

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 averaging 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 is associated with minimal mortality²³.

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 trained. Within a couple of years, however, they find themselves standing the heat much better and disliking the cold.

The adaptive level changes somewhat with the season²⁴. There are also marked differences between the sexes. In the cold zone the thickness of the 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 both higher for women.

Finally, the thickness and insulating value of the clothing worn is an important factor in the determination of the comfort level.

EFFECTIVE TEMPERATURE INDEX

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 from cold or 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 tests^{25,26,27,28} at the A.S.H.V.E. Research Laboratory,

²³Civilization and Climate, by Ellsworth Huntington, Yale University Press, 1928.

²⁴The Reactions of the Clothed Human Body to Variations in Atmospheric Humidity, by C.-E. A. Winslow, L. P. Herrington and A. P. Gagge (*American Journal of Physiology*, Vol. 124, December, 1938, p. 692).

²⁵A.S.H.V.E. RESEARCH REPORT No. 673—Determination of the Comfort Zone, by F. C. Houghten and C. P. Yaglou (*A.S.H.V.E. TRANSACTIONS*, Vol. 29, 1923, p. 361).

²⁶A.S.H.V.E. RESEARCH REPORT No. 691—Cooling Effect on Human Beings by Various Air Velocities, by F. C. Houghten and C. P. Yaglou (*A.S.H.V.E. TRANSACTIONS*, Vol. 30, 1924, p. 193).

²⁷A.S.H.V.E. RESEARCH REPORT No. 717—Effective Temperature with Clothing, by C. P. Yaglou and W. E. Miller (*A.S.H.V.E. TRANSACTIONS*, Vol. 31, 1925, p. 89).

²⁸A.S.H.V.E. RESEARCH REPORT No. 755—Effective Temperature for Persons Lightly Clothed and Working in Still Air, by F. C. Houghten, W. W. Teague, and W. E. Miller (*A.S.H.V.E. TRANSACTIONS*, Vol. 32, 1926, p. 315).

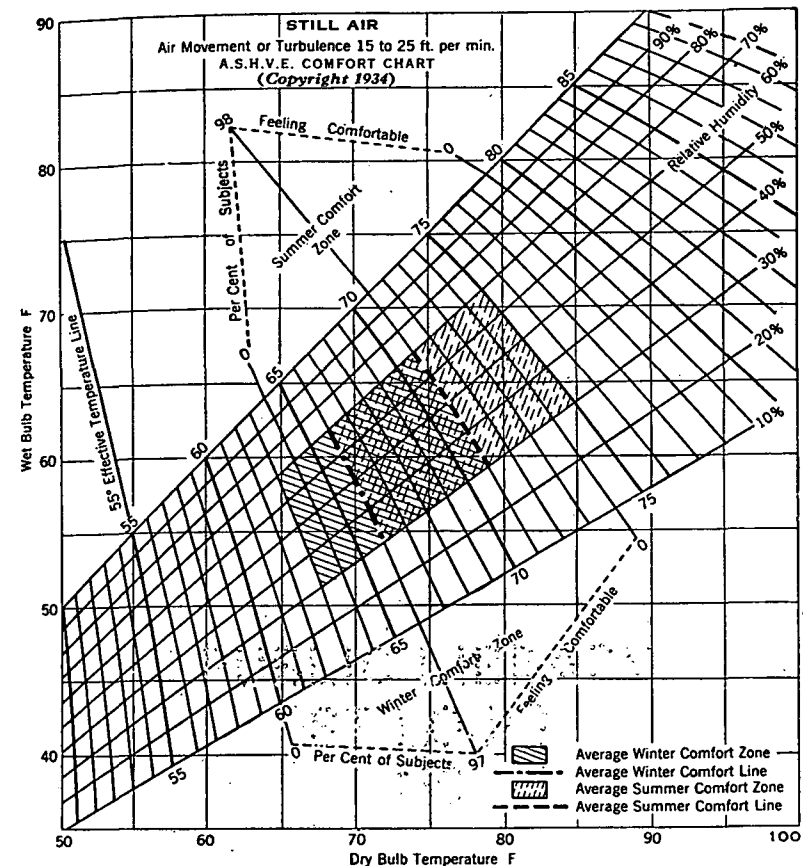


FIG. 6. A.S.H.V.E. COMFORT CHART FOR AIR VELOCITIES OF 15 TO 25 FPM (STILL AIR)

Note.—Both summer and winter comfort zones apply to inhabitants of the United States only. Application of winter comfort line is further limited to rooms heated by central station systems of the convection type. The line does not apply to rooms heated by radiant methods. Application of summer comfort line is limited to homes, offices and the like, where the occupants become fully adapted to the artificial air conditions. The line does not apply to theaters, department stores, and the like where the exposure is less than 3 hours.

Pittsburgh, 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 determines the physiological effects on the body induced by heat or cold. For this reason, it is called the *effective temperature* scale or index.

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 ad-