

Hot Water Supply

Hot Water Supply Piping, Storage Capacity and Heating Load, Methods of Heating Water, Computing Grate and Coil Surface Area, Controls, Solar Water Heaters, Friction Loss

IN computing the total heating load for a building, it is important to allow ample boiler capacity for heating the hot water supply. The amount of warm water used in any large building is variable, depending on the type of structure, usage, occupancy and time of day. It is necessary to provide the piping, water heating and storage facilities of sufficient capacity to meet the peak demand without wasteful excess in equipment cost.

The determination of the amount of water used in residences has been well established over a period of time and as a result, reliable factors for water consumption are available. Tests have been made of the amount of water required by standard fixtures in normal use with water at ordinary pressures so that this information permits a fairly correct basis of design.

HOT WATER SUPPLY PIPING

As a result of investigations conducted at the *National Bureau of Standards*, basic design principles have been outlined for the design of the hot and cold water supply piping requirements in a plumbing system¹.

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. 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 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.

¹Methods of Estimating Loads in Plumbing Systems, by R. B. Hunter (*National Bureau of Standards, Report BMS65, 1940*). Plumbing Manual, Report of the Subcommittee on Plumbing, Central Housing Committee on Research, Design and Construction (*National Bureau of Standards, Report BMS66, 1940*). Water-Distributing Systems for Buildings, by R. B. Hunter (*National Bureau of Standards, Report BMS79, 1941*).

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

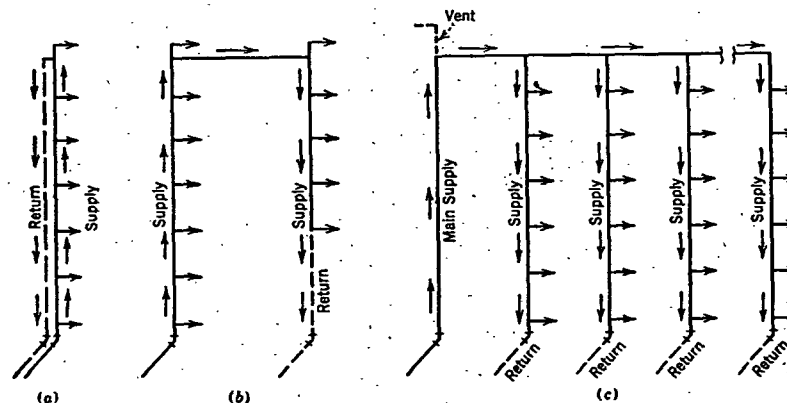


FIG. 1. METHODS OF ARRANGING HOT WATER CIRCULATION LINES

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