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Textiles — Determination of water repellency of fabrics by the Bundesmann rain-shower test

*Textiles — Hydrophobicité de tissus à l'aide d'un essai d'arrosage
suivant la méthode Bundesmann*



Reference number
ISO 9865:1991(E)

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.

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.

International Standard ISO 9865 was prepared by Technical Committee ISO/TC 38, *Textiles*.

Textiles — Determination of water repellency of fabrics by the Bundesmann rain-shower test

1 Scope

This International Standard describes a method for the determination of the water repellency of textile fabrics by a rain-shower test known as the Bundesmann method.

The test may be used to assess the effectiveness of finishing procedures for rendering textile fabrics water-repellent.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing*.

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 water repellency: The resistance of textile fabrics to absorb rain shower water. The criterion is the amount of water absorbed following the effects of a defined artificial rain shower for a specific duration. In addition, the amount of water penetrating the textile fabrics and the water run-off may be recorded.

4 Principle

Test specimens of textile fabrics are mounted on cups and then exposed to an artificial rain shower under defined conditions. The water repellency is assessed by visual comparison of the wet specimens with reference photographs. The water absorbed by the specimens during the test is weighed. The water penetrating the specimens is also collected in the cups and recorded.

5 Apparatus and materials

NOTE 1 The rain shower equipment produces an artificial rain shower defined by water flow, drop size and drop fall height. The rain shower equipment may have one or more devices for holding the specimens. To remove excess water from the specimens, a centrifuge for horizontal rotation at a specific speed is used.

5.1 Rain shower equipment,¹⁾ comprising a system of 300 identical drop-forming devices, e.g. nozzles or jets, equally distributed over a circular horizontal surface (area $\approx 1\,300\text{ cm}^2$) of 406 mm diameter.

The approximate diameter of the drop produced by each drop former is 4 mm. Water emerging from the drop former produces a drop of approximately 0,07 ml. The water flow of the rain shower equipment can be varied so that the time-related flow of water prescribed for the test can be set to $(100 \pm 5)\text{ ml/min}$ for a rain shower surface area of 100 cm^2 . The drop fall height, i.e. the vertical distance between the drop former and the centre of the specimen surface, is 1 500 mm. For the rain shower test, normal tap water is used which is passed through a mechanical filter to remove coarse contamination. The water temperature is $(20 \pm 3)\text{ }^\circ\text{C}$ or $(27 \pm 2)\text{ }^\circ\text{C}$ (the latter for tropical countries).

Water temperature, water hardness and pH value shall be measured and recorded in the test report.

1) For details of the source of supply of the rain shower equipment, apply to national standards institutions.

NOTE 2 A flow rate of (100 ± 5) ml/min is equivalent to (200 ± 10) ml in 2,5 min for a surface area of 80 cm².

5.2 Clamping device for the specimen, having the configuration of a cup to enable the water passing through the specimen to be collected and measured. The top of the cup serves to clamp the specimen in place by means of a clamping ring. Each cup shall have a tap. For thick textile fabrics, the clamping rings used are larger than those used for clamping thin textile fabrics. The exposed area of the clamped specimen is 80 cm². The outer diameter of the cup is 100 mm. To ensure that the water flows from the surface of the specimen, the centreline of the cup is inclined at 15° from the vertical. In addition, each cup comprises a wiper assembly pressed against the underside of the specimen during testing with a force of approximately 250 cN to describe 20 reciprocating rotary movements per minute at an angle of approximately 100°. The 48 mm long and 5 mm wide arms of the wiper assembly have a polished scraping surface of stainless steel, curved slightly to the top in the longitudinal direction (radius of curvature approximately 630 mm) and rounded on the scraper edge with an approximate radius of 5 mm.

Each cup has an air vent (7 ± 1) mm in diameter, through which air can be displaced.

When several specimens are tested simultaneously, numerous (e.g. four) clamping devices are arranged closely spaced in an annular configuration on a carrier. The carrier is required to revolve at the rate of $(6 \pm 0,5)$ rpm during the rain shower test so that all specimens are subjected to consistent rain shower exposure.

5.3 Centrifuge, comprising a disc with a horizontal mounting surface of diameter 175 mm rotating at 700 rpm. The time required to attain the speed of 700 rpm from 0 and vice versa is between 1 s and 2 s.

Approximately 50 ribs, each 1 mm in height, are provided in a radial arrangement on the surface of the disc. The ribs are equally spaced round the disc so that the wet specimens cannot stick to the surface.

Four steel pins approximately 6 mm long spaced approximately 60 mm away from the centre of the disc are provided in an equally spaced arrangement to secure the specimens. The specimens are pressed on to these pins and only secured during rotation.

The total mass of the disc and shaft propelled by the drive motor shall be 410 g.

The centrifuge shall be automatically switched off by a timer following the prescribed rotation cycle.

5.4 Reference photographs,²⁾ as illustrated in figure 1.

5.5 Means of producing the standard atmospheres for conditioning and testing textiles, as specified in clause 6.

5.6 Means of weighing the test specimens.

6 Atmosphere for conditioning and testing

The conditioning and testing atmosphere shall be an atmosphere having a relative humidity of (65 ± 2) % and a temperature of (20 ± 2) °C or (27 ± 2) °C, as specified in ISO 139.

7 Preparation of test specimens

Cut or stamp out from the sample a circular specimen of 140 mm diameter free from wrinkles and creases, from at least four locations, each spaced at least 100 mm away from the edge of the sample. If possible do not take specimens directly from the ends of the material since experience has shown that the mass per unit area (or structure) and the finishing may be different to that of the majority of the fabric.

Prior to the rain shower test, condition the specimens in accordance with ISO 139 in the atmosphere specified in clause 6.

8 Equipment calibration

Switch on the rain shower equipment (5.1) for approximately 15 min prior to commencing testing or inspection to ensure the necessary consistency of the artificial rain shower and the water temperature. Measure the amount of water trapped in the cups. When the rain shower is set as required, (200 ± 10) ml of water shall be in each cup after 2,5 min. In continuous operation, calibrate the equipment at least twice every day. In addition, check frequently the proper functioning of the drop formers.

9 Procedure

First set the prescribed time-related range of the shower flow, noting that the shower shall not be turned off until all tests have been completed. Then weigh the conditioned specimens (see clause 6) to an accuracy of 0,01 g (dry mass m_1). Identify the face to be tested and place uppermost over the cups

2) For details of the source of supply of the reference photographs, apply to national standards institutions.

without any particular pre-tension, merely smoothing manually.

Expose the specimens to the shower for 10 min.

Assess the water repellency by visual comparison of the wet specimens at the end of the shower test with the reference photographs (see 5.4 and figure 1) according to five grades as follows:

- grade 5: fast runoff of small drops;
- grade 4: formation of large drops;
- grade 3: drops adhere to parts of the specimen;
- grade 2: specimen partly wetted;
- grade 1: specimen wet through over complete surface.

The water repellency may also be assessed after 1 min and 5 min.

Centrifuge the specimen for 15 s. Immediately afterwards, weigh the specimen to an accuracy of 0.01 g (this is best done in a closed weighing bottle), and record as the wet mass m_2 .

In addition to the water absorbed by the specimens in the rain shower test, collect in the cups any water which has passed through the specimens and, if required, determine its volume, in millilitres.

10 Expression of results

Calculate the water absorption w_{H_2O} , expressed as a percentage by mass, from the following equation:

$$w_{H_2O} = \frac{m_2 - m_1}{m_1} \times 100$$

where

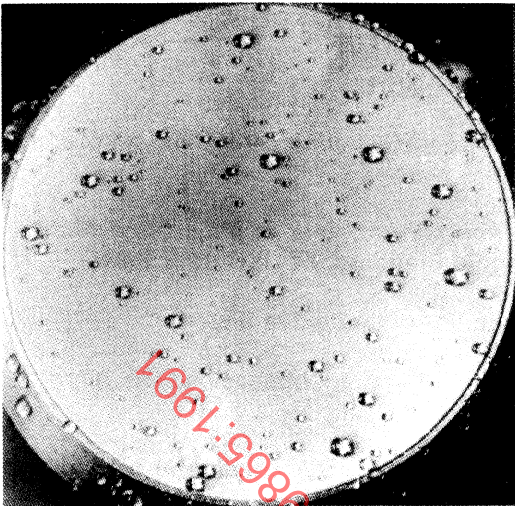
m_1 is the mass, in grams, of the specimens prior to testing;

m_2 is the mass, in grams, of the specimen after testing (including possibly partly wetted clamped edges of the specimen).

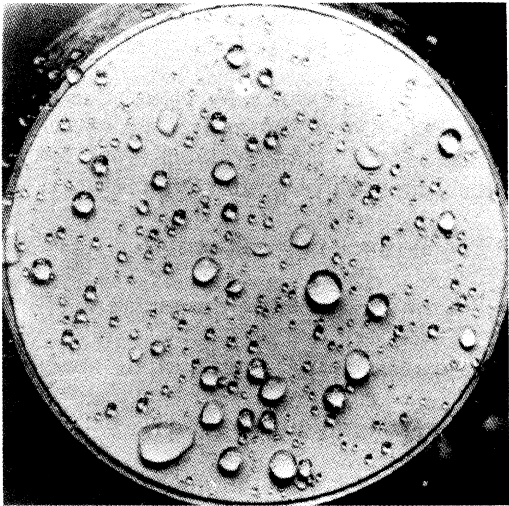
11 Test report

The test report shall include the following information:

- a) the number and year of publication of this International Standard, i.e. ISO 9865:1991;
- b) the nature of the textile tested;
- c) the type of test equipment and the manufacturer of the equipment;
- d) the temperature, hardness and pH value of the water used;
- e) the rain shower "ON" time;
- f) the centrifuge "ON" time;
- g) the number of tests;
- h) the water absorption w_{H_2O} , expressed as a percentage by mass: state the individual values, the arithmetic mean and the confidence tolerance of the mean value;
- i) the assessment of the water repellency by grading;
- j) whether the assessments were after 1 min, 5 min or 10 min;
- k) any wetting on the underside of the test specimens observed after 10 min;
- l) if required, the amount of water, in millilitres, which has passed through the specimens, and any special observations made on the specimens prior to or during testing;
- m) the date of the test.



Grade 5



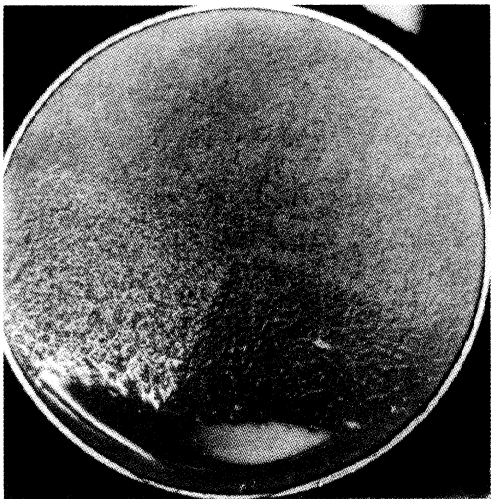
Grade 4



Grade 3



Grade 2



Grade 1

Figure 1 — Reference photographs