COOLING WATER PIPING

Many installations such as cooling towers, refrigeration systems and condensers require an adequate supply of cooling water.

For condensate piping, standard weight black pipe and cast-iron flanges are generally used.

In refrigeration condensers, where water is the cooling medium, iron pipe is commonly employed. The friction loss may be determined from Fig. 4 for fairly rough pipe. If brine is the cooling medium, a correction for density should be applied. It has been found that a water velocity of about 6 fps gives the most economical results.

TABLE 7. MAXIMUM DAILY (24-HR) REQUIREMENTS FOR HOT WATER IN GALLONS
For Apartments and Private Homes

No. of Rooms	Number of Bathrooms				
	1	2	3	4	5
1	60	—	—	—	—
2	70	—	—	—	—
3	80	—	—	—	—
4	90	120	—	—	—
5	100	140	—	—	—
6	120	160	200	—	—
7	140	180	220	—	—
8	160	200	240	250	—
9	180	220	260	275	—
10	200	240	280	300	—
11	—	260	300	340	—
12	—	280	325	380	450
13	—	300	350	420	500
14	—	—	375	460	550
15	—	—	400	500	600
16	—	—	—	540	650
17	—	—	—	580	700
18	—	—	—	620	750
19	—	—	—	—	800
20	—	—	—	—	850

Hotels

	Gal per 24 Hr
Room with basin	10
Room with bath—transient	50
Room with bath—resident	60
2 Rooms with bath	80
3 Rooms with bath	100
Public shower	200
Public basins	150
Slop sink	30

HEATING LOAD AND STORAGE CAPACITY

The maximum daily and the maximum hourly hot water demand form the basis for the selection of the heater and the storage tank. Generally, in the residential dwellings, the maximum daily hot water demand will be about 20–30 gal per person. The hot water used will ordinarily depend on the number of rooms and the number of bathrooms in any house or apartment.

Table 7 gives estimates of the maximum hot water requirements in 24 hr in various types of buildings.

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 and office buildings, 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, since, 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.

TABLE 8. ESTIMATED HOT WATER DEMAND PER PERSON FOR VARIOUS TYPES OF BUILDINGS

Type of Building	Hot Water Required	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[a]	1/7	4	1/5	1/7
Office buildings	2 gal per person per day[a]	1/5	2	1/5	1/6
Factory buildings	5 gal per person per day[a]	1/3	1	2/5	1/8
Restaurants	1.8 gal per person per meal[b]			1/10	1/10
Restaurants 3 meals per day		1/10	3	1/5	1/10
Restaurants 1 meal per day		1/5	2	2/5	1/6

[a]At 140 F [b]At 180 F

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 deg rise. The actual requirement is $(100 \times 8.33)/240 = 3.48$ sq ft per gal of water heated 100 deg. The value of 4 allows for transmission losses, etc.

There are two methods in common use for estimating the hot water requirements of a building: (1) by the number of people and (2) by the number of plumbing fixtures installed. Where the number of people to be served can be reasonably estimated, the data in Table 8 may be used.

Example 3. From Table 8, a residence housing five people would have a daily requirement of $5 \times 40 = 200$ gal per day, and a maximum hourly demand of $200 \times 1/7 = 28.5$ gal. The heater should have a storage capacity of $200 \times 1/5 = 40$ gal, and a heating capacity of $200 \times 1/7 = 28.5$ gal per hr.

The conditions given in Example 3 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 4.

Example 4. Assume an apartment house housing 200 people. From the data in Table 8: Daily requirements = $200 \times 40 = 8000$ gal. Maximum hours demand =