## HOT WATER SUPPLY PIPING

It is common practice to provide circulating piping in all hot water supply systems in which it is desirable to have hot water available continuously at the fixtures. In average sized and small residences and systems, in which the piping from the heater to the fixtures is short, return circulating piping is generally omitted in order to reduce installation cost and to reduce heat loss from the piping, particularly during periods of no water demand.

The hot water supply may be distributed by either an up-feed or down-feed piping system. Three common methods of arranging the circulating lines are shown in Fig. 7. Although the diagrams apply to multi-story buildings the arrangements (*a*) and (*b*) are sometimes used in residential designs.

A check valve should be provided in the run-out from each return riser to prevent temporary reversal of flow in the piping when a faucet is open.

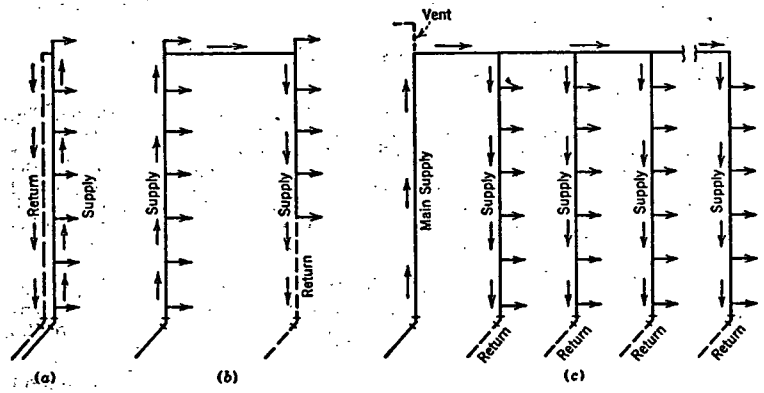



FIG. 7. METHODS OF ARRANGING HOT WATER CIRCULATION LINES.

Proper air venting of a circulating system is extremely important, particularly if gravity circulation is employed. In Fig. 7 (*a*) and (*b*) this is accomplished by connecting the circulating line below the top fixture supply. With this arrangement, air is eliminated from the system each time the top fixture is opened.

Where an overhead supply main is located above the highest fixture as in Fig. 7 (*c*), an automatic float type air vent is installed at the highest point of the system or a fixture branch is connected to the top of the main where air venting is desired and then dropped to the fixture outlet.

It is sometimes necessary to make an allowance for pressure drop through the heater when sizing hot water lines, particularly where instantaneous hot water heaters are used and the available pressure is low.

The principles involved in the sizing of the hot water supply pipes are the same as those for the sizing of cold water supply lines. For small and medium sized installations a ¾-in. hot water return will be ample. For larger installations the size of the hot water return may be computed from considerations of the heat losses in the hot water piping[3]. A throttling



valve should be placed in the hot water return pipe so that the rate of circulation may be adjusted.

Where the hot water piping system is exceedingly long, a water circulator is frequently installed and controlled from an immersion thermostat, in the return line, set to start and stop the pump over approximately a 20 F deg temperature range.

## STORAGE CAPACITY AND HEATING LOAD

In estimating the size of hot water storage tank required and the heating capacity to be provided either from the boiler or from an independent domestic hot water heater, it is necessary to know the total quantity of water to be heated per day, and the maximum amount which will be used in any one hour, as well as the duration of the peak load.

In cases where the requirements for hot water are reasonably uniform, as in residences, apartment buildings, hotels, and the like, smaller storage

TABLE 5. ESTIMATED HOT WATER DEMAND PER PERSON FOR VARIOUS TYPES OF BUILDINGS

| TYPE OF BUILDING | HOT WATER REQUIRED AT 140 F | MAX. HOURLY DEMAND IN RELATION TO DAY'S USE | DURATION OF PEAK LOAD HOURS | STORAGE CAPACITY IN RELATION TO DAY'S USE | HEATING CAPACITY IN RELATION TO DAY'S USE |
|---|---|---|---|---|---|
| Residences, apartments, hotels, etc. | 40 gal per person per day | 1/7 | 4 | 1/5 | 1/7 |
| Office buildings | 2 gal per person per day | 1/5 | 2 | 1/5 | 1/6 |
| Factory buildings | 5 gal per person per day | 1/3 | 1 | 2/5 | 1/8 |
| Restaurants<br>$0.50 meals<br>$1.00 meals<br>$1.50 meals | <br>1.5 gal per meal<br>2.5 gal per meal<br>4.5 gal per meal | | | 1/10 | 1/10 |
| Restaurants<br>3 meals per day | | 1/10 | 8 | 1/5 | 1/10 |
| Restaurants<br>1 meal per day | | 1/5 | 2 | 2/5 | 1/8 |

capacity is required than in the case of factories, schools, office buildings, etc., where practically the entire day's usage of hot water occurs during a very short period. Correspondingly, the heating capacity must be proportionately greater with uniform usage of hot water than with intermittent usage where there may be several hours between peak demands during which the water in the storage tank can be brought up to temperature. As a general rule it is desirable to have a large storage capacity in order that the heating capacity, and consequently the size of the heater, or the load on the heating boiler, may be as small as possible.

In estimating the hot water which can be drawn from a storage tank it should be borne in mind that only about 75 per cent of the volume of the tank is available, as by the time this quantity has been drawn off the incoming cold water has cooled the remainder down to a point where it can no longer be considered hot water.

Where steam from the heating boiler is used to heat domestic hot water, the computed load on the boiler should be increased by 4 sq ft EDR (equivalent direct radiation) for every gallon of water per hour heated through a 100 F rise. The actual requirement is $(100 \times 8.33)/240 = 3.48$ sq ft per