

- c. Electrical energy may be purchased at lower rates during off-peak periods and stored as heat in water kept in insulated tanks until needed.
- d. There is no wasted energy up the flue or in the ash as with fuel heating.

2 • To what localities is electrical heating adaptable?

To those localities where the heating season is relatively mild and where electrical energy is available at low cost, as in communities served by large hydro-electric plants.

3 • Approximately how low must the rates be to permit the use of electricity for heating purposes?

Probably the energy must sell for 2 cents or less per kw-hr. At 2 cents the cost would be \$5.86 per 1000 Mbh. (See Chapter 29 for comparison with other fuels.) This looks high, but the seasonal energy consumption would not be as large with electricity as with other fuels, for reasons stated in Question 1.

4 • Why is automatic control important in connection with electrical heating?

The higher cost of the energy makes it essential that none be wasted.

5 • In fan heating systems, what is an important difference between a steam heated coil and an electrically heated coil?

A coil supplied with steam at constant pressure will remain at constant temperature regardless of the amount of air passing over it. The temperature of the electric coil supplied with a constant amount of energy will rise if the air quantity is decreased and fall if the air quantity is increased.

Chapter 40

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

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 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. An *aneroid barometer* contains no liquid; it is portable but less accurate than the mercurial barometer. Atmospheric pressure in bending the thin corrugated top of a partially exhausted metallic box, or in distorting a thin-walled bent tube of metal, is made to move a pointer.

Pressures above or below atmospheric are usually measured by means of gages which indicate the difference between the pressure being measured and atmospheric pressure at the same time and place. A gage which indicates pressures higher than atmospheric is known as a *pressure gage*, and a gage which indicates pressures lower than atmospheric is known as a *vacuum gage*. The most common type of these gages contains a flexible hollow brass tube of oval cross section, known as a *Bourdon tube*. When subjected to unequal inside and outside pressures, this tube tends to straighten out, and a pointer motivated by this straightening indicates the pressure difference on a suitably graduated scale.

High vacuum readings such as are encountered in condenser and steam jet refrigeration practice are commonly obtained by the use of mercury column vacuum gages. When the readings obtained with the mercurial barometer and those with the mercury vacuum gage have both been corrected to 32 F, the difference in the two readings will give the absolute