ISO 11092 Textiles – Physiological Effects -Measurement of Thermal and Water-Vapour Resistance Under Steady-State Conditions (Sweating Guarded-Hotplate Test)

Description

5 Apparatus

5.1 Measuring unit, with temperature and water supply control, consisting of a metal plate approximately 3 mm thick with a minimum area of 0,04 m2 (e.g. a square with each side 200 mm in length) fixed to a conductive metal block containing an electrical heating element [see figure 1, items (I) and (6)]. For the measurement of water vapor resistance, the metal plate (I) must be porous. It is surrounded by a thermal guard [item (8) of figure 2] which is in turn located within an opening in a measuring table (11).

The coefficient of radiant emissivity of the plate surface (I) shall be greater than 0,35, measured at 20 °C between the wavelengths 8 µm to 14 µm, with the primary beam perpendicular to the plate surface and the reflection hemispherical.

Channels are machined into the face of the heating element block (6) where it contacts the porous plate to enable water to be fed from a dosing device (5).

The position of the measuring unit with respect to the measuring table shall be adjustable, so that the upper surface of test specimens placed on it can be made coplanar with the measuring table.

Heat losses from the wiring to the measuring unit or to its temperature-measuring device should be mini

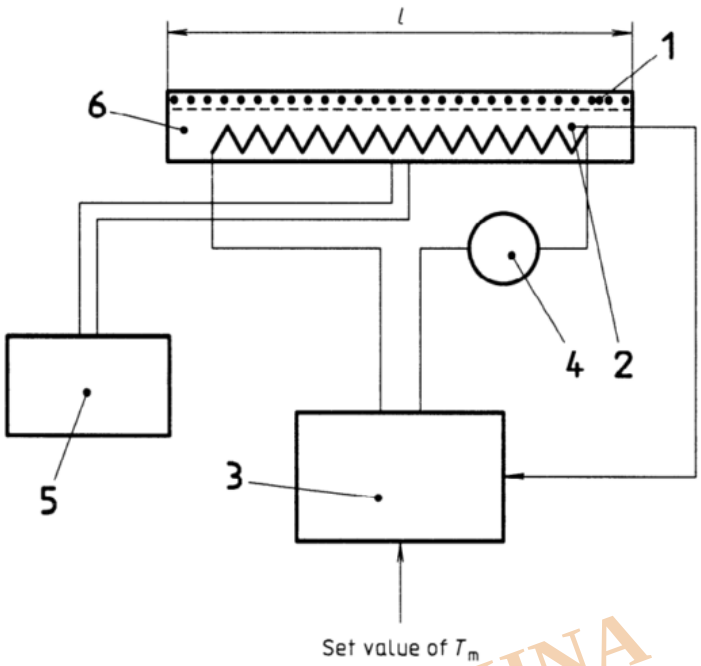
mized, e.g. by leading as much wiring as possible along the inner face of the thermal guard (8).

The temperature controller (3), including the temperature sensor of the measuring unit (2), shall maintain the temperature T,, of the measuring unit (7) constant to within ± 0,1 K. The heating power H shall

be measurable by means of a suitable device {4) to within + 2 % over the whole of its usable range.

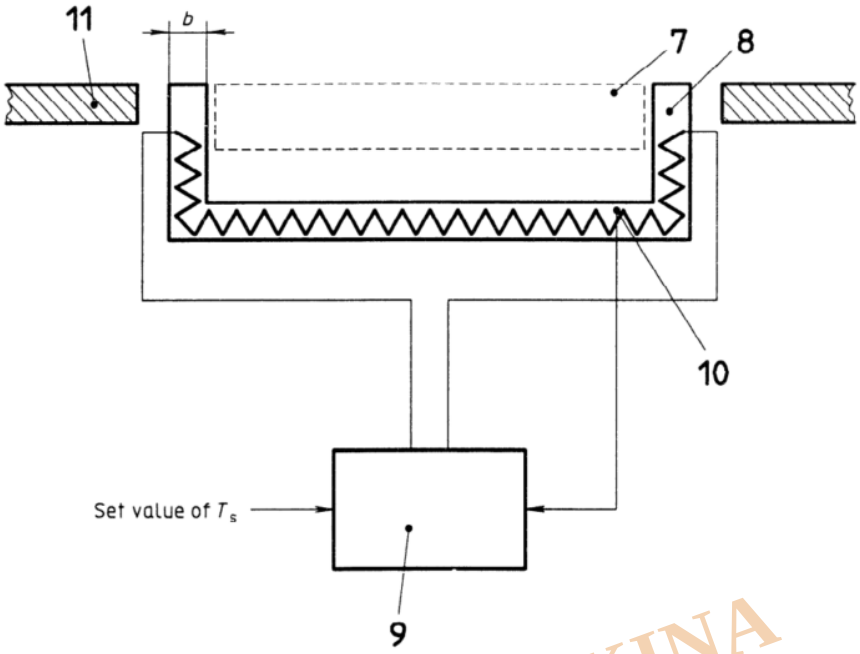
Water is supplied to the surface of the porous metal plate (I) by a dosing device {5) such as a motor-driven burette. The dosing device is activated by a switch which senses when the level of water in the plate falls more than approximately 1,0 mm below the plate surface, in order to maintain a constant rate of evaporation. The level switch is mechanically connected to the measuring unit.

Before entering the measuring unit, the water shall be preheated to the temperature of the measuring unit. This can be achieved by passing it through tubes in the thermal guard before it enters the measuring unit.



1 Metal plate
2 Temperature sensor
3 Temperature controller
4 Heating-power measuring device
5 Water-dosing device
6 Metal block with heating element

Figure 1 — Measuring unit with temperature and water supply control



7 Measuring unit according to 5.1
8 Thermal guard
9 Temperature controller
10 Temperature-measuring device
11 Measuring table

Figure 2 — Thermal guard with temperature control

5.2 Thermal guard with temperature control [item (8) of figure 2], consisting of a material with high thermal conductivity, typically metal, and containing electrical heating elements.

Its purpose is to prevent heat leakage from the sides and bottom of the measuring unit (7).

The width b of the thermal guard (figure 2) should be a minimum of 15 mm. The gap between the upper surface of the thermal guard and the metal plate of the measuring unit shall not exceed 1,5 mm.

The thermal guard may be fitted with a porous plate and water-dosing system similar to that of the measuring unit to form a moisture guard.

The thermal guard temperature T, measured by the temperature sensor {10) shall, by means of the controller (9), be maintained at the same temperature as the measuring unit T,, to within ± 0,1 K.

5.3 Test enclosure, into which is built the measuring unit and thermal guard, and in which the ambient air temperature and humidity are controlled.

The conditioned air shall be ducted so that it flows across and parallel to the upper surface of the measuring unit and thermal guard. The height of the duct above the measuring table shall not be less

than 50 mm.

The drift of the temperature T, of this air flow shall not exceed ± 0,1 K for the duration of a test. For the measurement of thermal resistanceZ and water-vapour resistance values below 100 m ·pajw, an accuracy of + 0,5 K is sufficient.

The drift of the relative humidity R.H. of this air flow shall not exceed ± 3 % R.H. forthe duration of a test.

This air flow is measured at a point 15 mm above the measuring table over the centre of the uncovered measuring unit and at an air temperature T, of 20 °C. The air speed v, measured at this point shall have a mean value of 1 m/s, with the drift not exceeding ± 0,05 mjs for the duration of a test.

It is important that at this point the air flow shall have a certain degree of turbulence, expressed by the related variation in air speed sjv,, of between 0,05 and 0,1, measured at approximately 6 s intervals over a time period of at least 10 min with an instrument which has a time constant of less than 1 s.

6 Test specimens

6.1 Materials < 5 mm thick

Test specimens shall completely cover the surfaces of the measuring unit and thermal guard.

From each material to be tested, a minimum of three test specimens shall be cut and tested.

Before testing, specimens shall be conditioned for a minimum of 12 h at the temperature and humidity specified in either 7.3 or 7.4 as appropriate.

6.2 Materials > 5 mm thick

6.2.1 Specimens falling into this category require a special test procedure to avoid loss of heat or water

vapour from their edges.

In the measurement of thermal resistance, corrections for thermal edge losses are necessary if the specimen thickness is greater than approximately twice the width b of the thermal guard (see figure 2). The deviation from the linear relationship between

thermal resistance and specimen thickness can be determined and corrected by the factor

$$[1 + (\Delta R_{ct}/R_{ct\ measured})]$$

using the measurement of the R,t values for several thicknesses of a homogeneous material such as foam, up to a total thickness d of at least that of the specimen to be tested (see figure 3).

6.2.2 If the thermal guard is not fitted with a porous plate and water-dosing system similar to that of the measuring unit, for the measurement of water vapor resistance the vertical sides of the cut specimens shall be surrounded by a water vapor impermeable frame of approximately the same height as that of the free-standing specimen. The inner dimensions of the frame shall be the same on all sides as those

of the porous plate of the measuring unit.

6.2.3 Before testing, specimens shall be conditioned for a minimum of 24 h at the temperature and humidity specified in either 7.3 or 7.4 as appropriate.

6.2.4 Specimens containing loose filling materials or having uneven thickness, such as quilts and sleeping bags, require a special mounting procedure as described in annex A.

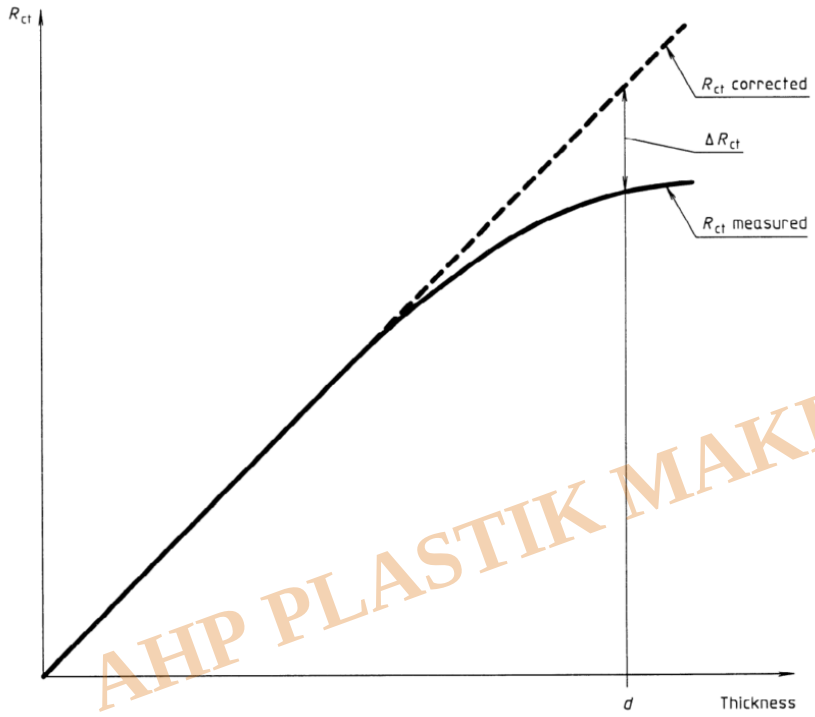
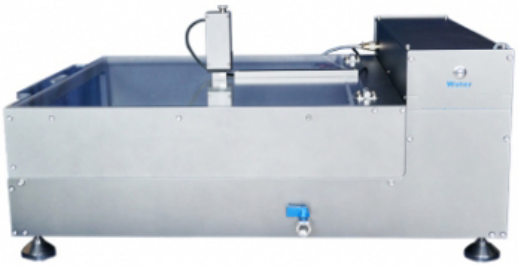


Figure 3 — Corrections for thermal edge losses during the measurement of thermal resistance



Sweating Guarded-Hotplate Test According to ISO 11092

- Test plate temperature 30-40C
- This device should be used inside a temperature-humidity chamber
- Wind speed 0-2 m/s
- Test plate area 250*250mm
- Specimen area 512*512mm
- Specimen thickness 0-70mm
- Thermal resistance range 0.002-2 m2K/W
- Wet resistance range m2Pa/W
- USB connection to computer

- Windows-based software included
- 7/24 online support

Category

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