Sprinkler System Formulas

Simple Flow Rate

$Q = K \bullet P^{0.5}$, where

Q = flow rate (GPM)
K = discharge coefficient of pipe
P = pressure (PSI)

General Volumetric Flow Rate

$Q = 29.8 \bullet D^2 Cd \bullet P^{0.5}$, where

Q = flow rate (GPM)
D = outlet diameter (Inches)
Cd = discharge coefficient based on outlet geometry
P = pressure (PSI)

Pressure Tank Sizing (Tank above sprinklers)

P = (30/A) - 15, where

P = air pressure in tank (PSI)
A = proportion of air in the tank

Pressure Tank Sizing (Tank below sprinklers)

P = (30/A) - 15 + (0.43 • H/A), where

P = air pressure carried in tank (PSI)
A = proportion of air in the tank
H = height of highest sprinkler above tank bottom (Ft)

Pressure Tank Sizing (Hydraulically calculated)

Pi = [(Pf + 15)/A] - 15, where

Pi = tank air pressure to use (PSI)
A = proportion of air in the tank
Pf = system pressure req'd per hydraulic calc. (PSI)

Darcy-Weisbach Formula for Friction Loss

$HL = f \bullet (L/D) \bullet (v^2/2g)$, where

HL = friction loss (Ft)
Re = Reynolds number (pVD / μ)
f = friction factor (f=64/Re)
v = water velocity (Ft/Sec)
g = gravitational constant (32.174ft/sec^2)
D = pipe diameter (Ft)
L = pipe length (Ft)

Pressure Velocity

$Pv = 0.001123 \bullet Q^2 / D^4$, where

Pv = pressure velocity (PSI)
Q = flow rate (GPM)
D = internal dia. of pipe (Inches)

Hazen-Williams Formula for Pressure Loss

$P = (4.52 \bullet Q^{1.85}) / (C^{1.85} \bullet d^{4.87})$, where:]

P = pressure loss (PSI) per lineal ft.
Q = flow rate (GPM)
C = friction factor of pipe (constant)
d = internal diameter of pipe (Inches)

Typical "C" values:

Unlined cast or ductile iron	100
Black steel (dry sys.incl.preaction)	100
Black steel (wet sys.incl.deluge)	120
Galvanized (all)	120
Plastic (listed)– all	150
Cement lined cast or ductile iron	140
Copper tube or stainless steel	150

Hazen-Williams Formula for Pressure Loss (in SI units)

$P = 6.05 \bullet 10^5 \bullet Q^{1.85} / (C^{1.85} \bullet d^{4.87})$, where

P = pressure loss (Bars) per lineal meter
Q = flow rate (Litre/Min)
C = friction factor of pipe (constant)
d = internal diameter of pipe (mm)