METABOLIC HEAT AND THERMAL COMFORT IN OFFICES

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Dissipation of excess metabolic heat is necessary for human thermal comfort. International standards ISO 7730 (1994) and ASHRAE Standard 55 (1992) are based on steady state equilibrium theories of heat exchange between the subject and the environment They rely on evaluation or estimation of physical variables (air temperature, mean radiant temperature, air velocity and humidity) and personal variables (insulation provided by clothing and rate of production of metabolic heat). Despite a solid research base dissatisfaction with thermal comfort remains the most common cause of complaint by office workers. In recent years a number of careful field studies have been conducted in an effort to resolve this anomaly. In this work researchers find the most challenging task is the determination of metabolic rate of subjects. The four physical variables can be measured with high orders of accuracy. The sum of reported values for each item of clothing gives a reasonably accurate estimate of the total. In the absence of a practicable method of measuring metabolic rate directly in the field, participants indicate types of activity performed during the immediately preceding hour and a weighted pro rata total of values as tabulated in the ISO and ASHRAE standards is accepted as an estimate of the current rate. A study by Brager *et al.* (1994) reviewed estimates of group average metabolic rate from several high quality field studies and concluded that an robust value for a large group of office workers is 1.2 met. The author has conducted a longitudinal field study of thermal comfort in an office building in Sydney, Australia. The site was visited on two occasions each month from July 1996 to June 1998 with a break of five months from February to August 1997. On each occasion participants were visited twice, in the morning and afternoon. A total of 1626 sets of data including details of metabolic activity over the preceding hour were obtained from 144 participants. Estimates of metabolic rate showed considerable between subject variation over a range from 1.0 to 1.9 met. Fifty percent were less than 1.2 met and 31 percent were above. 532 morning/afternoon pairs were collected and reveal that for 78 percent of respondents the estimate for the afternoon different from that obtained in the morning. Mean values were, however, constant at 1.2 met during the whole period of the study. ISO rules for estimation of comfort temperature indicate a change of 0.1 met will produce a change equivalent to a temperature change of 1°C and a change of 0.4 met will cause a sensation change of at least 2.5°C. It is concluded that the value of 1.2 met for a large group of office workers is robust; but that random individual variability caused by the changing demands of the job and possibly lunchtime recreation may be an unrecognised and difficult to diagnose cause of much of the complaint about thermal comfort in offices. The only corrective for this situation would be individual control of the personal thermal environment.

Brager, G.S., Fountain, M., Benton, C.C., Arens, E.A. & Bauman, F.S. (1994) A Comparison of Methods for Assessing Thermal Sensation and Acceptability in the Field. Thermal Comfort: Past Present and Future, 17-38. BRE, London.

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