resistant ability, and ease of application. Board or blanket types are most common.

Duct insulation must have the same characteristics as hull insulation. Semi-rigid board is most common, and the blanket type is used only for curved surfaces. Corrugated asbestos is not used because the presence of moisture tends to disintegrate it.

Preheaters are frequently located close to the outside air intake in order to conserve insulation, and for the same reason zone reheaters are located as close as possible to the zone. Where a reheater serves only one space, the heater is commonly located in the space.

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CHAPTER 50

WATER SERVICES

Estimate of Demand Load, Estimate of Pipe Capacity, Sizing of Cold Water Supply Piping, Hot Water Supply Piping, Storage Capacity and Heating Load, Methods of Heating Water, Computing Area of Heat Transmitting Surface, Control of Service Water Temperature, Solar Water Heaters

PROPER design of the water distributing system in a building is necessary in order that the various fixtures may adequately perform their function. The amount of either hot or cold water used in any building is variable, depending on the type of structure, usage, occupancy, and time of day. It is necessary to provide piping, water heating, and storage facilities of sufficient capacity to meet the peak demand without wasteful excess in either piping or equivalent cost. Most of the data on the sizing of the water supply pipes have been taken from various reports of the National Bureau of Standards[1].

ESTIMATE OF DEMAND LOAD

The demand load in building water supply systems is based on the number and kind of fixtures installed and on the probable simultaneous use of these fixtures. The essentials for making these estimates, consist principally of Table 1 giving demand weights in terms of fixture units for different plumbing fixtures under different conditions of service and Fig. 1 giving estimated demand in gallons per minute corresponding to any total number of fixture units. Fig. 2 shows an enlargement of Fig. 1 for a range up to 250 fixture units.

The estimated demand load for fixtures used intermittently on any supply pipe will be obtained by multiplying the number of each kind of fixture supplied through that pipe by its weight from Table 1, adding the products, and then referring to the appropriate curve of Figs. 1 or 2 with this sum. In using this method it should be noted that the demand for fixture or supply outlets other than those listed in the table of fixture units is not yet included in the estimate. The demands for outlets—such as hose connections, air conditioning apparatus, etc.—which are likely to impose continuous demand during times of heavy use of the weighted fixtures should be estimated separately and added to the demand for fixtures used intermittently, in order to estimate the total demand.

ESTIMATE OF PIPE CAPACITY

The size of iron pipe required to carry a given rate of flow with a given pressure drop may be determined from Fig. 3 for *Fairly Rough*, or Fig. 4 for *Rough* Pipe, respectively[2].

Ferrous pipe, after a few years of water supply service even with the best of waters in respect to corrosion and caking, will have become sufficiently roughened so that it may be considered as fairly rough pipe and, hence, Fig. 3 may be used to estimate the capacity of ferrous pipe which will carry such water. With badly corrosive or badly caking water, the flow chart in Fig. 4 should be used to estimate capacities of ferrous pipe and no pipe should be smaller than $\frac{3}{4}$ inch for this type of service.