Determination of proper size of service pipe

Determination of the proper size of service for any particular type of building is of the utmost importance, if ample pressures are to be available at all fixtures and the service pipe is not to be subjected to excessive velocities. Many homes supplied by a 3/4" service, which may have been ample when the service was installed are now inadequately served because the demand has been increased, by adding extra laundry tap, additional bathrooms, lawn sprinklers and similar water consuming conveniences. Such increased demand either subjects the service to excessive velocities, with attendant annoyances due to noise and water hammer, or results in unsatisfactory delivery at times from source of the fixtures.

Excessive velocities always aggravate corrosion, partly through the mechanism of erosion and partly by washing away protective films or coatings formed naturally by the action of the water. Corrosion combined with erosion is particularly destructive where continuous operation of a service at high velocities in active water occurs, as a service feeding a fountain or some commercial process requiring a continuous flow of water.

In these latter conditions, it is advisable to keep the velocities low - from three to five feet per second or less. In nonactive waters, velocities as high as 10 feet per second might be tolerated if the service is intermittent and the demand at the flow is not too frequent, provided, of course, that the main pressures are adequate.

The following factors affect the choice of proper size of the service line:

1. Pressure available at the main.
2. Pressure desired at the most remote fixture, usually the highest installed fixture above the main level, commonly assumed as 6 to 8 p.s.i.
3. Friction loss through corporation valve, service line, curb valve, water meter and customer's piping at maximum expected demand flow.
4. Velocity desired through the service line at maximum desired flow. No absolutely fixed rule can be set up for the proper velocity, and past experience with a particular water will, to a great extent, govern the maximum velocity desired.
5. Maximum expected demand flow. This factor is not the total combined flow with all fixtures wide open at the same time, but is proportional to the number of fixtures that may be expected to be in use simultaneously. The National Bureau of Standards has determined the probable peak demand flow for any housing unit based on the number and type of fixtures installed.

Table 6 lists the demand weights in “fixture units” as determined by the National Bureau of Standards. It is used in conjunction with Chart, Fig. 8 in determining the expected normal peak flow for any housing unit and any number or combination of fixtures as listed in table 6.

Table 10 is a simplified table showing the estimated demand flow in gallons per minute for various classes of structures.

Chart, Fig. 9 shows the pressure loss through disc type meters of various sizes.

(Special Note) Tables 6, 10, and charts Fig. 8 and Fig. 9 are reprinted by permission of the U.S. Dept. of Commerce, National Bureau of Standards publication “Building Materials and Structures Report BMS - 79". For a more detailed treatise, a copy of this publication may be obtained by writing to the National Bureau of Standards, Washington, D.C.

Example of sizing a service

The following is a set of calculations showing the determination of the proper service for a Class A dwelling - with flush tank water closet, one bathroom, one kitchen sink with combination fixtures, no laundry tray, and hose outlet.

The peak expected demand flow is estimated as follows:

Referring to table 6,

Fixture	Demand weight in fixture units
Water Closet, Flush Tank	3
Lavatory	1
Bathtub	2
Kitchen Sink Combination	3
	9

Referring to Chart, Fig. 8, the demand in gallons per minute for 9 fixture units is found to be about 7 gallons per minute. To this, should be added the hose outlet demand, in this example assumed at 5 gallons per minute which brings the expected total demand up to 12 gallons per minute.

For the purpose of this example, the following conditions are further assumed:

1. The dwelling is single story with maximum elevation above the main to the most remote fixture of 10 feet.
2. Minimum main pressure - 50 p.s.i.
3. Copper Service pipe is to be used.
4. A curb valve is to be installed.
5. A disc type water meter will be used.
6. Minimum pressure at most remote fixture desired, 8 p.s.i.

Determination of proper size of service pipe (continued)

7. Distance from meter to main, 75 feet.

8. Developed length of customer's piping to most remote fixture, including equivalent length of straight pipe due to elbows, tees, special fittings, etc. (considered for purpose of calculation to be of same size and type of pipe as service). Determination of friction loss allowable per 100 feet of pipe is based on the assumption that the entire peak demand issues from the most remote fixture through piping of same size as the service.

Pressure desired at most remove fixture	8	p.s.i.
Pressure loss due to 10 feet elevation	4.34	p.s.i.
Pressure loss at peak demand, meter (Fig. 9) . .	9.00	p.s.i.
	21.34	p.s.i.

Actual length of service pipe	75	ft.
Developed length of customer's piping to most remote fixture including equivalent length elbows, tees, etc.	40	ft.
Corporation Stop/Valve. Equivalent length straight pipe	5.86	ft.
Curb Stop/Valve. Equivalent length straight pipe	4.08	ft.
	124.94	ft.

Main to most remote fixture . . . (approx. 125 ft.)

Pressure available for pipe friction

Main pressure 50 p.s.i. - 21.34 = 28.66 p.s.i.

Max friction loss allowable per 100 ft.

$$\frac{100}{125} \times 28.66 = 23.00 \text{ p.s.i.}$$

Referring to chart "Flow Chart for Type "K" Copper Pipe," it will be noted that a 3/4" pipe loss is 20 p.s.i. per 100 feet at 12 GPM. Therefore, it is satisfactory from the standpoint of pressure loss.

It will be noted that the velocity is 9 ft/sec which is near the upper limit. However, the peak flow may only occur during use of hose outlet, and the 3/4" service is probably ample. In a service where the peak demand would be expected to occur frequently, it might be advisable to install a 1" service to reduce the erosion-corrosion effect if the water was somewhat active. A velocity approaching 10 feet per second may cause annoyance from water hammer and noise.

Table 10 offers considerable simplification in determining the demand estimate. Referring to table 10, it will be noted that the building in our example falls in Class A, and that the demand estimate is 6 GPM, to which is added the 5 GPM demand for the hose outlet for a total demand of 11 GPM - close near enough for estimating purposes.