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Textiles — Determination of moisture drying rate

Textiles — Détermination du taux de séchage

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 38, *Textiles*.

Introduction

In addition to traditional clothing, such as shirting made from cotton or polyester/cotton, speciality textile materials have been introduced to the market for use in sportswear, active wear, and leisurewear. The size of the market for this type of clothing has been growing and is expected to continue to grow as the global economy grows.

In a developing market, existing methods of evaluation for such specialist clothing are somewhat limited and new methods of test have not yet been developed to measure specific properties which form the basis of specialist claims.

This International Standard describes three new test methods for measuring the moisture drying rate of textile materials and which are intended to reflect the drying characteristics of the textile after it has become dampened with perspiration (sweat) due to the wearer being engaged in light sport or active living situations.

These test methods can also be applied to other textile materials for which moisture drying rates are required to be determined.

Although three test methods are described in this International Standard, the concerned parties should agree on the most appropriate method of test to be used.

Textiles — Determination of moisture drying rate

1 Scope

This International Standard specifies a testing method for evaluating the moisture-drying properties of all types of textile fabric. The method is not suitable for determining a drying rate on textiles in other forms such as loose fibre or yarn.

2 Normative reference

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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.

3.1
drying rate (DR)
length of time required to dry a known mass of moisture from a textile fabric

Note 1 to entry: It is expressed in drying percent per unit time.

3.2
drying time (100 %)
time for which 100 % of applied water loss occurs

4 Principle

A specified quantity of moisture is applied to a specimen and the weight of moisture remaining on the specimen after a specific period of time is measured. The drying rate and/or specific drying rate is calculated by linear regression of time against residual moisture content.

Two methods of test are given — vertical drying (Method A) and horizontal drying (Method B).

In Method A1, a specimen is hung vertically on a frame which is suspended beneath a balance, while in Method A2 a specimen is placed on a top-pan balance. In both of these methods, the specimens are exposed to the test environment on both sides. In Method B, a specimen is laid flat in a dish which is placed on a top pan balance and the specimen is only exposed to the environment on its uppermost surface. The results obtained by the two vertical drying methods (A1 and A2) are comparable but the results obtained using the horizontal drying method (B) are not comparable with those obtained using either vertical drying method.

NOTE For the purposes of this test method, water is taken as being representative of all types of body fluids into which the textile fabric might come into contact. This includes perspiration, saliva, or urine.

The test procedures for each of the three separate test methods are given in this International Standard. It is for the interested parties to agree on the most appropriate method to be used.

Method B is particularly suited for textile fabrics with good surface wetting or capillary (wicking) properties.

5 Reagents

5.1 Grade 3 water, as specified in ISO 3696.

NOTE Alternative liquids, such as artificial perspiration solution, can be substituted with the agreement of the parties. A chemical formulation for artificial perspiration solution is given in ISO 105-E04.

6 Materials and apparatus

6.1 Micro pipette, capable of dispensing the required volume of water to an accuracy of 0,01 ml.

6.2 Petri dish, made of glass with internal diameter at least 5 mm larger than the diameter of the test specimen and with an internal height of 20 mm ± 3 mm.

NOTE If validation is obtained, the other materials could be used.

6.3 Balance, with a suitable capacity and a resolution of 0,001 g. The full scale range of the balance shall be such that the total mass of the test assembly (test specimen plus supporting frame) falls between 10 % and 90 % of the full scale range of the balance.

For Method A1, the balance shall be equipped with the facility to suspend the test frame beneath the balance as shown in Figure 1. For Method A2 and Method B, the balance shall be capable of supporting the test frame or petri dish on the top pan.

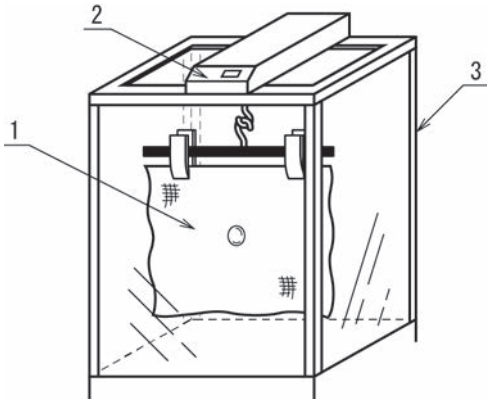
6.4 Method A1 testing apparatus

A schematic diagram of the apparatus is shown in Figure 1.

6.4.1 Hanger equipped with suitable means of mounting the test specimen (e.g. hooks, pins, or clips) and fitted with a means of being suspended below the balance (6.3), as shown in Figure 1. The materials used shall not be water absorbent.

6.4.2 Enclosure, open ended and of suitable dimensions so as to enclose the suspended test assembly and shall extend to at least 50 mm below the lowest edge of the suspended test specimen.

NOTE The enclosure can be made of any material such as glass, acrylic, etc. The dimensions will be dependent upon the dimensions of the balance (6.3) but a suitable size has been found to be at least 300 mm (width) by 300 mm (depth) by 300 mm (height).



Key

1 specimen
2 balance

3 hanger with clips

Figure 1 — Method A1 testing apparatus

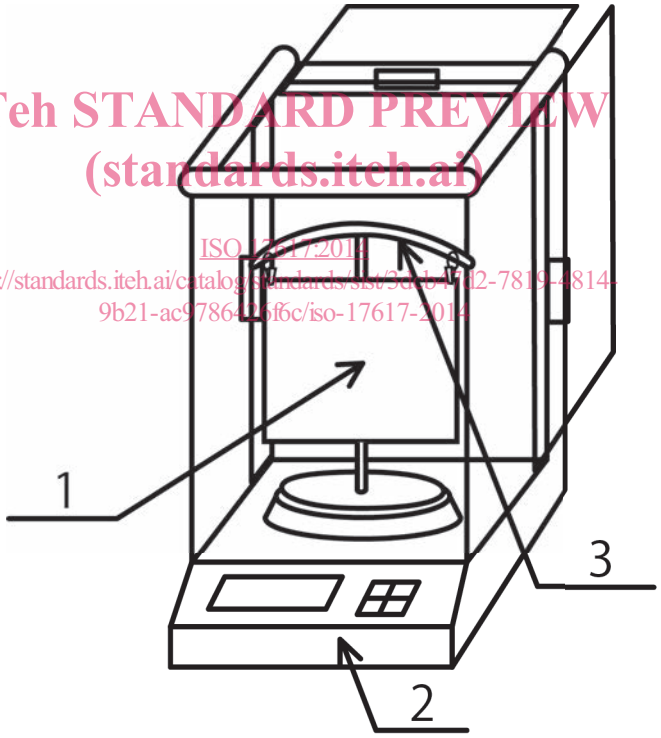
6.5 Method A2 testing apparatus

A schematic diagram of the apparatus is shown in Figure 2.

6.5.1 Hanger equipped with suitable means of mounting the test specimen (e.g. hooks, pins, or clips) and fitted with a means of being supported on the top pan of the balance (6.3) and within the test enclosure (6.5.2) as shown in Figure 2. The materials used shall not be water absorbent.

6.5.2 Enclosure made of any suitable non-water absorbent material and of suitable dimensions so as to enclose the balance and the test assembly. The height of the enclosure shall be at least 50 mm greater than the overall height of the test assembly when placed on the top pan of the balance. The enclosure shall be open on two opposing faces and on the face directly above the test specimen.

NOTE Many commercially available balances are already equipped with enclosures which have appropriate sliding panels.



Key

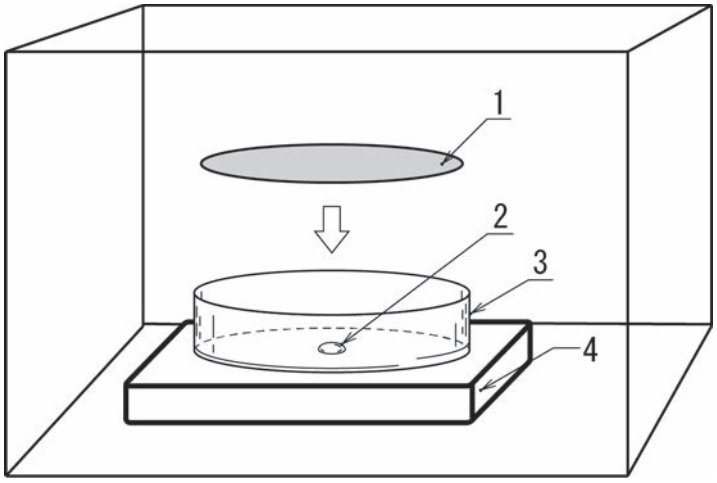
1 specimen
2 balance
3 hanging frame

Figure 2 — Method A2 testing apparatus

6.6 Method B testing apparatus

A schematic diagram of the apparatus is shown in Figure 3.

6.6.1 Enclosure made of any suitable material comprising four walls and without a ceiling. The enclosure shall be of sufficient dimensions to enclose the balance (6.3) and the height shall be at least 50 mm greater than the plane of the upper surface of the petri dish containing the test specimen.



Key

1 specimen
2 moisture
3 petri dish
4 balance

Figure 3 — Method B testing apparatus

6.7 Anemometer, capable of measuring air speed to an accuracy of 0,01 m/s.

6.8 Timing device, with accuracy of ±1 s.

6.9 Water applying frame, comprising a means of holding a sample of fabric in a horizontal plane above the supporting bench top surface and which leaves a central area of the test specimen of approximately 100 mm diameter exposed to the environment.

NOTE Annular rings, such as embroidery rings, rectangular plates with a central orifice and equipped with clips or pins have been found to be suitable. Alternatively, samples can be supported in the hand but particular attention is required to avoid transfer of moisture or contamination to or from the skin surface.

6.10 Plastic gloves.

7 Preparation

7.1 Conditioning and testing atmosphere

The test specimens shall be conditioned in the standard atmosphere at a temperature of 20 °C and a relative humidity of 65 % as defined in ISO 139 for at least 24 h.

Testing shall be carried out in the conditioned environment as above and in a location which is substantially draught free (i.e. the air velocity across the exposed face(s) of the test specimen shall not exceed 0,1 m/s).

The air velocity shall be measured immediately prior to commencing each sequence of testing using an anemometer (6.7).

7.2 Preparation of specimen

7.2.1 Sampling

7.2.2 Number and dimension of test specimen

Prepare one test specimen for the validation test and three further test specimens for the drying rate tests. The dimensions of the test specimens shall be as given in Table 1.

Whenever manual handling of the test specimens is necessary, it is recommended that non-absorbent gloves are worn to avoid any unintentional transfer or loss of moisture or contamination between the test specimen and skin surface.

Table 1 — Typical dimension of specimen for the test

Test method		Method A (unit: mm)		Method B (Diameter: mm)
		Method A1: suspending	Method A2: top pan	
Dimension	Specimen for drying test	Square: (200 ± 2) × (200 ± 2)	Square: (100 ± 2) × (100 ± 2)	Circular: 85 ± 2

Alternative size test specimens are permitted provided that any wicking does not extend to within 10 mm of any edge of the test specimen.

7.2.3 Conditioning of specimens

Prior to test, samples shall be conditioned in the conditioning atmosphere (7.1) for a minimum of 24 h.

7.2.4 Conditioning of water

Keep the water in the testing condition (7.1) for at least for 24 h. The water used in the test shall be at a temperature of (20 ± 2)°C.

8 Validation test

Prior to carrying out the test, conduct the validation test as described in Annex A. Samples shall have an absorption time of less than or equal to 60 s. Samples with an absorption time of greater than 60 s are not suitable for testing using the methods described in this International Standard. The average absorption time obtained shall be recorded in the test report.

9 Testing procedure

9.1 Method A

Method A is a vertical drying method using either of two configurations — Method A1: suspension method (see 6.4 and Figure 1) or Method A2: top pan method (see 6.5 and Figure 2).

9.1.1 Prepare suspension hangers (6.4) for Method A or hanging frames (6.5).

9.1.2 Attach the test specimen to a suspension hanger (Method A1) or to a hanging frame (Method A2).

9.1.3 For Method A1, attach the suspension hanger complete with test specimen to the hook of the balance. For Method A2, place the holding frame complete with test specimen on the top pan of the

balance. Weigh the complete assembly to the nearest 0,001 g and record with mass as the mass before application (M_w).

9.1.4 Remove the suspension hanger (Method A1) or holding frame (Method A2) from the balance before removing the test specimen from the suspension frame or holding frame.

9.1.5 Lay the test specimen horizontally on the water applying frame (6.9) so that the central portion of the underside of the test specimen is not in contact with any surface and the surface to be tested is uppermost.

9.1.6 For Method A1, apply 0,30 ml ± 0,01 ml of conditioned water to the approximate centre of the exposed upper surface of the test specimen using the micropipette (6.1).

If leakage occurrs, record it in the report. When leakage occurrs, the effectiveness of the test should be judged by the concerned parties.

9.1.7 For Method A2, apply 0,08 ml ± 0,01 ml of conditioned water to the approximate centre of the exposed upper surface of the test specimen using the micropipette (6.1).

If leakage occurrs, record it in the report. When leakage occurrs, the effectiveness of the test should be judged by the concerned parties.

9.1.8 Remove the test specimen from the water applying frame (6.9) and re-attach the test specimen to the suspension frame (Method A1) or the hanging frame (Method A2) and return the test assembly to the balance. This shall be completed within 60 s of the water being absorbed into the surface of the test specimen. Weigh the test assembly to the nearest 0,001 g and immediately start the timing device (6.8). Record the mass of the assembly as M_0.

9.1.9 Repeat the measurement of the mass of the test assembly at intervals of 5 min ± 15 s, until either a total of 60 min has elapsed or until the remaining water mass falls to within 10 % of the initial water mass. Record the mass of the test assembly as each interval t as M_t where t is the time elapsed in minutes.

9.1.10 Repeat the test on the remaining two test specimens.

It is permissible to carry out concurrent tests on all three samples provided that separate suspension frames or holding frames are used for each test specimen.

9.1.11 Calculate the drying rate in accordance with Clause 10.

9.1.12 Determine the mean drying rate from the three individual test results obtained in 9.1.11.

9.2 Method B: Horizontal drying

This method uses the apparatus as described in 6.6 and Figure 3.

9.2.1 Place the test specimen in the base of the petri dish (6.2) so that the test specimen lays flat. Place the test assembly on the balance and measure the mass to the nearest 0,001 g. Record the mass as the mass of the assembly before test (M_w).

9.2.2 Remove the test specimen assembly from the petri dish. Apply (0,1 ± 0,01) ml of water using a micropipette to the centre of the base of the petri dish and replace the test specimen with the surface to be tested face down and in contact with the water. Immediately start a timing device (6.8) and re-weigh the test assembly to the nearest 0,001 g and record this mass as M_0.

It is preferable not to remove the petri dish from the balance in order to apply the water.