
USE OF GLOBE STEREO THERMOMETER FOR EVALUATION OF IRREGULAR RADIATION LOAD

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Introduction: The aim of this study was to verify globe stereo thermometer as appropriate indicator of irregular radiation load and to develop criteria for evaluation of irregular radiation load in environmental and occupational settings.

Methods: Experiments were held in climate chamber in a group of 20 (10 men and 10 women). Experimental persons (EPs) were dressed in uniform suit with thermal resistance 0.7 clo. The resultant temperature of globe thermometer (t_g) at the height of head was convenient in all experiments with optimal conditions for mental work in sitting position i.e. 24 °C. The difference between radiation temperature in direction of radiation (t_{rA}) and t_g ($\Delta t_{rA}-t_g$) in case of vertical radiation surface was in individual experimental conditions ± 0 , ± 5 , ± 10 and $+20$ °C, in case of horizontal radiation surface in range from $+20$ to $+34$ °C (radiation intensity 100 and 200 W.m⁻²). The air velocity (v_a) was 0.25 m.s⁻¹ in all experiments. In the course of experiments thermal and humidity settings were continually measured in the height of head (110 cm) i.e. t_g and stereo temperature (t_{stereo}) measured by globe stereo thermometer Jokl-Jiráček and recorded into the computer. Parameters t_a , v_a , t_{rA} and RH (Relative humidity) were measured by Indoor Climate Analyser type 1213 Bruel a Kjaer. EPs were exposed to the same conditions always for a time of 1 hour. In cause of experiments EPs were sitting next to computer (in case of vertical radiation surface forehead to the source of radiation) and were solving computer games making demands on attention and short term operational memory. In the first and last experiment EPs exposed to

the optimal thermal conditions in which dry air temperature (t_a), t_{rA} and t_g were identically 24 °C. Of physiological parameters values of heart frequency, skin temperature at six places on body surface and body temperature were continually measured and recorded. At the end of experiment each person filled questionnaire including total temperature sense impressions. Temperature sense impressions were expressed in scale ASHREA (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) in range -3(cold) to +3 (hot). Data was analysed by correlation and regression analysis.

Results: In all conditions stereo temperature correlated significantly ($R = 0.99$) with radiation temperature measured by the Bruel a Kjaer device. Values of parameters $\Delta(t_r - t_g)$ the same as $\Delta(t_{\text{stereo}} - t_g)$ correlated significantly with total thermal sense impressions expressed in ASHREA scale both in experiments with hot and cold vertical radiation surface and in experiments with horizontal radiation surface. Acceptable limits for irregular radiation load for work with energetic rate up to do 110 W.m⁻² were proposed with regard to ventilation system. For category A, B and C limit values $\Delta(t_{\text{stereo}} - t_g)$ (°C) on level in compliance with sense impressions of heat or cold were established as $\pm 0,67$, $\pm 1,25$ and ± 2 by ASHREA.

Conclusion: Whereas stereo temperature correlates well with radiation temperature it can be used for calculation of radiation temperature and for evaluation of radiation asymmetry (Δt_{pr}) in accordance with EN ISO 7730 or it can be used together with resulted temperature of globe thermometer as a suitable indicator of both total and irregular temperature load.