

A Database of Static Clothing Thermal Insulation and Vapor Permeability Values of Non-Western Ensembles for Use in ASHRAE Standard 55, ISO 7730, and ISO 9920

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Hashem Akbari, Professor, Concordia University, Montreal, QC, Canada: Typically, the clothing data are presented as the physical properties of clothing and do not include film coefficient (convection coefficient). Is there a reason that you included film coefficient in your data for clothing?

George Havenith: Indeed, in our slide presentation I presented the data only as “total insulation,” which is composed of the intrinsic clothing insulation and the surface air layer insulation (corrected for the increase in outer surface area due to clothing). The surface air layer insulation consists of the inverse of the sum of the convective and radiative heat transfer coefficients of the air layer, as you indicate.

In the actual publication, however, you will also find the separate data for intrinsic clothing insulation and for the outer surface air layer and for the correction factor for surface area “ f_{cl} .” This matches the conventional presentation.

For reasons of presentation time limits, I could not show this breakdown in components and chose to show the overall effects on the total insulation only in the presentation.

Ahmad Al-Sahhaf, PhD, Ministry of Electricity and Water, Nuzha, Kuwait: 1) Have you considered using infrared thermography in the study? 2) The presentation shows emphasis of the effect of convection heat transfer without the effect of radiation. The color of the clothing has a strong effect on thermal comfort. Is this aspect taken into account in the study?

George Havenith: 1) We tend to use infrared (IR) thermography in our research, but have not done so in this study. IR pictures would have provided us with the outer surface

temperatures of the clothing, which has no direct role in the application of the standard. The average outer surface temperature can also be deducted in a different way, by knowing the intrinsic insulation and the outer air layer insulation—the ratio of the two links to the ratio of the temperature gradient between skin, the clothing, and environment.

2) The main application of ANSI/ASHRAE Standard 55-2013 is in indoor environments. As we have shown before for indoor and for solar radiation (Bröde et al, 2010. Heat gain from thermal radiation through protective clothing with different insulation, reflectivity and vapour permeability, *International Journal of Occupational Safety and Ergonomics* 16(2):231–44.), clothing color is irrelevant in the absence of direct solar radiation but does affect heat transfer in the visible solar spectrum. Thus, given the focus of this project on indoor conditions and the limits to the funding, the effect of solar radiation was not studied.