INTERNATIONAL STANDARD

ISO 17699

First edition
2003-10-15

Footwear — Test methods for uppers and lining — Water vapour permeability and absorption

Chaussures — Méthodes d'essai des tiges et des doublures — Perméabilité à la vapeur d'eau et absorption de la vapeur d'eau

Reference number
ISO 17699:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17699 was prepared by CEN (as EN 13515:2001) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 216, *Footwear*, in parallel with its approval by the ISO member bodies.

For the purposes of international standardization, a list of corresponding International and European Standards for which equivalents are not given in EN 13515 has been added as Annex ZZ.

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 309 "Footwear", the secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by June 2002, and conflicting national standards shall be withdrawn at the latest by June 2002.

This European Standard is based on the IUP 15 method and the European Standard EN 344-1 "Requirements and test methods for safety, protective and occupational footwear for professional use.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard specifies two test methods for assessing, respectively, the water vapour permeability and the water vapour absorption of uppers or complete upper assembly irrespective of the material, in order to assess the suitability for the end use.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12222, *Footwear - Standard atmospheres for conditioning and testing of footwear and components for footwear.*

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987).*

EN 13512, *Footwear - Test methods for uppers and lining - Flex resistance.*

3 Terms and definitions

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

3.1
water vapour permeability
amount of water vapour a material will transmit through its structure expressed as mass of water transmitted per area of material per hour

3.2
water vapour absorption
amount of water vapour a material will absorb in a specified time expressed as mass of water per area of material

3.3
upper
material forming the outer face of the footwear which is attached to the sole assembly and covers the upper dorsal surface of the foot. In case of boots, this also includes the outer face of the material covering the leg. Only the materials that are visible are included, no account should be taken of underlying materials

3.4
complete upper assembly
finished upper, fully seamed, joined or laminated as appropiate, comprising the centre material and any lining(s) together with all components such as interlinings, adhesives, membranes, foams or reinforcements, but excluding toe puffs and stiffners

NOTE The complete upper assembly may be flat, 2-dimensional or comprise lasted upper in the final footwear.

4 Apparatus and material

The following apparatus and material shall be used:

4.1 Water vapour permeability test method

4.1.1 Cylindrical test pots each with an internal height of 80 mm ± 10 mm and internal volume of 100 cm^3 ± 20 cm^3, and including the following:

4.1.1.1 **One circular open end** with an internal diameter of D = 30 mm ± 1 mm and is known to the nearest 0,1 mm.

4.1.1.2 **A clamping ring** with an internal diameter D.

4.1.1.3 **Means of tightly clamping a test specimen** between the clamping ring and the open end so that the pot is sealed by the test specimen.

4.1.2 **Test machine** (see Figure 1) including the following:

4.1.2.1 **Vertically mounted turntable** which:

a) has at least three test stations, each of which is capable of holding a test pot so that its axis is parallel to, and 67 mm ± 2 mm from the axis of rotation of the turntable;

b) is rotated at 7,8 rad/s ± 0,5 rad/s[1)]

4.1.2.2 **Paddle type fan** which:

a) has three flat blades inclined at 120° to one another. The blades shall be flat with approximate dimensions 90 mm x 75 mm;

b) is mounted so that its axle is coaxially aligned with the axis of the turntable (see 4.1.2.1) and the blades pass within a distance of 10 mm ± 5 mm of the open ends of test pots (see 4.1.1) mounted on the turntable;

c) is rotated at 146 rad/s ± 10 rad/s[1)] in a direction opposite to the direction of rotation of the turntable.

Dimensions in millimetres

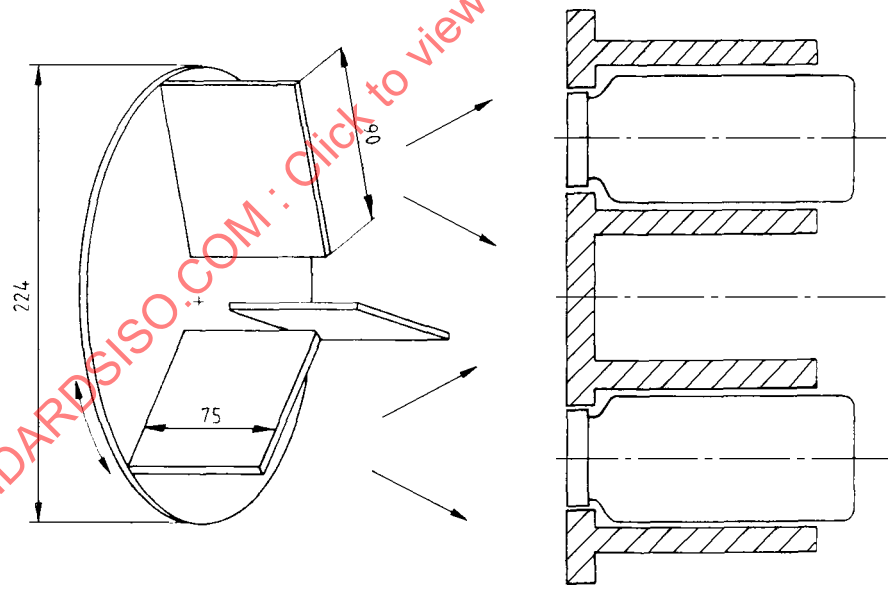


Figure 1 — Schematic diagram of apparatus to be used in the water vapour permeability test

4.1.3 **Analytical balance** capable of measuring mass up to 200 g to the nearest 1 mg.

4.1.4 **Silica gel** with a particle size greater than 2 mm and which is preferably self indicating.

Freshly dry the silica gel in a ventilated oven at 125º C ± 5 °C for at least 16 h and cool in a sealed container for at least 6 h. Once dried the silica gel will remain dry for many days if kept in air tight containers. Typically the colour of self indicating silica gel will turn from blue when dry to pink or colourless when saturated.

1) 1 rad ≈ 0,16 rev.

4.1.5 **Press knife**, or similar cutting device, capable of cutting test specimens with a diameter which is sufficiently larger than *D* to enable a good seal to be made around the open end (see 4.1.1.1) of the pot.

4.2 Water vapour absorption test method (see Figure 2)

4.2.1 **Two round test pots** each with a volume of 100 cm^3 ± 20 cm^3, and including the following:

4.2.1.1 **One open end** with a flat annular surface of internal diameter of 35,0 mm ± 0,5 mm and external diameter of at least 20 mm larger. The external diameter can be provided by a flange of minimum width 10 mm or by a cylinder of minimum wall thickness 10 mm.

4.2.1.2 **A metal disk** of diameter greater than 55 mm.

4.2.1.3 Means of tightly clamping a test specimen and a piece of impermeable material (see 4.2.5) between the open end and the disk so that the pot is sealed by the test specimen.

4.2.2 **Analytical balance** capable of measuring mass up to 100 g to the nearest 1 mg.

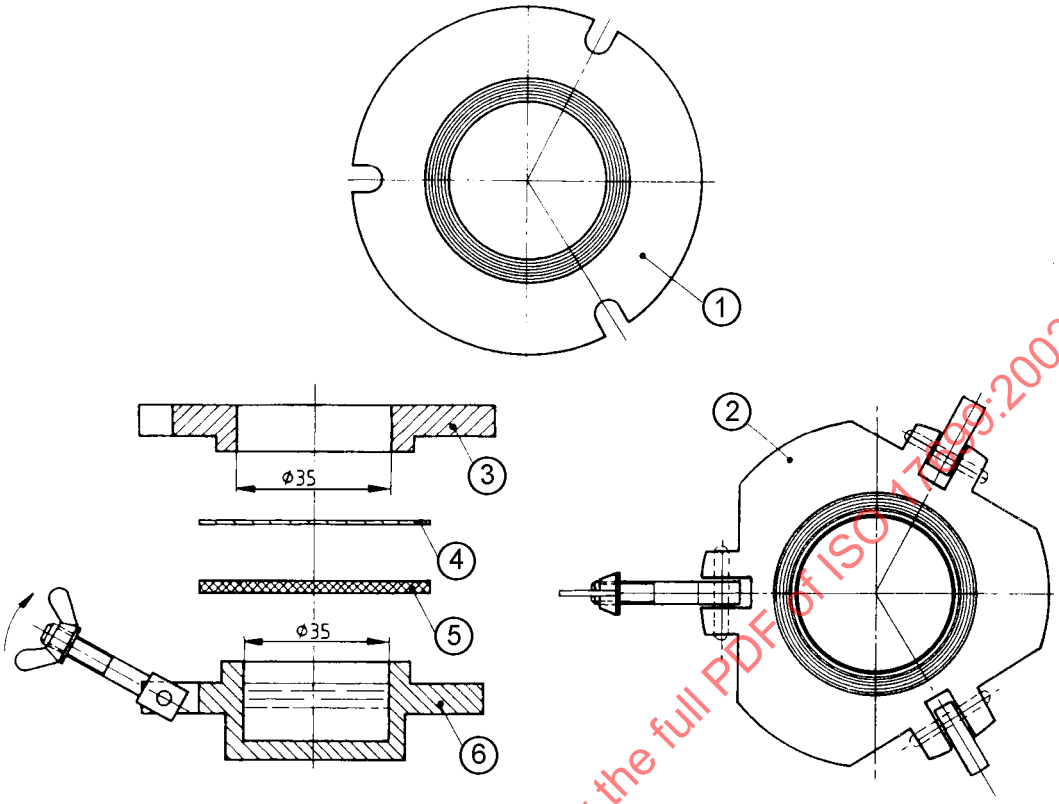
4.2.3 **Device** capable of measuring time up to 8 h to the nearest 0,1 h, e.g., a stopwatch.

4.2.4 **Distilled or deionised wate**r complying with EN ISO 3696.

4.2.5 **Two circular pieces** of impermeable material of minimum diameter 55 mm.

4.2.6 **Cutting device** such as a press knife, capable of cutting test specimens of diameter 45 mm ± 5 mm.

Dimensions in millimetres



Key

1 Top
2 Bottom
3 Top
4 Seal
5 Specimen
6 Bottom

Figure 2 — Apparatus for determination of water vapour absorption

5 Sampling and conditioning

5.1 Water vapour permeability test method

5.1.1 Unless otherwise specified, cut three samples of dimensions 70 mm x 45 mm.

5.1.2 For sheet materials cut test specimens from a range of positions across the full usable width and length of the sheet material. For a material with a woven structure this should prevent any two specimens containing the same warp or weft threads. Prepare test pieces from complete upper assemblies when the lining material is permanently attached to the upper material.

5.1.3 For test specimens cut from footwear uppers avoid any areas containing seams or perforations and any other design features which mean that the test specimen will not be of uniform thickness across its entire surface area.

NOTE It may not be possible to cut a test specimen of sufficient size from certain types of footwear, especially children's, and the test specimen size should not be reduced. If it is not possible to cut the correct size test specimen from a shoe upper the materials themselves must be tested.

5.1.4 Mark each test specimen with a unique reference code.

5.1.5 Store the cut test specimens in a standard controlled environment specified in EN 12222 for at least 24 h prior to testing and carry out the test in this atmosphere.

5.1.6 Carry out 20 000 cycles according to EN 13512.

5.2 Water vapour absorption test method

5.2.1 If the test is being carried out to assess a single material, then cut two circular test specimens with a diameter of 45 mm ± 5 mm.

For sheet materials, cut test specimens from a range of positions across the full usable width and length of the sheet material. For a material with a woven structure this should prevent any two specimens containing the same warp or weft threads.

5.2.2 If the test is being carried out to assess a composite assembly of materials used in a complete product, such as a lined shoe, then cut two circular test specimens, with a diameter as specified in 5.2.1, from each of the materials used in this assembly.

5.2.3 For test specimens cut from footwear uppers avoid any areas containing seams or perforations and any other design features which mean that the test specimen will not be of uniform thickness across its entire surface area.

NOTE It may not be possible to cut a test specimen of sufficient size from certain types of footwear, especially children's and the test specimen size should not be reduced. If it is not possible to cut the correct size test specimen from a shoe upper the materials themselves must be tested.

5.2.4 Mark each test specimen with a reference number.

5.2.5 Store the test specimens in a standard conditioned environment as specified in EN 12222 for at least 24 h before starting the test.

5.2.6 Carry out 20 000 cycles according to EN 13512.

6 Test method

6.1 Water vapour permeability test method

6.1.1 Principle

A circular test specimen is clamped across the open end of a test pot containing a moisture absorbing desiccant. Air of specified humidity and temperature is blown over the test specimen at a set velocity. The air within the pot is circulated by moving the pot which agitates the desiccant. After a measured time the mass of water vapour transmitted through the test specimen is determined and the water vapour permeability of the material calculated.

6.1.2 Procedure

6.1.2.1 Pour freshly dried silica gel (see 4.1.4) into one of the pots (see 4.1.1) until it is half full.

6.1.2.2 Place a test specimen centrally over the open end of the pot prepared in 6.1.2.1 so that the surface which would be closer to the source of water vapour in the final product is uppermost. For example if assessing the perspiration transmission properties of a footwear upper material, then the surface which will be nearer to the foot should be uppermost.

6.1.2.3 Fit a clamping ring (see 4.1.1.2) centrally over the top of the test specimen and tighten the ring so that the test specimen is securely held around its edges and the pot is sealed.

6.1.2.4 Repeat the procedure in 6.1.2.1 to 6.1.2.3 for the remaining two test specimens.

6.1.2.5 Place each filled test pot onto the turntable (see 4.1.2.1) and operate the test machine for 20 h ± 4 h. This is to condition the test specimens.

6.1.2.6 Remove each of the test pots from the turntable.

6.1.2.7 For each test pot and as quickly as possible remove the clamping ring to release the test specimen, pour away the silica gel from inside the pot, refill the pot with a similar amount of freshly dried silica gel and replace the test specimen and clamping ring on the pot by repeating the procedure in 6.1.2.2 and 6.1.2.3

6.1.2.8 With the minimum of delay use the balance (see 4.1.3) to measure the combined mass of each test pot, silica gel and test specimen assembly, and record these values as M_0 to the nearest 1 mg. Record the time that these measurements were made as T_0.

6.1.2.9 Replace the test pots on the turntable and start the machine.

6.1.2.10 After 11,5 h ± 4,5 h stop the test machine and remove the test pots from the turntable.

6.1.2.11 With the minimum of delay use the balance to measure the combined mass of each of test pot, silica gel and test specimen assembly, and record these values as M_1 to the nearest 1 mg. Also record the time that these measurements were made as T_1.

6.2 Water vapour absorption test method

6.2.1 Principle

Either a single circular test specimen or an assembly of circular test specimens which is representative of a completed product or taken from a closed shoe upper, is clamped between an impermeable membrane and the open end of a vertical cylindrical chamber containing a specified volume of water. After a set time the mass of water absorbed by the test specimen is measured.

6.2.2 Procedure

6.2.2.1 Use the balance (see 4.2.2) to measure the mass of each test specimen and record these values as M_o to the nearest 1 mg.

6.2.2.2 If assessing an assembly of materials prepare two test specimen stacks as follows:

Place one test specimen of each type of material that is to be tested together, centrally on top of each other so that the order and orientation of the specimens in the stack are the same as in the final product. If possible join together the test specimens in each stack using a similar method to that used in manufacture of the actual product, for example by bonding together with an adhesive layer. The stacks will subsequently be referred to as test assemblies.

6.2.2.3 Pour 50 cm^3 ± 5 cm^3 of distilled water, temperature according to EN 12222, into each of the two pots.

6.2.2.4 Place a test specimen or test assembly centrally over the top of each clamping ring so that the surface which will be inside the footwear is lowermost.

6.2.2.5 From this stage onwards take great care to keep the pots vertical and avoid rapid or jerky movement which might splash water onto the test specimen.

6.2.2.6 Place a piece of impermeable material (see 4.2.5) centrally over the top of each test specimen or test assembly.

6.2.2.7 Place a disk (see 4.2.1.2) centrally over the top of each piece of impermeable material and clamp the disks to the pots so that the test specimens are securely held around their edges and the pot is sealed.

6.2.2.8 Place the pots in an environment of temperature of according to EN 12222 for 8,0 h ± 0,1 h.