

Had the tank been set 10 ft higher, the head available for friction, while still giving the same pressure at the top fixtures, would have been $0.43 \text{ lb} \times 10 \text{ ft}$ or 4.3 lb greater and this, with the 1 lb drop used previously, would give a total allowable drop of 1 lb + 4.3 lb = 5.3 lb which, divided by the 600 ft equivalent run gives a drop per 100 ft of $\frac{5.3 \times 100}{600} = 0.9 \text{ lb}$.

With this drop, the sizes according to the chart (Fig. 2) are 6 in., 5 in., and 4 in., respectively. If the run is reduced to 200 ft instead of 600 ft, the allowable drop will

TABLE 6. TYPICAL CALCULATION OF PIPE SIZES ON DOWN-FEED RISER WITH FLUSH VALVE WATER-CLOSETS AND URINALS

(Riser No. 2. Fig. 4)

FLOOR OF BLDG.	FIXTURES ON FLOOR	GPM PER FIXTURE	MAXIMUM GPM ON FLOOR	MAXIMUM GPM ON RISER	USAGE (PER CENT)	PROBABLE FLOW IN RISER GPM	ALLOWABLE DROP LB PER 100 FT	PIPE SIZE IN.
1st	1 W. C.	45	45	45	100	45	30	1½
2nd	2 W. C. 1 U. 1 Lav.	45 30 3	90 30 3					
			123	168	58	98	30	1½
3rd	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9					
			249	417	31	130	30	2
4th	4 W. C. 2 U. 3 Lav.	45 30 3	180 60 9					
			249	666	24	160	30	2
5th	6 W. C. 4 Lav.	45 3	270 12					
			282	948	19	180	30	2
6th	6 W. C. 4 Lav.	45 3	270 12					
			282	1230	16	196	30	2½
7th	6 W. C. 4 Lav.	45 3	270 12					
			282	1512	14	211	30	2½
8th	6 W. C. 4 Lav.	45 3	270 12					
			282	1794	12	215	2	4

be $\frac{5.3 \text{ lb} \times 100}{200} = 2.7 \text{ lb per 100 ft}$. This gives 5 in., 4 in., and 3 in., respectively, for the flows of 400, 200, and 100 gpm.

From Example 4 it is evident that, while the down-feed system possesses certain economies in size for the riser portion, it is quite likely to involve large distribution main sizes, especially when the tank is not elevated to a considerable degree.

Example 5. Fig. 4 shows a typical down-feed layout with three risers extending eight stories and with the fixtures noted on each floor. This will be solved assuming that the level of the water in the house tank is 30 ft above the fixtures on the top floor, that the

length of run from the tank to the farthest fixture is 200 ft, equivalent length of fittings 100 ft, and the pressure required at the fixture is 7 lb.

The 30-ft head is equal to a static pressure of 0.43×30 or 12.9 lb per square inch and to maintain a pressure of 7 lb at the highest fixtures the drop allowable in pressure is $12.9 - 7.0 \text{ lb}$ or 5.9 lb. As the total equivalent run is 300 ft, this is a drop per 100 ft of 1.97 lb, or practically 2 lb. Therefore, all risers and mains from the top floor back to the tank must be sized on the basis of a drop of 2 lb per 100 ft. Tables 5, 6, 7 and 8 show the schedule for Risers Nos. 1, 2 and 3 with the maximum flow taken from Table 1, the percentage of use at the peak taken from Fig. 1, and the probable flow at the peak worked

TABLE 7. TYPICAL CALCULATION OF PIPE SIZES ON DOWN-FEED RISER WITH FLUSH VALVE WATER-CLOSETS AND URINALS

(Riser No. 3. Fig. 4)

FLOOR OF BLDG.	FIXTURES ON FLOOR	GPM PER FIXTURE	MAXIMUM GPM ON FLOOR	MAXIMUM GPM ON RISER	USAGE (PER CENT)	PROBABLE FLOW IN RISER GPM	ALLOWABLE DROP LB PER 100 FT	PIPE SIZE IN.
1st	1 S. S.	4	4	4	100	4	30	¾
2nd	3 W. C. 1 Lav.	45 3	135 3					
			138	142	63	89	30	1½
3rd	2 Lav.	3	6	148	61	90	30	1½
4th	3 W. C. 1 Lav. 1 S. S.	45 3 4	135 3 4					
			142	290	41	119	30	2
5th	1 S. S.	4	4	294	41	120	30	2
6th	1 S. S.	4	4	298	40	120	30	2
7th	1 S. S.	4	4	302	40	121	30	2
8th	1 S. S.	4	4	306	40	122	2	3

TABLE 8. SIZE OF DISTRIBUTION MAIN FOR DOWN-FEED SYSTEMS (SEE FIG. 4)

RISER NO.	MAXIMUM GPM RISER	MAXIMUM GPM MAIN	USAGE (PER CENT)	PROBABLE GPM	ALLOWABLE DROP LB PER 100 FT	SIZE OF MAIN IN.
1	1038	1038	18	187	2	4
2	1794	2832	9	255	2	4
3	306	3138	9	282	2	5

out for each portion of the riser. Riser sizes are taken from Fig. 2, using a drop of 30 lb per 100 ft except on the riser from the top story back to the tank where 2 lb per 100 ft is the allowable limit.

Since down-feed risers are nearly always sized for a pressure loss of 30 lb per 100 ft, it is possible to arrange useful sizing data in tabular form. Fig. 5 shows a typical down-feed riser for a 20 story building. Table 9 may be used for sizing such a riser of any height and for any probable flow up to 250 gpm.

It should be noted that the two top floors in Fig. 5 are sized for less than 30 lb per 100 ft. Regardless of the height of the riser being sized, the two top floors of it should be sized from values given for the top floors of Fig. 5.