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 tempera-

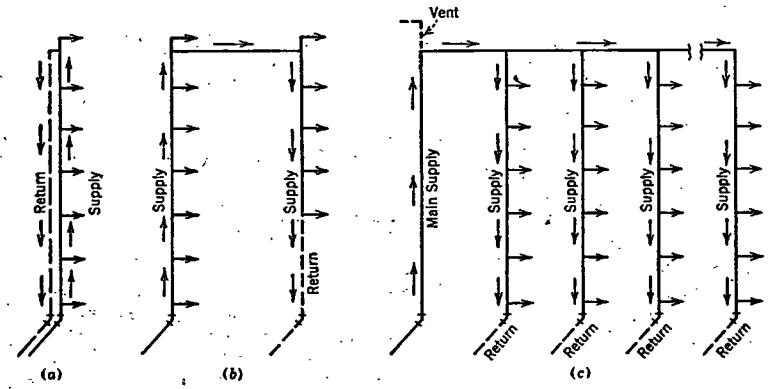

FIG. 1. METHODS OF ARRANGING HOT WATER CIRCULATION LINES

ture. 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 $200 \times \frac{1}{4} = 28.5$ gal. The heater should have a storage capacity of $200 \times \frac{1}{5} = 40$ gal and a heating capacity of $200 \times \frac{1}{4} = 28.5$ gal per hour.

The conditions given in *Example 1* may be cited as average. It is possible to vary the storage and heating capacity by increasing and decreasing one over the other. Such a condition is illustrated in *Example 2.*

Example 2. Assume an apartment house housing 200 people. From the data in Table 1: Daily requirements $= 200 \times 40 = 8000$ gal. Maximum hours demand $= 8000 \times \frac{1}{4} = 1140$ gal. Duration of peak load = 4 hours. Water required for 4-hour peak $= 4 \times 1140 = 4560$.

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
Residences apts., hotels, etc.	40 gal per person per day	1/4	4	1/5	1/4
Office buildings	2 gal per person per day	1/5	2	1/5	1/6
Factory buildings	5 gal per person per day	1/8	1	3/5	1/8
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			1/10	1/10
Restaurants 3 meals per day		1/10	8	1/5	1/10
Restaurants 1 meal per day		1/5	2	3/5	1/6

If a 1000 gal storage tank is used, hot water available from the tank $= 1000 \times 0.75 = 750$. Water to be heated in 4 hours $= 4560 - 750 = 3710$ gal. Heating capacity per hour $= \frac{3710}{4} = 930$ gal.

If instead of a 1000 gal tank, a 2500 gal tank had been installed, the required heating capacity per hour would be $\frac{4560 - (2500 \times 0.75)}{4} = 671$ gal.

Table 2 may be used to determine the size of water heating equipment from the number of fixtures. To obtain the *probable maximum demand* multiply the total quantity for the fixtures by the Demand Factor in line 11. The heater or coil should have a water heating capacity equal to this *probable maximum demand.* The storage tank should have a capacity equal to the *probable maximum demand* multiplied by the storage capacity factor in line 12. *Example 3* will illustrate the procedure.