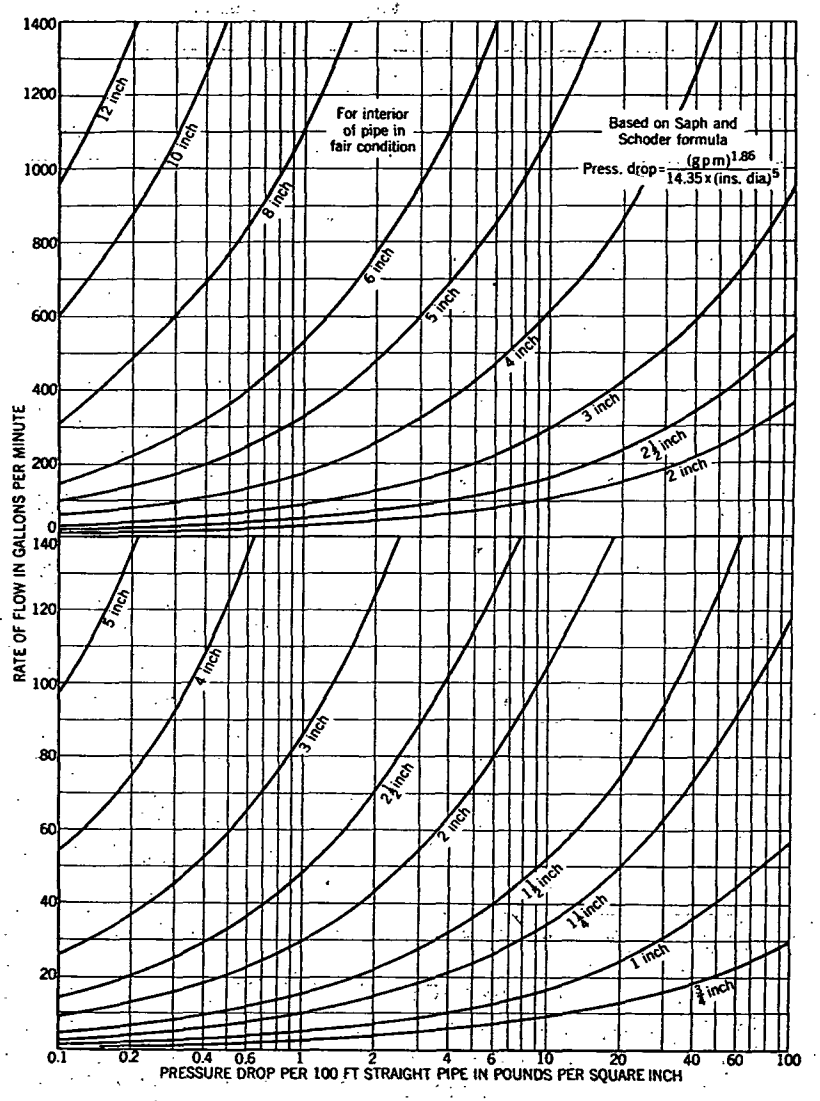

FIG. 2. CHART GIVING PRESSURE DROP FOR VARIOUS RATES OF FLOW OF WATER

should always be used to recheck the exact equivalent length of the pipe after an approximate diameter has been selected and after the number of fittings has been determined. The allowable pressure drop per 100 ft of

pipe may be determined by dividing the total allowable drop for the system by the equivalent length of the system in hundreds of feet.

The pressure drop for various rates of water flow for standard size pipes is given in Fig. 2. This chart carries an allowance for reasonable roughness of the interior surface and for the effect of many years of service. The Saph and Schoder formulae have been proved conservative not only by the *American Water Works Association* but also by various tests conducted by the A.S.H.V.E. Committee on Research.

Example 2. Assume a street pressure of 70 lb, the height of the highest fixture 50 ft, the length of the longest run 200 ft, the pressure at the top fixture 15 lb, and the pressure loss through the meter 10 lb. Without knowing the additional length of pipe to be added for the fittings it will be assumed that this is about 100 ft. The surplus pressure

TABLE 3. APPROXIMATE ALLOWANCES FOR FITTINGS AND VALVES IN FEET OF STRAIGHT PIPE

SIZE OF PIPE (INCHES)	TYPE OF FITTING OR VALVE					
	90 DEG ELBOW	45 DEG ELBOW	TEE IN RUN OF MAIN	GATE VALVE	GLOBE VALVE	ANGLE VALVE
½	2	1	1	1	17	9
¾	2	1	2	1	21	12
1	3	1	2	1	29	15
1¼	4	2	3	1	38	19
1½	5	2	3	1	45	22
2	5	3	3	1	58	28
2½	7	3	5	2	68	34
3	8	4	6	2	82	42
4	11	5	7	2	115	56
5	14	6	9	3	140	70
6	16	8	11	4	160	85

which will be available for pressure drop will then be 70 lb − (15 lb + 10 lb + 50 ft × 0.43 lb) = 70 lb − (15 lb + 10 lb + 21.5 lb) = 23.5 lb.

To change this into drop per 100 ft: $\frac{23.5 \text{ lb} \times 100}{200 \text{ ft} + 100 \text{ ft}} = 7.8$ lb per 100 ft.

The pipe may then be sized from the probable flow by selecting a size that does not give a drop in excess of 7.8 lb per 100 ft.

METHOD OF SIZING UP-FEED SYSTEMS

Example 3. A typical layout of cold water lines for a 3-story, nine-family apartment house is shown in Fig. 3. The branch to each apartment supplies 1 lavatory, 1 bath tub, 1 flush valve closet, and 1 kitchen sink. Pressure in the street main is 70 lb per square inch and a minimum pressure of 15 lb per square inch must be maintained on the top floor. Find the sizes of all parts of the system.

Solution: The first step toward the solution of such a problem is the determination of the probable flow in the various parts of the system. In Section *A*, which supplies cold water to a single apartment, the maximum flow would be as follows:

1 water closet	45 gpm
1 lavatory	3 gpm
1 tub	5 gpm
1 sink	4 gpm
	57 gpm