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Published: 2016-10-18

Document Version
Publisher’s PDF, also known as Version of record

Link to publication

Citation for published version (APA):
The Testing Methods with Thermal Manikins: Standard Procedures and Their Practical Use

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Abstract

There are available many standards that do utilise thermal manikins in one or another way. First, of course, there are the standards that describe thermal manikins and the specific methods [1, 2]. Then, there are the standards that do define the method and set the requirements/define the use [3-5], and those that utilise manikin results in one or another way [6-9]. The ones that do involve both methods, requirements and/or user performance estimation either in the same standard or in a directly related one, have often a better connection between test results and possible effect on performance. In product standards the latter part may also be weak as the classification per se is considered as the most important there.

With thermal properties of apparel and thermal environment evaluation where environment, clothing and activity all interact, however, it is not often true. My opinion is that if a test is carried out then the test conditions should be chosen so that the results are easily usable as widely as possible. For example, many standards on ergonomics of the thermal environment [6-9] do utilise basic clothing insulation as input. EN 342 on cold protective clothing [10] requires walking tests with air velocity of around 0.4 m/s, and the results cannot be directly implemented into ISO 11079 [8] for finding proper clothing insulation for specific user needs and environmental conditions. It would, thus, require additional testing or more complicated calculations that both increase costs for the end user. Considering this, the suggested testing procedures and correction algorithms for insulation and evaporative resistance in ISO 9920 [9] are very useful. In this standard, however, some other issues may arise with adding up individual garments, as clothing design, draping, number of layers, way of overlap etc. is not considered, and error may exceed 30 % [11]. Also, correction equations do not count for all possible clothing design [12]. If any thermal stress prediction algorithms of another standard have counted in clothing behaviour differently, then a more advanced correction may still not fit in and lead to unexpected errors in final estimations [13]. For some products, e.g. headgear and footwear, the standard methods to determine the most important clothing properties – thermal insulation and evaporative resistance, are not yet available in spite of the available methodology [14, 15]. The development of these should consider the latest research and set test requirements from the user and usability perspective.

References:


