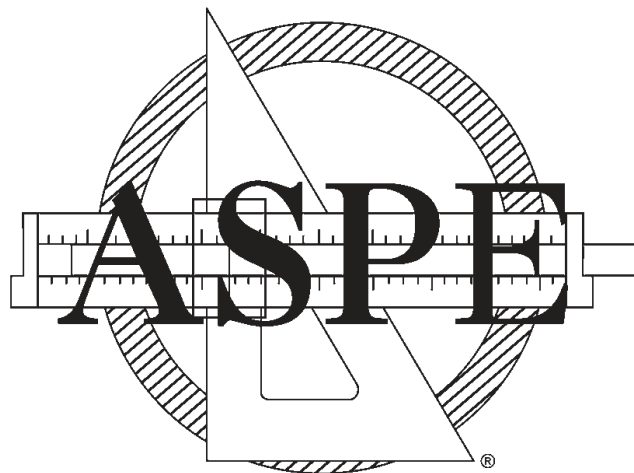


American Society of Plumbing Engineers

Plumbing Engineering & Design Handbook of Tables



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Darcy-Weisbach Formula

Equation

$$h_f = f \left(\frac{L}{D} \right) \left(\frac{V^2}{2g} \right)$$

$$p = h_f \times \left(\frac{\phi}{144} \right)$$

where

h_f = friction head loss, ft of fluid

p = friction head loss, psi

f = coefficient of friction or friction factor, dimensionless (from Colebrook equation or Moody diagram)

L = length of pipe, ft

D = inside diameter of pipe, ft

V = average velocity of flow, fps

g = gravitational acceleration, 32.2 ft/sec/sec

ϕ = lbs/ft³

For turbulent flow, “ f ” can be determined by the C.F. Colebrook Formula, Moody diagrams, or from manufacturers’ data or various handbooks.

Colebrook Formula

Equation

$$\frac{1}{\sqrt{f}} = -2 \log_{10} \left[\left(\frac{\varepsilon}{3.7D} \right) + \left(\frac{2.51}{R\sqrt{f}} \right) \right]$$

also, $R = \frac{VD}{\nu}$

where

R = Reynolds number (Figure 5-9)

f = Friction Factor (dimensionless)

ε = Absolute roughness, in ft

D = Inside diameter of pipe, ft

V = Average pipe velocity, ft/sec

ν = Kinematic Viscosity, ft²/sec

Pressure Loss in Pipe Fittings and Valves

Equation

$$\Delta h = \frac{kV^2}{2g}$$

$$\Delta P = \left(\frac{Q}{C_v} \right)^2 \text{ S.G.}$$

where

Δh = Fluid head (ft)

V = Velocity (ft/sec)

g = Acceleration of gravity (ft/sec²)

P = psi

Q = gpm

SG = Specific gravity (water = 1.0); for water, $\Delta h \times 0.43 = \text{psi}$

C_v = Flow through a valve where pressure loss of 1 psi occurs