entire environment, can be cooled by placing him in a small cooled and ventilated booth, by blowing cooled air over him, or by circulating cooled air through a loose-fitting suit [22].

ACCLIMATIZATION

Acclimatization and the factor of psychology are two important influences in air conditioning which cannot be ignored. The first is man's ability to adapt himself to changes in air conditions; the second is an intangible matter of habit and suggestion.

Some persons regard the unnecessary endurance of cold as a virtue. They believe that the human organism can adapt itself to a wide range of air conditions with no apparent discomfort or injury to health. In the light of present knowledge of air conditioning these views are not justified. Acclimatization to extreme conditions involves a strain upon the heat regulating system and interferes with the normal physiologic functions of the human body. Thousands of years in the heat of Africa do not seem to have acclimatized the Negro to a temperature exceeding 80 F. The same holds true of northern races with respect to cold, although the effects are mitigated by artificial control. An environment averaging 64 F for the 24-hour period has been indicated as associated with minimal mortality [23].

Within limits, however, there does occur a definite adaptation to external temperature level. People and animals raised under conditions of tropical moist heat stand chilling poorly as they are unable quickly to increase internal combustion to keep up the body temperature. For this reason they have trouble standing the cold, stormy weather of the temperate zones, and when exposed to it are very susceptible to respiratory infections. Likewise, people living in cool climates suffer greatly in the moist heat of the tropics until their adaptive mechanism has been adjusted. Within a few years, however, they find themselves reacting as natives to the new environment.

The adaptive level changes somewhat with the season [24]. There are also marked differences between the sexes. In the cold zone the thickness of thermal insulating tissues of women is almost double that of men, although the sensory responses to cold are similar. In the hot zone, the threshold of sweating and skin temperature levels are higher for women. The thickness and insulating value of the clothing worn is also an important factor in the determination of the comfort level.

In recent tests made at the A.S.H.V.E. Research Laboratory [25], subjects were required to perform light work under very hot conditions for a four hour period each day. It was found that the ability of a new subject to endure these conditions showed daily improvement for a period of at least two weeks. However, after acclimatization was completed, a recess of several days had no effect on the endurance of the subject.

EFFECTIVE TEMPERATURE INDEX

The primary purpose of comfort air conditioning is to provide an environment in which the body can easily maintain its thermal equilibrium, and thereby experience a feeling of comfort. It is important, therefore, that the designing engineer know what conditions are necessary for comfort.

Sensations of warmth or cold depend, not only on the temperature of the surrounding air as registered by a dry-bulb thermometer, but also upon the temperature indicated by a wet-bulb thermometer, upon air movement and upon radiation effects. Dry air at a relatively high temperature may feel cooler than air of considerably lower temperature with a high moisture content. Air motion makes any moderate condition feel cooler. Radiation to cold or from warm surfaces is another important factor under certain conditions.

Combinations of temperature, humidity, and air movement which induce the same feeling of warmth are called thermo-equivalent conditions. A series of studies [26] at the A.S.H.V.E. Research Laboratory established the equivalent conditions met with in general air conditioning work. This scale of thermo-equivalent conditions not only indicates the sensation of warmth, but also to a considerable degree determines the physiological *effects* on the body induced by heat or cold. For this reason, it is called the *effective temperature* scale or index, and it denotes sensory heat level.

Effective temperature is an empirically determined index of the degree of warmth perceived on exposure to different combinations of temperature, humidity, and air movement. It was determined by trained subjects who compared the relative warmth of various air conditions in two adjoining conditioned rooms by passing back and forth from one room to the other.

The numerical value of the index for any given air conditions is fixed by the temperature of slowly moving (15 to 25 fpm air movement) saturated air which induces a like sensation of warmth or cold. Thus, any air condition has an effective temperature of 60 deg, when it induces a sensation of warmth like that experienced in slowly moving air at 60 deg saturated with moisture. The *effective temperature index* cannot be measured directly but is determined from dry- and wet-bulb temperature and air motion observations by reference to an Effective Temperature Chart (see Figs. 4, 5 and 6) or tables.

Fig. 4 gives the effective temperature for any combination of dry- and wet-bulb temperatures for *still air* (15 to 25 fpm) conditions. Charts similar to Fig. 4 for air velocities of 300 and 500 fpm have been presented in some of the earlier editions of the GUIDE. Fig. 5 is another form of effective temperature chart embodying all three variables; dry-bulb and wet-bulb temperatures, and air velocity.

As stated previously, effective temperature is an index of the degree of warmth experienced by the body. An effective temperature line is, therefore, a line defining the various combinations of conditions which will induce like sensations of warmth. It does not necessarily follow that like sensations of comfort will also be experienced along the entire length of an effective temperature line. Some degree of discomfort is likely to be experienced at very high or very low relative humidities, regardless of the effective temperature. It has also been found that the optimum effective temperature varies with the season, and is lower in winter than in summer.

Fig. 6, commonly referred to as the Comfort Chart [27], is an effective temperature chart on which the summer and winter *comfort zones* have been indicated. These zones indicate the various combinations of conditions under which 50 per cent or more of the people are comfortable. Curves showing the percentage of subjects comfortable at each effective