International Standard

ISO 11092

Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)

Textiles — Effets physiologiques — Mesurage de la résistance thermique et de la résistance à la vapeur d'eau en régime stationnaire (essai de la plaque chaude gardée transpirante)

Third edition
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This document was prepared by Technical Committee TC38, *Textiles,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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This third edition cancels and replaces the second edition (ISO 11092:2014), which has been technically revised.

The main changes are as follows:

— the Normative references clause (Clause 2) has been added and subsequent clauses have been renumbered;

— in 8.1.3.1, the water supplied to the measuring plate has been changed to Grade 3 water in accordance with ISO 3696;

— in 9.1 and 9.2, the thermal resistance values have been changed to standard notation;

— in 9.1, the precision is no longer only applicable to foams;

— in 9.2, the reproducibility of the water vapour resistance values has been updated based on the results from the interlaboratory test in 2025;

— Annex C has been made normative;

— a Bibliography has been added.

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Introduction

This document is the first of a number of standard test methods in the field of clothing comfort.

The physical properties of textile materials which contribute to physiological comfort involve a complex combination of heat and mass transfer. Each can occur separately or simultaneously. They are time-dependent, and can be considered in steady-state or transient conditions.

Thermal resistance is the net result of the combination of radiant, conductive and convective heat transfer, and its value depends on the contribution of each to the total heat transfer. Although it is an intrinsic property of the textile material, its measured value can change through the conditions of test due to the interaction of parameters, such as radiant heat transfer with the surroundings.

Several methods exist which can be used to measure heat and moisture properties of textiles, each of which is specific to one or the other and relies on certain assumptions for its interpretation.

The sweating guarded-hotplate (often referred to as the “skin model”) described in this document is intended to simulate the heat and mass transfer processes which occur next to human skin. Measurements involving one or both processes can be carried out either separately or simultaneously using a variety of environmental conditions, involving combinations of temperature, relative humidity, air speed, and in the liquid or gaseous phase. Hence transport properties measured with this apparatus can be made to simulate different wear and environmental situations in both transient and steady-states. In this document only steady-state conditions are selected.

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Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)

1 Scope

This document specifies methods for the measurement of the thermal resistance and water-vapour resistance, under steady-state conditions, of e.g. fabrics, films, coatings, foams and leather, including multilayer assemblies, for use in clothing, quilts, sleeping bags, upholstery and similar textile or textile-like products.

The application of this measurement technique is restricted to a maximum thermal resistance and water-vapour resistance which depend on the dimensions and construction of the apparatus used (e.g. 2 m^2·K/W and 700 m^2·Pa/W respectively, for the minimum specifications of the equipment referred to in this document).

The test conditions used in this document are not intended to represent specific comfort situations, and performance specifications in relation to physiological comfort are not stated.

2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
thermal resistance
R_{ct}
temperature difference between the two faces of a material divided by the resultant heat flux per unit area in the direction of the gradient

Note 1 to entry: It is a quantity specific to textile materials or composites which determines the dry heat flux across a given area in response to a steady applied temperature gradient. The dry heat flux can consist of one or more conductive, convective and radiant components.

Note 2 to entry: Thermal resistance is expressed in square metres kelvin per watt.

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