Part II
Booster Pump Systems.

Part II is an adjunct to Chapter 6 and shall not be considered as part of this code unless formally adopted as such. The following has been provided for the convenience of the user for reference purposes:

6.1 Where the water pressure is not sufficient to meet the water supply demands of a building, a booster pump system shall be installed. The pump system shall be permitted to be used for the entire building, for the upper floors in one or more zones, or for select equipment connections having high-pressure requirements.

The required capacity of the pump system shall be determined where the building demand is evaluated in terms of peak demand. The peak demand shall be determined as described for the water service. The pressure requirement shall be derived from the Bernoulli equation.

Note: Between any 2 points of an ideal flow stream, $h + p/d + v^2/2g$ shall be a constant. In a more realistic flow, a friction head and pump head shall be as follows:

Equation 6-1

$$h_1 + \frac{p_1}{d} + \frac{v_1^{\ 2}}{2g} + h_p = h_2 + \frac{p_2}{d} + \frac{v_1^{\ 2}}{2g} + h_f$$

Where:

- h = the flow stream's elevation above a datum, m (ft.) p as its static pressure, kPa (lb./ft.^{2})
- d = its density, kg/m^3 (lb./ft.^{3})
- v = its velocity, m/sec (ft./sec)
- h_p= the pump head (total dynamic head)
- g = acceleration of gravity, 9.8m/s^2 (32.2ft./sec^2)
- h_f = the friction head loss between Points 1 and 2, m (ft.)

Where Point 1 is at a location of a known pressure such as the street main and Point 2 is at a fixture, the equation shall be rearranged to derive the required pump head to adequately supply that fixture. Various fixtures in the building shall be permitted to be selected to derive various pump heads. The maximum pump head is considered the top fixture of the most remote riser. Additionally, after considering that velocities are similar between Points 1 and 2, the two velocity terms shall be permitted to be omitted.

Equation 6-2

$$h_p = h_2 - h_1 + \frac{(p_2 - p_1)}{d} + h_f$$

The friction head includes various losses such as friction from straight pipe, fittings, valves meters, tanks, treatment devices, and backflow preventers. In addition, the head loss through the booster pump system piping and its control valves shall be added. These are typically 1.2m (4 ft.) and up to 5.5m (18 ft.) respectively.

The design of the booster pump system shall consist of one or more electrically driven centrifugal pumps, connecting pipework various controls such as pressure-reducing valves, motor controls, and a hydro-pneumatic tank.

Example 6-1: Determining Total Dynamic Head. Determine the required total dynamic head of a booster pump system for a building with its most remote fixture as a pressure balancing shower valve (assumed 138kPa [20 psi]) located 14.6m (48 ft.) above the pump; street pressure as 172kPa (25 psi) as read from a gauge near the pump; the total equivalent length of pipe as 122m (400 ft.); the uniform pressure loss of this length as 35kPa per 35m (5 psi/100 ft.); and pressure loss through the service meter as 41kPa (6 psi) and through a water softener as 62kPa (9 psi).

Solution: From Equation 6-2, $(p_2 - p_1)/d$ becomes (138 – 172)/9.8 = -3.50m.

The building friction head becomes (120 x 35/30 + 41 + 62)/9.8 = 24.8m.

The pump system friction head becomes 1.22 + 5.49 = 6.7m.

The total dynamic head therefore becomes 14.6 – 3.50 + 24.6 + 6.70 = 42.4m.

Solution (U.S.): From Equation 6-2, $(p_2 - p_1)/d$ becomes (20 - 25) x 144/62.4 = -11.5ft.

The building friction head becomes (400 x 0.05 + 6 + 9) x 144/62.4 = 80.8ft.

The pump system friction head becomes 4 + 18 = 22ft.

The total dynamic head therefore becomes 48 - 11.5 + 80.8 + 22 = 139ft.