

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. 1. 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. Proper air venting of a circulating system is extremely important, particularly if gravity circulation is employed. In Fig. 1 (a) and (b) this is accomplished by connecting the circulating line below the top fixture

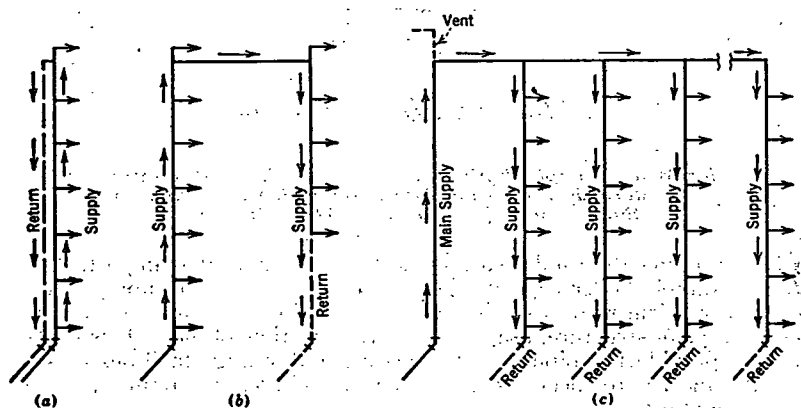


FIG. 1. METHODS OF ARRANGING HOT WATER CIRCULATION LINES

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. 1 (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. This is particularly true where instantaneous hot water heaters are used and the available pressure is low.

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

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 $\frac{100 \times 8.33}{240} = 3.48$ sq ft per gallon of water heated 100 F. The value of 4 allows for transmission losses, etc.

There are two ways in common use of estimating the hot water requirements of a building; first, by the number of people and second, by the number of plumbing fixtures installed. Where the number of people to be served is known or can be reasonably estimated, the data in Table 1 may be used.

Example 1. From Table 1, a residence housing five people would have a daily requirement of $5 \times 40 = 200$ gal per day, and a maximum hourly demand of $200 \times \frac{1}{4}$

TABLE 1. 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
Res., apts., hotels, etc.	40 gal per person per day	$\frac{1}{4}$	4	$\frac{1}{5}$	$\frac{1}{4}$
Office buildings	2 gal per person per day	$\frac{1}{5}$	2	$\frac{1}{5}$	$\frac{1}{6}$
Factory buildings	5 gal per person per day	$\frac{1}{8}$	1	$\frac{2}{5}$	$\frac{1}{6}$
Restaurants \$0.50 meals \$1.00 meals \$1.50 meals	1.5 gal per meal 2.5 gal per meal 4.5 gal per meal			$\frac{1}{10}$	$\frac{1}{10}$
Restaurants 3 meals per day		$\frac{1}{10}$	8	$\frac{1}{5}$	$\frac{1}{10}$
Restaurants 1 meal per day		$\frac{1}{5}$	2	$\frac{3}{5}$	$\frac{1}{6}$