Table 3 gives a method for computing the sizes of mains and risers and the pipe sizes given are based upon a pressure drop in the main riser of 10 lb. per 100 ft. of run; other values such as 5 lb. or 7 lb. can be used from Table 5 if it is found advisable on account of very long runs.

It will be seen that 60 per cent of the total amount of water required for all the fixtures on any floor is given as the *factor of use* and that a further reduction is made by deducting 10 per cent on each floor below the top floor until 40 per cent is reached. This of course is a matter of judgment and experience, but the volume of flow will be adequate for the average case, providing the pipe sizes selected are ample for the drop in pressure admissable.

WHEN TANK IS ON ROOF

If tank is elevated about 35 ft. above highest fixture, which would be about 25 ft. above the roof, all the computations given herein will apply for branch connections and main risers except that the main riser will have its greatest diameter at the top. It will be seen that 35 ft. elevation will give the necessary 15 lb. pressure at the highest fixture.

FRICTION IN ELBOWS

Friction caused by elbows should be added to straight pipe friction. Each elbow in a line will add friction equal to a length of straight pipe at forty times the diameter of the pipe approximately as follows:

Pipe size	¾	1	1¼	1½	2	2½	3	3½	4
Equivalent length of straight pipe in feet	2.5	3.3	4.1	5	5	8.3	10	11.7	13.3

The pressure loss due to friction in the main leading to base of riser can readily be added to the pressure required at the base of a riser, thus:

Required—the size of riser and main for a 10-story building 100 ft. high where the water use per floor as given by Table 1 for fixtures aggregates 100 gal. per floor:

The computations as given in Table 3 show that the water flow required on the various floors is as follows:

TABLE 7. GIVING EXAMPLE OF RISER SIZES FOR DIFFERENT PRESSURE DROPS PER 100 FT. RUN

Floor	Gal. per min.	5 lb.	7 lb.	10 lb.	20 lb.
10	60	2	2	2	1½
9	108	2½	2½	2½	1½
8	144	3	3	2½	2
7	168	3½	3	3	2½
6	180	3½	3	3	2½
5	180	3½	3	3	2½
4	184	3½	3	3	2½
3	192	3½	3	3	2½
2	216	3½	3	3	2½
1	240	3½	3½	3	2½

If the system of mains and risers is based upon 10 lb. pressure drop per 100 ft. run, the pressure required at base of riser when water is flowing will be 69 lb., see Table 6 at 100 ft. height; or at 20 lb. drop it would be 79 lb. while at 5 lb. drop it would only be 64 lb.

Pressure required at the main 100 ft. away with 10 lb. drop per 100 ft. would be 69 + 10 = 79 lb. or 50 ft. away 69 + 5 = 74 lb.

WATER SUPPLY FORMULA

CF = Cu. ft. per min. discharged

G = Gal. per min. discharged

H = Friction head of water in feet = pressure × 2.31; if water is raised vertically, deduct number of feet raised, from head due to pressure.

L = Length of pipe in feet—including horizontal and vertical runs.

$$CF = 0.16 \sqrt{\frac{(3d)^5 \times 3H}{L}} \quad (1)$$

$$G = 1.2 \sqrt{\frac{(3d)^5 \times 3H}{L}} \quad (2)$$

$$H = \frac{(0.16 \times CF)^2 \times L}{(3d)^5} \quad (3)$$

$$H = \frac{(1.2\,G)^2 \times L}{(3d)^5} \quad (4)$$

The above formula neglect the head due to entry, which need not be computed except when L is very short.

H_1 = head due to entry in feet.

$$H_1 = \left(\frac{0.83\,G}{d^2 \times 13}\right)^2 \text{ or } H_1 = \left(\frac{0.16\,CF}{d^2 \times 13}\right)^2$$

Example—

Required the discharge of a 2 in. main with pressure 30 lb. 100 ft. horizontal run and 30 ft. vertical run.

$$H = 30 \times 2.31 - 30 = 39.3$$

$$\text{Formula (2) } G = 1.2 \sqrt{\frac{(3 \times 2)^5 \times 3 \times 39.3}{100 + 30}} = 100.8$$

In the above case the head due to entry would be

$$H_1 = \left(\frac{0.83 \times 100.8}{2 \times 2 \times 13}\right)^2 = 2.56 \text{ ft.}$$

Usually this can be neglected except for very close calculations.