## PROBLEMS IN PRACTICE

**1 ● The heating capacity of an indirect water heater is 100 gal per hour, using steam at 215 F and raising the water from a temperature of 50 to 150 F. Determine the heating capacity of the same water heater using water at a temperature of 180 F for the heating medium.**

Using Equation 1, and because the surface area of the water heater is the same for each condition, the two conditions may be equated as follows:

$$\frac{100 \times 8.33\ (150 - 50)}{240\left[215 - \frac{(150 + 50)}{2}\right]} = \frac{Q \times 8.33\ (150 - 50)}{100\left[180 - \frac{(150 + 50)}{2}\right]}$$

$Q$ = 28.98 gal per hour, capacity of heater using water at a temperature of 180 F.

**2 ● Why is it impractical to size water supply piping so pipe friction will produce an equal pressure on each fixture?**

Because the friction would be built up only in periods of maximum flow and at all other times it would be only a fraction of that required.

**3 ● What is the purpose of zoning water supply systems in tall buildings?**

To avoid excessive pressures in the lower stories.

**4 ● Define the maximum possible flow, the maximum probable flow, and the average probable flow.**

The maximum possible flow is the flow which would occur if all of the outlets on the system were opened at one and the same time. The maximum probable flow is the flow which will occur with probable peak conditions. The average probable flow is the flow likely to occur under a normal condition of use.

**5 ● What is the factor of usage?**

This is the percentage of the maximum possible flow which is likely to occur at peak load.

**6 ● How many feet higher than the uppermost fixtures must the water line in a house tank be to provide about 15 lb per square inch pressure at the fixture outlet?**

Allowing for pipe losses, about 45 ft.

**7 ● What methods of hot water circulation commonly are employed with hot water supply systems?**

*a.* Up-feed risers with returns having no connections paralleling the risers.
*b.* Up-feed risers with returns in other locations, and with connections taken off both supply and return.
*c.* One main up-feed riser, without connections, supplying all down-feed risers for all fixtures.

**8 ● Which method of hot water supply generally is the most satisfactory?**

The single main up-feed riser supplying drop risers for all fixtures.

**9 ● How much of the water stored in a hot water storage tank really is available for use?**

About 75 per cent, because when only 25 per cent of the original water remains in the tank it has been so cooled down by the entering water that it is too cold for satisfactory use.

**10 ● In cases of intermittent demand, does a large hot water storage tank increase or decrease the steam load for water heating?**

It decreases the steam load in cases of intermittent demand but causes no change in the steam load if the demand is constant.



Chapter 44

# TEST METHODS AND INSTRUMENTS

**Pressure Measurement, Temperature Measurement, Air Movement, Humidity Measurement, Carbon Dioxide Determination, Dust Determination, Flue Gas Analysis, Measurement of Smoke Density, Heat Transmission, Eupatheoscope**

SEVERAL types of measuring apparatus are available for accurately determining the thermal capacity and air movement of gaseous vapors and homogeneous materials. This chapter gives a brief description of the principal instruments used in connection with the proper control and testing of heating and air conditioning installations.

## TEST METHODS

The SOCIETY has adopted standard test methods or codes for testing and rating most heating, ventilating and air conditioning equipment. A list of the titles of these test codes may be referred to on pages 854 and 855. Many of the test instruments required are specified and described in these codes.

## PRESSURE MEASUREMENT

Atmospheric pressure is usually measured by a *mercurial barometer* which, in its simplest form, consists of a glass tube about 3 ft long, closed at the upper end, filled with mercury and inverted in a shallow bath of mercury. The pressure of the atmosphere on the exposed top of the mercury in the cistern supports a column of mercury in the tube to a height of about 30 in. Readings are taken of the height of the column between the levels of mercury in the tube and in the cistern. Atmospheric pressure is the same as the pressure exerted by this supported column of mercury, and, in pounds per square inch, is equal to its height in inches times 0.491, which is the weight in pounds of 1 cu in. of mercury at 32 F. At latitude 45 deg and sea level, and at a temperature of 32 F, the atmosphere will support a column of mercury 29.921 in. in height. The pressure of 14.7 lb per square inch, derived by multiplying 29.921 by 0.491, is called *standard* or *normal barometric pressure.* Since the height of the barometer depends on the density of the mercury as well as on the pressure of the atmosphere, and since the density is dependent on the temperature, mercurial barometer readings should always be corrected for temperature.