

49 Biophysical devices for measuring heat transfer through clothing materials

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At our Institute the assessment of heat exchange and vapor transmission through clothing materials is currently achieved by a series of techniques and devices.

1. Wetttable flat plate - Heat transfer properties of fibers and fabrics are carried out by use of a heated, wetttable flat plate. The plate consists of three separate heated and controlled sections. All heat leaving these test sections passes through the fiber or fabric, The plate allows the user to determine the dry heat transfer (clo) and the evaporative heat transfer (h) of flat pieces of materials before they are made into part of a clothing ensemble.
- 2) Copper hand - A sectional copper hand is employed for prototype handwear items. The copper hand has twenty-three thermally isolated sections which allows the evaluation of total and individual regional insulation values of handwear items.
- 3) Copper feet -Two sectional copper feet are employed for footwear items. Each foot has twenty-eight thermally isolated sections. Total and individual regional insulation values of footwear items are processed on a microcomputer.
- 4) Copper manikins (static) - three types of manikin are currently used to measure the static heat transfer properties of clothing ensembles. The first type consists of single circuit manikins which allow the measurement of the overall insulation and permeability of clothing without control of the surface temperature pattern. The second type allows temperature control of specific zones. Such manikins allow the measurement of insulation but not vapor permeability of clothing ensembles. These manikins have fifteen individually heated zones which allow control of the surface temperature pattern. The third type of manikin is a sectional manikin which measures overall and individual regions for insulation and vapor permeability properties. This manikin has six thermally isolated, individually controlled sections which allow control over surface temperature pattern. All of the static manikins are presently manually controlled with AC power. Work is underway to modify these manikins with individual DC power supplies thereby allowing use of computer control and data acquisition system.
- 5) Copper manikin (articulated) -This manikin has nineteen individually heated zones that control surface temperature pattern and measure insulation and vapor permeability of clothing ensembles. This manikin has the potential of generating walking motion up to 1.56 ms⁻¹ thereby allowing the study of thermal changes in clothing associated with movement.