
GLOBE STEREO THERMOMETER – A NEW DEVICE FOR MEASUREMENT OF IRREGULAR RADIATION LOAD IN THE ENVIRONMENT AND OCCUPATIONAL SETTINGS

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Introduction: Irregular radiation load influences well-being at work and work efficiency. The essentials for measurement and assessment are contained in EN ISO 7730:2005 Standard. This research work was aimed at verification of the Jokl-Jiráček globe stereo thermometer produced by SIPOCH Prague, for assessment of irregular thermal load. The globe thermometer with a sphere mean of 15 cm, a metal coating of which is created by six collaterally separated identical segments fixed on a non-conducting core. The core composition prevents from heat transmission by conveyance and radiation among adjacent and opposite segments. Temperature of individual segments is being recorded by thermal detectors fixed on inner surface. Temperature records in all segments are continually registered and saved in a pad device which simultaneously calculates the resultant globe temperature as a mean of the temperatures of the six segments.

Methods: The experiments were held in a climate chamber at the Institute of Public Health in Ostrava. The experiments were divided into three phases according to the air velocity: I. $v_a = 0.25 \text{ m.s}^{-1}$, II. $v_a = 0.5 \text{ m.s}^{-1}$ and III. $v_a = 1.0 \text{ m.s}^{-1}$. The resultant globe temperature (t_g) was convenient with optimal conditions for mental sedentary work, i.e. 24°C . There were six conditions related to vertical radiation surface ($\Delta t_r - t_g = -10, -5, 0, +5, +10, \text{ and } +20^\circ\text{C}$) and three ones related to horizontal radiation surface with radiation intensity 100, 150, and 200 W.m^{-2} in each phase. Dry air temperature in positive radiation load was lower than 24°C ; on the contrary it was higher in negative radiation load. Thermal and humidity settings in the climate chamber were continually measured at a height of 110 cm by Indoor Climate Analyser type 1213 by Bruel & Kjaer. Resultant globe temperature and stereo temperature were measured by globe stereo thermometer developed by research team.

Results: Correlation between stereo temperature (t_{stereo}) measured by the Jokl-Jiráček globe stereo thermometer and radiation temperature (t_{rA}) measured by the Bruel & Kjaer device was almost perfect ($R = 0.99$) in all phases. Radiation temperature (t_{rA}) is not dependent on air circulation whereas t_{stereo} is. Due to explicit correlation of $\Delta(t_{\text{stereo}} - t_g)$ with difference in radiation temperature $\Delta(t_{rA} - t_{rB})$ it proves possible to use stereo temperature to calculate radiation temperature and to assess radiation asymmetry (Δt_{pr}) pursuant to EN ISO 7730:2005 or can be stereo temperature along with resultant globe temperature used as an appropriate indicator of total and irregular thermal load.

Conclusion: The Jokl-Jiráček globe stereo thermometer enables simultaneous measurement of t_{stereo} and t_g . Stereo temperature may be used to calculate t_r or, along with t_g may be further used as an appropriate indicator of total and irregular thermal load.