SLOVENSKI STANDARD
SIST EN 17534:2023

01-januar-2023

Tekstilije - Fiziološki učinki - Merjenje prenosa tekočega znoja in pufranja

Textiles - Physiological effects - Measurement of liquid sweat transport and buffering

Textilien - Physiologische Wirkungen - Messung des flüssigen Schweißtransports und der flüssigen Schweißpufferung

Textiles - Effets physiologiques - Mesurage du transfert de sueur liquide et de l'effet tampon vis-à-vis de la sueur liquide

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Textilien - Physiologische Wirkungen - Messung des flüssigen Schweißtransports und der flüssigen Schweißpufferung

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 17534:2022) has been prepared by Technical Committee CEN/TC 248 “Textiles and textile products”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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Introduction

For the assessment of the physiological properties of textiles worn next to the skin, not only their thermophysiological properties in stationary conditions (thermal and water vapour resistance) are important, which can be measured according to EN ISO 11092 with the sweating guarded-hotplate (Skin Model), but also their capacity to buffer in stationary sweat pulses and to transport liquid sweat, occurring in the practical use of textiles and clothing.

With liquid sweat appearing on the wearer's skin, the textiles take it up and transport it into the next textile layers or into the environmental air. This so-called buffering capacity and transport of liquid water (sweat) of a textile is measured quantitatively with the sweating guarded-hotplate, slightly modified from the design and procedures described in the above standard. A textile is judged to perform better, the more efficient the transport of sweat from the skin is, and the less liquid sweat remains on the skin.

1 Scope

This document specifies a test method for measuring liquid sweat management properties of knitted, woven and nonwoven textile fabrics, namely buffering index, sweat transport and sweat uptake.

2 Normative references

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.

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

EN ISO 11092, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test) (ISO 11092)*

3 Terms and definitions

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

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

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

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

3.1
uptake
buffering
effect measured by the quantity of liquid water remaining in the textile material in grams during and after a period of time in contact with water

3.2
sweat transport
F
amount of liquid water (sweat) in grams taken up by 1 m² of the textile material and within 1 h transported into ambient air with specific temperature and relative humidity

3.3
liquid sweat management
combining of the uptake or buffering of the sweat from the skin, on one hand, and of the transport of the sweat from the skin to the ambience, on the other hand

3.4
moisture permeability
F_1
effect measured by the amount of liquid water in grams taken up by 1 m² of the textile material and within 1 h transported into ambient air with a water vapour pressure gradient of 1 hPa between the two sides of the textile material

3.5
sweat uptake
G_2
effect measured by the portion of liquid water remaining in the textile material in grams after 15 min of contact with water

3.6
buffering index
K_f
ratio of the sum of liquid water transported through the textile material (G_1) and remaining in the textile material (G_2) in grams after 15 min of contact with water, to the total amount of water injected into the textile material (G_0) in grams

4 Reagents

Grade 3 water compliant with EN ISO 3696.

5 Test accessories

5.1 Thin foil

A thin foil sized 25 cm × 25 cm which is water and water vapour impermeable. A suggested material for the foil is PET (polyethylene terephthalate) with a thickness of 0,1 mm. The thin foil shall present a good thermal stability and a good planarity to enable close contact with the plate of the skin-model.

NOTE The foil prevents the water from being wicked into the measuring unit for the duration of the test.

5.2 Polyester woven fabric

A polyester woven fabric with a mass of (100 ± 3) g/m² and a size of 20 cm × 20 cm[1)].

NOTE This fabric simulates distribution of sweat on skin.

Water absorbency of this fabric can be checked using the method described in Annex A of ISO 17617:2014 (drop test).

When soiling is visible, this polyester woven fabric shall be cleaned. The cleaning procedure is as follows: the polyester woven fabric is rinsed in distilled water at room temperature until the soiling has been removed. Then the fabric is air-dried at room temperature.

5.3 Frame (for method B)

A frame made of material with a low thermal conductance, for example synthetic resin.

Dimensions of the frame are:

— outer size: 300 mm × 300 mm;

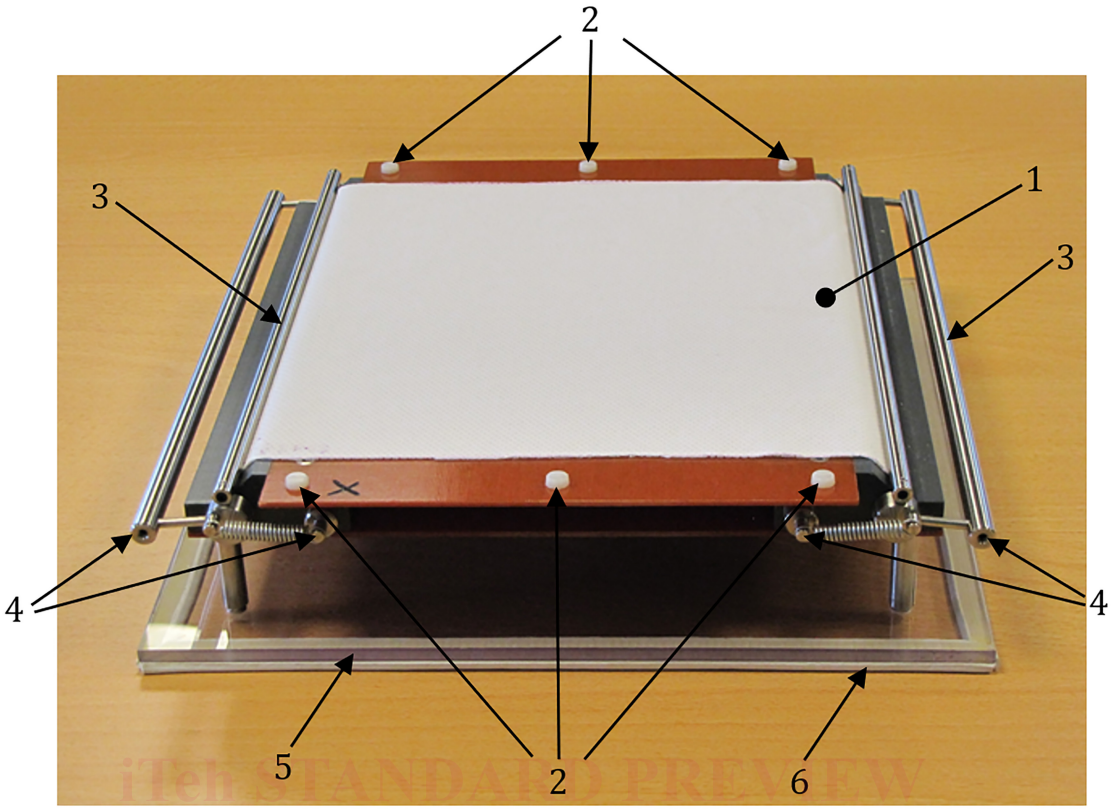
— inner size: 230 mm × 230 mm;

— thickness: (2 ± 0,1) mm.

5.4 Specimen carrier

A specimen carrier, see Figure 1.

[1)] A suitable reference for the polyester woven fabric is 'Vektron 4003' produced by Klopman International, Berliner Strasse 101, D-40880 Ratingen, Germany. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN/TC248 of the product named. Equivalent products may be used if they can be shown to lead to the same results.



Key

1 test specimen
2 spacers
3 clips (closed position)
4 mechanism to open and close the clips
5 lid
6 gasket

Figure 1 — Specimen carrier in reverse position

The lid shall be large enough to be laid down on the frame and cover the sample without touching it. Spacer height shall be 3 mm.

The use of the specimen carrier is illustrated in Annex A, Figures A.1 to A.8.

6 Measurement and test methods

6.1 General

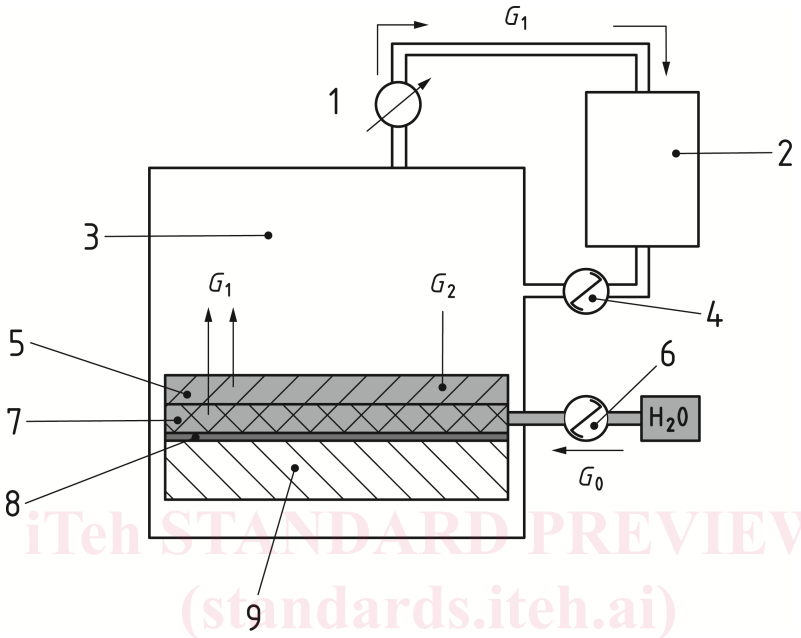
Two methods are described. Method A implies a technical modification by adding a gas meter to the sweating guarded-hotplate. If it is not possible to modify the equipment, method B can be used on any sweating guarded-hotplate compliant with EN ISO 11092.

It has been shown that both methods provide similar results.

6.2 Method A

6.2.1 Principle

The buffering capacity and transport of liquid sweat of a textile material is measured with the sweating guarded-hotplate, specified in EN ISO 11092, with as additional components a gas meter and two temperature sensors at the inlet and outlet of the gas meter (Figure 2).



Key

1	gas meter	7	polyester woven fabric
2	drying column	8	water and water vapour impermeable foil
3	climatic cabinet (35 °C, 30 % RH)	9	measuring unit
4	air pump	G_0	water injected in the polyester woven fabric
5	test specimen	G_1	water transported through the test specimen
6	syringe	G_2	sweat uptake

Figure 2 — Principle of apparatus

To perform the test the sweating guarded-hotplate's measuring unit kept at 35 °C is covered with the thin foil. On top of the foil the polyester woven fabric is placed.

During the test, the air stream (velocity (1 ± 0,05) m/s) in the climatic cabinet of the sweating guarded-hotplate is maintained at a constant temperature of (35 ± 0,5) °C with a relative humidity (RH) of (30 ± 3) %. This is effected by the climatic cabinet's air pump set to a pumping power of 3 000 l/h. With this pump the air of the climatic cabinet is circulated through a drying column filled with silica gel as drying agent. The total volume of the air circulated during the test period of 15 min is determined by a gas meter.

During the test, water vapour diffusion is taking place through the test specimen due to the difference in water vapour pressure between the surface of the polyester woven fabric placed on the measuring unit and the air within the climatic cabinet. In addition the test specimen is absorbing water out of the underlying polyester woven fabric, which is simulating the sweating human skin. This water absorbed by the test specimen is also at least partly evaporated into the air of the climatic cabinet. The total amount of moisture in the form of water vapour being transported into the ambient air is determined by the moisture content of the air volume which has to be circulated from the climatic cabinet through the drying

column in order to maintain the water vapour pressure within the climatic cabinet at its set value of 30 % RH (= 16,9 hPa).

Optionally the specimen carrier (5.4) can be used to enhance the reproducibility of the measurements. This device has two functions: (1) in normal position it acts as a specimen carrier and (2) when it is reversed it acts as a lid. When the device acts as a specimen carrier, a system of clips allows to carry the test specimen in closed position and to lay it on the polyester woven fabric in opened position. By this way the test specimen can be laid on the polyester woven fabric in one operation with the maximum of planarity. The test specimen is laid from a distance determined by the spacers. When the device acts as a lid, it is possible to cover the wetted polyester woven fabric to allow the liquid water to spread completely and evenly while avoiding evaporation.

6.2.2 Test specimens

The test specimens are sized 21 cm × 21 cm. From each material to be tested, a minimum of three test specimens should be taken and tested. Prior to testing, the test specimens should be conditioned at the test climate (35 °C, 30 % RH) for a minimum of 24 h.

6.2.3 Test procedure

The water and water vapour impermeable foil as well as the polyester woven fabric are placed on the measuring unit of the sweating guarded-hotplate. A bowl with about 0,2 l water with a temperature of 35 °C is placed within the climatic cabinet. Measuring unit is set to (35 ± 0,1) °C and air in the climatic cabinet is set to (35 ± 0,5) °C (isothermal conditions). The relative humidity within the climatic cabinet is set to (30 ± 3) % RH. The air stream in the climatic cabinet is set to (1 ± 0,05) m/s.

After the air within the climatic cabinet has reached a steady-state temperature and humidity of 35 °C and 30 % RH, respectively, the conditioned test specimen is weighed (m_1).

The air pump of the climatic cabinet is switched off and the gas meter is reset to 0. Then the climatic cabinet is opened and the water bowl removed. After that with a syringe (15 ± 0,5) g of water (see Clause 4) with a temperature of 35 °C are evenly distributed onto the polyester woven fabric. Then the test specimen item is placed wrinkle free on the polyester woven fabric and at the edge facing the air stream in the climatic cabinet fixed with adhesive tape to the measuring table of the sweating guarded-hotplate. The climatic cabinet is closed, and with switching on the air pump the test is started.

If the specimen carrier is used then immediately after the water is distributed onto the polyester woven fabric, it is placed on the measuring unit acting as a lid with the test specimen on its upper face. The climatic cabinet is closed. An elapsed period of 5 min allows the water to spread evenly in the polyester woven fabric. The climatic cabinet is opened. The specimen carrier is reversed and the test specimen is laid on the polyester woven fabric by releasing the clips. Immediately after that the climatic cabinet is closed and the air pump is switched on to start the test.

After about 13 min into the test period the air temperatures at the inlet and outlet of the gas meter T_i and T_o, respectively, are registered. After 15 min ± 5 s (to be determined with a stop watch) the test is ended by switching off the air pump, and the air volume V_A shown by the gas meter is registered. The test specimen is then removed and weighed (m_2).