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Textiles — Determination of dynamic hygroscopic heat generation

Contents

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directiveswww.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.htmlwww.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*.

This second edition cancels and replaces the first edition (ISO 18782:2015), which has been technically revised.

The main changes are as follows:

— in Clause- 3, temperature definitions have been added;

— in Clause 7, Figure- 1 has been changed from one testing position to 4 testing positions;

— in 7.2.5.5, rectifying plate was introduced for more stable testing;

— in Clause- 9, the preconditioning by testing condition has been added.;

— in Annex- A, the preconditioning by testing procedure has been added to the testing method for the determination of air flow rate for high humidity.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.htmlwww.iso.org/members.html.

Introduction

In the apparel and clothing market, warm heat-comfort textile material is attracting consumers' attention. It offers comfortable warmth through the combined technology of the hygroscopic heat generation and heat insulation.

The phenomenon of the hygroscopic heat generation is known as a common function of natural fibres especially, but not so much for synthetic fibres. Therefore, the synthetic fibre producers have been developing fibres and textiles with an appropriate warm-feeling property.

This document provides a test method to obtain the practical heat generation of textiles under wearing conditions.

The apparatus used in this test method has multiple test positions. So, this method is practical and economical with high accuracy.

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Textiles — Determination of dynamic hygroscopic heat generation

1 Scope

This document specifies a test method for the determination of hygroscopic heat generated by flowing low to high humidity air on one side of a surface. It is applicable to all kinds of sheet-shaped textile materials.

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.

ISO 105-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

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 terminological databases for use in standardization at the following addresses:

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

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

3.1
generated hygroscopic heat
hygroscopic heat generated by the loss of kinetic energy when gaseous water molecules are adsorbed on a surface of textile material~~.~~

3.2
temperature at low humidity
$T_{initial}$
initial equilibrium temperature at measurement side of a specimen when the low humidity air is supplied~~.~~

3.3
generated hygroscopic heat temperature
ΔT
temperature difference between the initial equilibrium temperature and the temperature when the high humidity air is supplied on measurement side of a specimen~~.~~

3.4
maximum temperature at high humidity
$\boldsymbol{T}_{\mathbf{max}}$
maximum temperature at measurement side of a specimen when high humidity air is supplied.

3.5
maximum generated hygroscopic heat temperature
$\boldsymbol{\Delta T}_{\mathbf{max}}$
maximum value of the generated hygroscopic heat temperature ΔT.

4 Principle

When the air supply is switched from low humidity to high humidity in instant, the temperature at the specimen increases and reaches a peak due to the hygroscopic heat generation. The temperature at one side of specimen is measured during this air change and the peak temperature is determined as ΔT_{max}. In this test method, the high humidity air flow rate is determined by a cotton control specimen in which the ΔT_{max} becomes 2,8 °C ± ± 0,3 °C.

5 Testing condition

5.1 Low humidity air

The air is taken from the atmosphere of the constant temperature and humidity chamber (7.1) in which the temperature is controlled at 20 °C ± 2 °C and the humidity at (40 ± 3) % RH. The air flow rate is set at 1,0 l/min ± 0,1 l/min.

5.2 High humidity air

The air in the constant temperature and humidity chamber (7.1) is passed through bubbling bottle (7.2.2) and supplied to specimen as a high humidity air.

NOTE High humidity air is controlled by the air flow rate only; therefore, humidity measurements are not essential. However, the humidity of high humidity air has been known as (90 ± 5) % RH.

6 Reagents and materials

6.1 Water, distilled water, ion exchanged water, grade 3 water according to ISO 3696 or equivalent for humidifying air in a bubbling bottle (7.2.2).

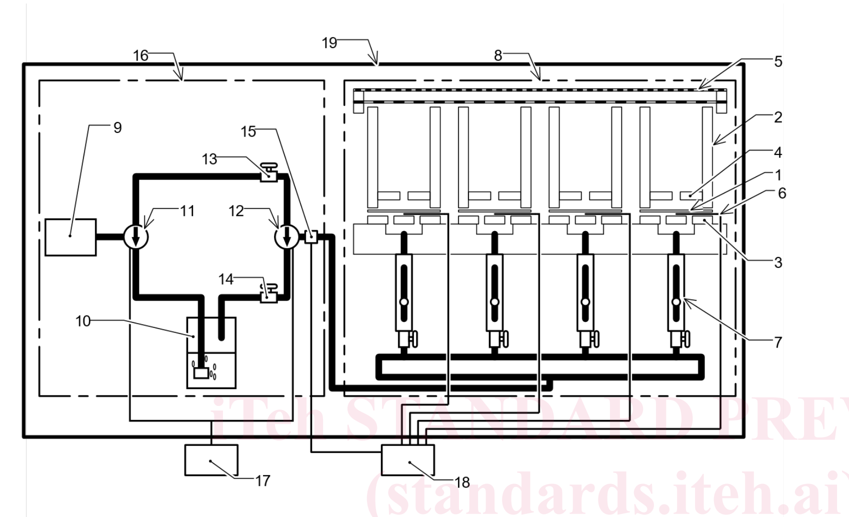
6.2 Control specimen, a cotton adjacent fabric as specified in ISO 105-F02.

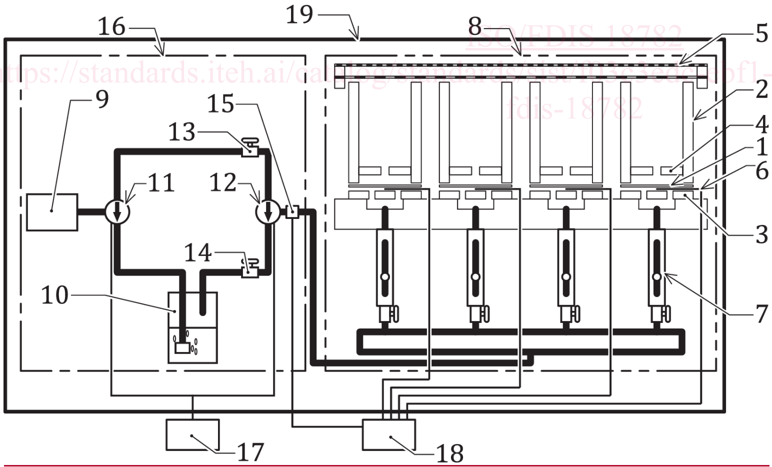
7 Apparatus

7.1 Constant temperature and humidity chamber or room, capable of maintaining the temperature at 20 °C ± 2 °C and the humidity at (40 ± 3) % RH. The hygroscopic heat generation testing apparatus (7.2) is placed in the chamber or room.

7.2 Hygroscopic heat generation testing apparatus, is shown in Figure 1. All devices are placed in the chamber (7.1) in case of cabin type. If in case the oven type, the switching valve and control device

(7.2.3) and monitoring recorder (7.3) are placed in the outside of the chamber. Air is supplied from one air supply path to four measuring units. One photograph is shown in Annex C as an example of practical testing apparatus.





Key

Key

1	specimen	10	air bubbling bottle with water
2	specimen holder	11, 12	switching valve
3	specimen table	13, 14	flow control valve

4 air lid
5 rectifying plate
6 thermometer
7 flowmeter with regulating valve
8 measuring units
9 air pump
15 humidity sensor
16 air supply path
17 control device
18 monitoring recorder
19 constant temperature and humidity chamber

Inserted Cells

Figure 1 — ~~The schematic~~Schematic diagram of the testing apparatus

7.2.1 Air pump, capable of collecting air from the atmosphere of the chamber (7.1) and supplying air to the specimen at a rate of 1,0 l/min ± 0,1 l/min.

7.2.2 Bubbling bottle, consisting of an air-tight bottle with an air inlet tube attached to a porous cylinder such as air stones to make fine air bubbles and with air outlet tube to collect high humidity air after bubbling. Completely submerge the porous cylinder in water during testing.

7.2.3 Switching valve with control device, used for switching to low humidity air path (11, 13, 12 and 15 in Figure 1) or high humidity air path (11, 14, 12 and 15 in Figure 1) passed through a bubbling bottle (10 in Figure 1 and 7.2.2).

7.2.4 Humidity sensor, used for detecting a humidity of air supply path, from 5 % RH to 100 % RH, with accuracy ±5 % RH.

7.2.5 Measuring units and rectifying plate,

four measuring units (as shown in Figure 1) ~~that~~where each unit consists of: a specimen table (7.2.5.1), a specimen holder (7.2.5.2), a thermometer (7.2.5.3), and a flowmeter with regulating valve (7.2.5.4). Each measuring unit is positioned as shown in Figure 2, and a rectifying plate (7.2.5.5) is stacked to cover the entire measuring part.

7.2.5.1 Specimen table, consisting of a board of polystyrene foam with a square of 50 mm, a thickness of 7 mm ± 2 mm and 4 air holes with a diameter of 5,0 mm ± 0,3 mm each. The holes are located 10 mm from the centre of the table in diagonal positions in the square.

EXAMPLE For example, polystyrene foam with a thermal conductivity of 0,035 W/m K can be used as a heat-insulating material.

