		100 mm 98.9 114.3 7.7		150 mm 138.7 160.3 10.8		200 mm 198.0 225.3 13.7		250 mm 246.4 280.4 17.0		300 mm 277.3 315.5 19.1		Nominal Size Pipe ID Pipe O.D. Wall Thick	
Flow L/min	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Velocity MPS	Bars/100 M Loss	Flow Cu. M/Hr	Flow L/sec
100	0.36	0.02	0.22	0.01									6.0	1.67
125	0.45	0.03	0.27	0.01									7.5	2.08
150	0.54	0.04	0.33	0.01									9.0	2.50
175	0.63	0.05	0.38	0.02									10.5	2.92
200	0.72	0.07	0.43	0.02									12.0	3.33
225	0.81	0.09	0.49	0.03	0.25	0.00							13.5	3.75
250	0.90	0.10	0.54	0.03	0.28	0.01							15.0	4.17
275	0.99	0.12	0.60	0.04	0.30	0.01							16.5	4.58
300	1.08	0.15	0.65	0.04	0.33	0.01							18.0	5.00
325	1.17	0.17	0.71	0.05	0.36	0.01							19.5	5.42
350	1.26	0.19	0.76	0.06	0.39	0.01							21.0	5.83
375	1.35	0.22	0.81	0.06	0.41	0.01							22.5	6.25
400	1.44	0.25	0.87	0.07	0.44	0.01							24.0	6.67
475	1.71	0.34	1.03	0.10	0.52	0.02							28.5	7.92
500	1.80	0.38	1.09	0.11	0.55	0.02							30.0	8.33
550	1.98	0.45	1.19	0.13	0.61	0.03	0.30	0.00					33.0	9.17
600	2.16	0.53	1.30	0.15	0.66	0.03	0.32	0.01					36.0	10.0
650	2.34	0.61	1.41	0.18	0.72	0.03	0.35	0.01					39.0	10.8
700	2.52	0.70	1.52	0.20	0.77	0.04	0.38	0.01					42.0	11.7
750	2.70	0.80	1.63	0.23	0.83	0.04	0.41	0.01					45.0	12.5
800	2.88	0.90	1.74	0.26	0.88	0.05	0.43	0.01					48.0	13.3
850	3.06	1.01	1.85	0.29	0.94	0.06	0.46	0.01					51.0	14.2
900	3.24	1.12	1.95	0.33	0.99	0.06	0.49	0.01					54.0	15.0
950	3.42	1.24	2.06	0.36	1.05	0.07	0.51	0.01					57.0	15.8
1000	3.60	1.36	2.17	0.40	1.10	0.08	0.54	0.01	0.35	0.00			60.0	16.7
1100	3.96	1.62	2.39	0.47	1.21	0.09	0.59	0.02	0.38	0.01			66.0	18.3
1200	4.32	1.90	2.61	0.56	1.32	0.11	0.65	0.02	0.42	0.01			72.0	20.0
1300	4.68	2.21	2.82	0.64	1.43	0.12	0.70	0.02	0.45	0.01			78.0	21.7
1400	5.04	2.53	3.04	0.74	1.54	0.14	0.76	0.03	0.49	0.01	0.39	0.00	84.0	23.3
1500	5.40	2.88	3.26	0.84	1.65	0.16	0.81	0.03	0.52	0.01	0.41	0.01	90.0	25.0
1600	5.76	3.24	3.47	0.95	1.76	0.18	0.87	0.03	0.56	0.01	0.44	0.01	96.0	26.7
1700			3.69	1.06	1.87	0.20	0.92	0.04	0.59	0.01	0.47	0.01	102	28.3
1800			3.91	1.18	1.98	0.23	0.97	0.04	0.63	0.01	0.50	0.01	108	30.0
1900			4.13	1.30	2.09	0.25	1.03	0.04	0.66	0.02	0.52	0.01	114	31.7
2000			4.34	1.43	2.20	0.27	1.08	0.05	0.70	0.02	0.55	0.01	120	33.3
2200			4.78	1.71	2.42	0.33	1.19	0.06	0.77	0.02	0.61	0.01	132	36.7
2400			5.21	2.01	2.64	0.38	1.30	0.07	0.84	0.02	0.66	0.01	144	40.0
2600			5.65	2.33	2.86	0.45	1.41	0.08	0.91	0.03	0.72	0.02	156	43.3
2800					3.08	0.51	1.51	0.09	0.98	0.03	0.77	0.02	168	46.7
3000					3.31	0.58	1.62	0.10	1.05	0.04	0.83	0.02	180	50.0
3200					3.53	0.66	1.73	0.12	1.12	0.04	0.88	0.02	192	53.3
3400					3.75	0.73	1.84	0.13	1.19	0.04	0.94	0.03	204	56.7
3600					3.97	0.82	1.95	0.14	1.26	0.05	0.99	0.03	216	60.0
3800					4.19	0.90	2.05	0.16	1.33	0.06	1.05	0.03	228	63.3
4000					4.41	0.99	2.16	0.18	1.40	0.06	1.10	0.03	240	66.7
4500					4.96	1.23	2.43	0.22	1.57	0.08	1.24	0.04	270	75.0
5000					5.51	1.50	2.70	0.27	1.75	0.09	1.38	0.05	300	83.3
5500							2.97	0.32	1.92	0.11	1.52	0.06	330	91.7
6000							3.24	0.37	2.09	0.13	1.65	0.07	360	100.0
6500							3.51	0.43	2.27	0.15	1.79	0.08	390	108.3
7000							3.78	0.49	2.44	0.17	1.93	0.10	420	116.7
7500							4.05	0.56	2.62	0.19	2.07	0.11	450	125.0
8000							4.33	0.63	2.79	0.22	2.21	0.12	480	133.3
8500							4.60	0.71	2.97	0.24	2.34	0.14	510	141.7
9000							4.87	0.79	3.14	0.27	2.48	0.15	540	150.0
9500							5.14	0.87	3.32	0.30	2.62	0.17	570	158.3
10000							5.41	0.96	3.49	0.33	2.76	0.19	600	166.7
10500							5.68	1.05	3.67	0.36	2.89	0.20	630	175.0
11000							5.95	1.14	3.84	0.39	3.03	0.22	660	183.3
11500									4.01	0.43	3.17	0.24	690	191.7
12000									4.19	0.46	3.31	0.26	720	200.0
13000									4.54	0.54	3.58	0.30	780	216.7
14000									4.89	0.62	3.86	0.35	840	233.3
15000									5.24	0.70	4.13	0.39	900	250.0
16000									5.59	0.79	4.41	0.44	960	266.7
17000									5.93	0.88	4.69	0.50	1020	283.3
18000											4.96	0.55	1080	300.0
19000											5.24	0.61	1140	316.7
20000											5.51	0.67	1200	333.3
21000											5.79	0.73	1260	350.0

Shaded area represents velocities over 1.5 mps. Use with caution where water hammer is a concern.

Conversions:
Bars/100 M x 100 = kPa/100 M
Bars/100 M x 10.21 = Metres/100 M
Bars/100 M x 4.42 = PSI/100 ft.

WATER METER PRESSURE LOSS CHART

Typical Pressure Losses (PSI)

				Nominal Size				
Flow GPM	**5/8"**	**3/4"**	**1"**	**1-1/2"**	**2"**	**3"**	**4"**	**Flow GPM**
1	0.2	0.1						1
2	0.3	0.2						2
3	0.4	0.3						3
4	0.6	0.5	0.1					4
5	0.9	0.6	0.2					5
6	1.3	0.7	0.3					6
7	1.8	0.8	0.4					7
8	2.3	1.0	0.5					8
9	3.0	1.3	0.6					9
10	3.7	1.6	0.7					10
11	4.4	1.9	0.8					11
12	5.1	2.2	0.9					12
13	6.1	2.6	1.0					13
14	7.2	3.1	1.1					14
15	8.3	3.6	1.2					15
16	9.4	4.1	1.4	0.4				16
17	10.7	4.6	1.6	0.5				17
18	12.0	5.2	1.8	0.6				18
19	13.4	5.8	2.0	0.7				19
20	15.0	6.5	2.2	0.8				20
22		7.9	2.8	1.0				22
24		9.5	3.4	1.2				24
26		11.2	4.0	1.4				26
28		13.0	4.6	1.6				28
30		15.0	5.3	1.8	0.7			30
32			6.0	2.1	0.8			32
34			6.9	2.4	0.9			34
36			7.8	2.7	1.0			36
38			8.7	3.0	1.2			38
40			9.6	3.3	1.3			40
42			10.6	3.6	1.4			42
44			11.7	3.9	1.5			44
46			12.8	4.2	1.6			46
48			13.9	4.5	1.7			48
50			15.0	4.9	1.9			50
52				5.3	2.1			52
54				5.7	2.2			54
56				6.2	2.3			56
58				6.7	2.5			58
60				7.2	2.7	1.0		60
65				8.3	3.2	1.1		65
70				9.8	3.7	1.3		70
75				11.3	4.3	1.5		75
80				12.8	4.9	1.6	0.7	80
90				16.1	6.2	2.0	0.8	90
100				20.0	7.8	2.5	0.9	100
110					9.5	2.9	1.0	110
120					11.3	3.4	1.2	120
130					13.0	3.9	1.4	130
140					15.1	4.5	1.6	140
150					17.3	5.1	1.8	150
160					20.0	5.8	2.1	160
170						6.5	2.4	170
180						7.2	2.7	180
190						8.0	3.0	190
200						9.0	3.2	200
220						11.0	3.9	220
240						13.0	4.7	240
260						15.0	5.5	260
280						17.3	6.3	280
300						20.0	7.2	300
350							10.0	350
400							13.0	400
450							16.2	450
500							20.0	500
75% of Max Meter Capacity	**15 GMP**	**22.5 GMP**	**37.5 GMP**	**75 GMP**	**120 GMP**	**225 GMP**	**375 GMP**	**75% of Max Meter Capacity**

Note: Shaded areas exceed 75% of maximum safe meter capacity

PRESSURE LOSS THROUGH WATER METERS

Pressure Loss in Kilopascals: (kPa)

Flow L/min	15mm	20mm	25mm	40mm	Flow L/min
		Meter Size			
3.8	1.38	0.69			3.8
7.6	2.07	1.38			7.6
11.4	2.76	2.07			11.4
15.1	4.14	3.45	0.69		15.1
19.0	6.21	4.14	1.38		19.0
22.7	8.96	4.83	2.07		22.7
26.5	12.41	5.52	2.76		26.5
30.3	15.86	6.90	3.45		30.3
34.1	20.69	8.96	4.14		34.1
37.8	25.51	11.03	4.83		37.8
41.6	30.34	13.10	5.52		41.6
45.4	35.16	15.17	6.21		45.4
49.2	42.06	17.93	6.90		49.2
53.0	49.64	21.37	7.58		53.0
56.8	57.23	24.82	8.27		56.8
60.6	64.81	28.27	9.65	2.76	60.6
64.4	73.78	31.72	11.03	3.45	64.4
68.1	82.74	35.85	12.41	4.14	68.1
72.0	92.39	39.99	13.79	4.83	72.0
75.7	103.43	44.82	15.17	5.52	75.7
83.3		54.47	19.31	6.90	83.3
90.8		65.50	23.44	8.27	90.8
98.4		77.22	27.58	9.65	98.4
106.0		89.64	31.72	11.03	106.0
113.6		103.43	36.54	12.41	113.6
121.1			41.37	14.48	121.1
128.7			47.58	16.55	128.7
136.3			53.78	18.62	136.3
143.8			59.99	20.69	143.8
151.4			66.19	22.75	151.4
159.0			73.09	24.82	159.0
166.5			80.67	26.89	166.5
174.1			88.26	28.96	174.1
181.7			95.84	31.03	181.7
189.3			103.43	33.79	189.3
196.8				36.54	196.8
204.4				39.30	204.4
212.0				42.75	212.0
219.5				46.20	219.5
227.1				49.64	227.1
246.0				57.23	246.0
265.0				67.57	265.0
283.9				77.91	283.9
302.8				88.26	302.8

Note: The greatest pressure loss reflects the maximum safe capacity for the meter.

LOSS OF PRESSURE DUE TO FRICTION IN ORDINARY RUBBER HOSE

Loss in Pounds per Sq. Inch (PSI) per 100 Feet of Length Sizes ½"through 5"

Flow of Water in U.S. GPM	½	⅝"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"
0.5	0.40										
1.5	3.02	1.01	0.42								
2.5	7.75	2.58	1.08								
5	27.80	9.27	3.86	0.95	0.32	0.13					
10	99.50	33.20	13.80	3.38	1.14	0.47					
15		71.00	29.60	7.25	2.45	1.01	0.25	0.08			
20		121.00	50.30	12.40	4.15	1.71	0.42	0.14			
25			76.50	18.70	6.34	2.60	0.64	0.22			
30			108.00	26.50	8.96	3.68	0.90	0.30	0.13		
35			142.00	34.80	11.80	4.83	1.18	0.40	0.17		
40				44.70	15.10	6.20	1.52	0.51	0.21		
45				55.00	18.60	7.65	1.87	0.63	0.26		
50				67.50	22.80	9.35	2.28	0.78	0.32		
60				94.30	31.80	13.10	3.19	1.08	0.45		
70				126.00	42.50	17.50	4.25	1.44	0.60		
80					50.60	22.50	5.48	1.86	0.77		
90					67.50	27.80	6.80	2.30	0.95	0.23	
100					81.50	33.50	8.19	2.78	1.15	0.28	
125					124.00	50.60	12.40	4.20	1.73	0.43	
150						72.10	17.60	5.97	2.46	0.60	0.20
175						94.50	23.10	7.83	3.23	0.79	0.27
200						122.00	29.60	10.10	4.15	1.02	0.34
225							36.80	12.50	5.15	1.26	0.43
250							44.60	15.20	6.25	1.53	0.52
275							55.30	18.10	7.45	1.83	0.62
300							62.50	21.20	8.75	2.15	0.73

ROUGHNESS COEFFICIENT C VALUES FOR HAZEN-WILLIAMS EQUATION

Values of C Type Of Pipe	Range	New Pipe	Design C
PVC	160–145	150	150
Polyethylene	150–130	140	140
Asbestos-Cement	160–140	150	140
Cement-Lined Steel	160–140	150	140
Welded Steel	150–80	140	100
Riveted Steel	140–90	110	100
Concrete	150–85	120	100
Wrought or Cast Iron	150–80	130	100
Copper, Brass	150–120	140	130
Wood Stave	145–110	120	110
Vitrified Clay		110	100
Corrugated Steel		60	60

Above values of C for use with Hazen-Williams Equation, friction head losses in PSI per foot of pipe length for fresh water at 60 degrees Fahrenheit.

$$H_f = 0.00090194 \left(\frac{100}{C}\right)^{1.852} \frac{Q^{1.852}}{d^{4.866}}$$

Where:

H_f = head loss due to friction in pounds per square inch (PSI)

C = Hazen Williams coefficient for roughness of the inside of the pipe

Q = flow in gallons per minute (GPM)

d = inside diameter of pipe in inches

L = length of pipe in feet

REFERENCE TABLES OF SELECTED DATA

Head Losses Through Standard Foot Valves

Head Loss in Feet	1½"	2"	2½"	3"	4"	6"	8"	10"	12"
					Flow in GPM				
1	39	66	96	152	268	632	1122	1805	2603
2	57	97	140	221	390	919	1632	2625	3786
3	71	120	175	275	486	1145	2032	3269	4713
4	83	141	204	322	568	1337	2374	3819	5507
5	94	159	230	363	641	1509	2678	4308	6213
6	104	175	254	401	707	1665	2956	4755	6836
7	113	190	276	435	769	1810	3212	5168	7452
8	121	205	297	468	826	1945	3453	5555	8010
9	129	218	317	499	880	2073	3680	5920	8636
10	137	231	335	528	932	2195	3896	6267	9037

TABLE OF APPROXIMATE PRESSURE LOSSES FOR PIPE FITTINGS

Listed in Equivalent Feet of Pipe

Steel Fitting Type	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"
Coupling	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3.0	4.0	6.0	8.0
Run of St. Tee	1.0	1.0	1.5	2.0	2.0	2.5	3.0	4.0	5.0	7.0	10.0
Tee, Side Outlet	3.0	4.5	5.0	7.0	9.0	11.0	13.0	16.0	20.0	31.0	42.0
Tee, Run Reduced ½"	1.5	2.5	3.0	4.0	5.0	6.0	7.0	8.0	12.0	16.0	20.0
Elbow, 90°	1.5	2.5	3.0	4.0	5.0	6.0	7.0	8.0	12.0	16.0	20.0
Elbow, 45°	0.75	1.0	1.3	1.7	2.0	2.5	3.0	3.5	5.0	7.5	10.0
Corporation Stop	9.0	9.0	9.0	9.0	9.0	9.0					
Curb Stop	6.0	6.0	7.0	7.0	8.0	8.0					

Plastic IPS or Copper Fitting Type	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"
Coupling	1.5	2.5	3.0	3.0	4.0	6.0	7.0	8.0	11.0	18.0	24.0
Run of St. Tee	2.5	3.0	4.0	5.0	6.0	8.0	9.0	11.0	15.0	21.0	28.0
Tee, Side Outlet	7.0	9.0	12.0	15.0	18.0	24.0	30.0	36.0	45.0	70.0	90.0
Tee, Run Reduced ½"	3.5	4.5	6.0	8.0	9.0	11.0	14.0	17.0	24.0	34.0	45.0
Elbow, 90°	3.5	4.5	6.0	8.0	9.0	11.0	14.0	17.0	24.0	34.0	45.0
Elbow, 34°	1.5	2.0	3.0	3.5	4.0	5.0	7.0	8.0	10.0	16.0	20.0

To use this chart, multiply the approximate equivalent feet of pipe value by the proper pipe pressure loss per 100 feet rating, then divide by 100. The result is the fitting loss in PSI.

Note: It is recommended that the above chart be used only when the manufacturers recommended pressure loss values are not available.

PRESSURE LOSS THROUGH SWING CHECK VALVES
Pressure Loss (PSI)

Flow GPM	½"	¾"	1"	1¼"	1½"	2"
2	0.2					
3	0.5					
6	1.0	0.3				
8	1.7	0.5				
10	2.6	0.8	0.3			
12	3.6	1.1	0.5			
14	4.8	1.5	0.6			
16		2.0	0.9			
18		2.4	1.0			
20		3.0	1.2	0.4		
22		3.5	1.4	0.5		
24		4.1	1.7	0.6		
26		4.8	2.0	0.7	0.4	
28			2.2	0.8	0.5	
30			2.5	0.9	0.5	
32			2.9	1.1	0.6	
34			3.2	1.2	0.6	
36			3.6	1.3	0.7	
38			3.9	1.5	0.8	
40			4.3	1.6	0.8	0.3
42			4.7	1.7	0.9	0.3
44				1.9	1.0	0.4

Flow GPM	1¼"	1½"	2"	2½"	3"	4"
46	2.1	1.1	0.4			
48	2.2	1.2	0.5			
50	2.4	1.3	0.5			
55	2.9	1.5	0.6			
60	3.4	1.8	0.7			
65	3.9	2.0	0.8			
70	4.5	2.4	0.9	0.4		
75		2.7	1.0	0.5		
80		3.0	1.2	0.6		
90		3.7	1.5	0.7		
100		4.6	1.8	0.9	0.4	
120			2.5	1.2	0.5	
140			3.3	1.6	0.7	
160			4.3	2.1	0.9	0.3
180			5.3	2.6	1.1	0.4
200			6.5	3.1	1.4	0.5
250				4.7	2.1	0.7
300				6.6	2.9	1.0
350					3.8	1.3
400					4.9	1.7
450						2.1
500						2.6

PRESSURE LOSSES THROUGH COPPER AND BRONZE FITTINGS
Equivalent Feet of Straight Tubing

	Wrought Copper					Cast Bronze					
Nominal Tube Size	90° Elbow	45° Elbow	Tee Run	Tee Side Outlet	90° Bend	180° Bend	90° Elbow	45° Elbow	Tee Run	Tee Side Outlet	Compression Stop
$^3/_8$	0.5	0.5	0.5	1	0.5	½	1	0.5	0.5	2	9
½	0.5	0.5	0.5	1	0.5	1	1	1	0.5	2	13
$^5/_8$	0.5	0.5	0.5	2	1	1	2	1	0.5	3	17
¾	1	0.5	0.5	2	1	2	2	1	0.5	3	21
1	1	1	0.5	3	2	2	4	2	0.5	5	30
1¼	2	1	0.5	4	2	3	5	2	1	7	
1½	2	2	1	5	2	4	8	3	1	9	
2	2	2	1	7	3	8	11	5	2	12	
2½	2	3	2	9	4	16	14	8	2	16	
3	3	4			5	20	18	11	2	20	
3½	4				7	24	24	14	2	31	
4					8	28	28	17	2	37	
5					10	37	41	22	2	48	
6					13	47	52	28	2	61	

PRESSURE LOSSES IN VALVES AND FITTINGS

Example: The dotted line shows that the pressure loss in a 6 inch standard elbow is equivalent to approximately 16 feet of 6 inch standard pipe.

Note: For sudden enlargements or sudden contractions, use the smaller diameter, "d", on the pipe size scale.

Globe Valve, Open

Angle Valve, Open

Close Return Bend

Standard Tee Through Side Outlet

Standard Elbow or Run of Tee Reduced Z|x

Medium Sweep Elbow or Run of Tee Reduced Z|v

Long Sweep Elbow or Run of Standard Tee

Gate Valve, Open

Standard Tee

Sprinkler Angle Control Valve, Open

Sudden Enlargement
$$\frac{d}{D} = \frac{1}{4}$$
$$\frac{d}{D} = \frac{1}{2}$$
$$\frac{d}{D} = \frac{3}{4}$$

Ordinary Entrance

Sudden Contraction
$$\frac{d}{D} = \frac{1}{4}$$
$$\frac{d}{D} = \frac{1}{2}$$
$$\frac{d}{D} = \frac{3}{4}$$

45˚ Elbow

Equivalent Length of Straight Pipe, Feet

3000
2000
1000
500
300
200
100
50
30
20
10
5
3
2
1
0.5
0.3
0.2
0.1

Normal Diameter of Standard Pipe, Inches

48
42
36
30
24
22
20
18
16
14
12
10
9
8
7
6
5
4½
4
3½
3
2½
2
1½
1¼
1
¾
½

Inside Diameter, Inches

50
30
20
10
5
3
2
1
0.5

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Helping our customers succeed is what drives us. While our passion for innovation and engineering is built into everything we do, it is our commitment to exceptional support that we hope will keep you in the Hunter family of customers for years to come.

Gregory R. Hunter, President of Hunter Industries