PRESSURE LOSSES IN A PIPING SYSTEM

PIPING CALCULATIONS

As a fluid flow through a piping system, it will experience a head loss depending on, among other factors, fluid velocity, pipe wall smoothness and internal pipe surface area. Table 6 and 7 give Friction Loss and carrying capacity data for Sch. 40 and Sch. 80 thermoplastic pipe based on the Williams and Hazen formula where H is friction head

$$H = .2083\,(100/C)^{1.852} \times (q^{1.852}/d^{4.8655})$$

in feet of water/hundred feet of pipe, q is flow (in gpm), and d is inside diameter of the pipe in inches. C is the surface roughness constant which is 150 for thermoplastic pipe.

Fittings and valves, due to their more complex internal configurations, are a significant factor in friction losses experienced in fittings and valves in relation to pipe is in equivalent pipe length. This is the length of pipe required to give the same friction loss as the same size fitting or valve. Table 8 is a tabulation of the equivalent pipe length in feet for the various sizes of a number of common fittings and valves.[1] By using this table and the friction loss tables, the friction loss can be calculated for any fluid velocity.

For example, suppose we wanted to determine the pressure loss across a 2”, Schedule 40, 90˚ elbow, at 75 gpm. From Table 8 we find the equivalent length of a 2”, 90˚ elbow, to be 5.5 feet of pipe. From Table 6 the friction loss of 5.5 feet of pipe would be

5.5/100 x 8.82 = .49 ft. of head

which is the head loss across the 2”, Schedule 40, 90˚ elbow. If it were a Schedule 80, 90˚ elbow we would use Table 7

5.5/100 x 12.27 = .67 ft. of head

which is the head loss across the 2”, Schedule 80, 90˚ elbow.

VALVE CALCULATIONS

As an aid to system design, liquid sizing constants (Cv values) are shown applicable. These values were determined by actual test in our laboratory, and are defined as the flow rate through the valve required to produce a pressure drop of 1 psi.

To determine the pressure drop for a given condition the following formula may be used:

$$\Delta P = Q^2\ S.G./Cv^2$$

Where ΔP = Pressure drop across the valve in psi
Q = Flow through the valve in gpm
S.G. = Specific gravity of the liquid (Water = 1.0)
Cv = Flow coefficient