भारतीय मानक

Indian Standard

IS 15891 (Part 13) : 2024
ISO 9073-13 : 2023

बिना बुने हुए वस्त्र — परीक्षण पद्धतियाँ

भाग 13 समय के साथ द्रव्य का बार-बार टकराव (कृत्रिम मूत्र)

(पहला पुनरीक्षण)

Nonwovens — Methods of Test

Part 13 Repeated Liquid Strike-Through Time (Simulated Urine)

(First Revision)

ICS 59.080.30

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October 2024 **Price Group 8**

Industrial Fabrics Sectional Committee, TXD 33

NATIONAL FOREWORD

This Indian Standard (Part 13) (First Revision) which is identical to ISO 9073-13 : 2023 'Nonwovens — Test methods — Part 13: Repeated liquid strike-through time (simulated urine)' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Industrial Fabrics Sectional Committee and approval of the Textiles Division Council.

This Indian Stanadard was first published in 2017. This revision has been brought out to harmonize it with the latest version of ISO 9073-13 : 2023.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In the standard intended to be adopted, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 139 Textiles — Standard atmospheres for conditioning and testing	IS 6359 : 2023 Method for conditioning of textiles (*first revision*)	Technically Equivalent
ISO 189 Paper and board — Sampling to determine average quality	IS 1060 (Part 5/Sec 1) : 2014/ ISO 186 : 2002 Methods of sampling and test for paper and allied products: Part 5 Methods of test for paper and board, Section 1 Sampling to determine average quality	Identical
ISO 2859-1 Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	IS 2500 (Part 1) : 2000/ ISO 2859- 1 : 1999 Sampling procedure for inspection by attributes: Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (*third revision*)	Identical
ISO 3696 Water for analytical laboratory use — Specification and test methods	IS 1070 : 2023 Reagent grade water — Specification (*fourth revision*)	Technically Equivalent
ISO 3951-1 Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL	IS/ISO 3951-1 : 2022 Sampling procedures for inspection by variables: Part 1 Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL (*first revision*)	Identical

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Indian Standard

NONWOVENS — METHODS OF TEST

PART 13 REPEATED LIQUID STRIKE-THROUGH TIME (SIMULATED URINE)

(First Revision)

SAFETY WARNING — This document does not claim to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. It is expected that the person performing this test has been fully trained in all aspects of this procedure.

1 Scope

This document specifies a test method for the determination of the strike-through time (STT) for each of three subsequent doses of liquid (simulated urine) applied to the surface of a test specimen of nonwoven coverstock.

This test method is intended for quality control and is designed for comparison of STT for different nonwoven coverstocks. It does not simulate in-use conditions for finished products.

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

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 9092, *Nonwovens — Vocabulary*

ISO 11224, *Textiles — Web formation and bonding in nonwovens — Vocabulary*

NWSP 010.1, *Three Standard Test Methods for Nonwoven Absorption*

NWSP 005.0, *Nonwoven sampling*

NWSP 070.7, *Repeated Liquid Strike-Through Time (Simulated Urine)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9092, ISO 11224 and the following 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

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

3.1
sample
product or portion of a product taken from a production lot for testing purposes, identifiable and traceable back to the origin.

3.2
simulated urine
testing liquid consisting of a 9 g/l solution of sodium chloride in demineralized water with a surface tension of (70 ± 2) mN/m

3.3
test specimen
specific portion of the identified sample upon which a test is performed, many test specimens sometimes being tested from the same sample, using different locations.

3.4
strike-through time
STT
time taken for a known volume of liquid to pass through the nonwoven that is in contact with an underlying dry standard absorbent pad

4 Principle

Three subsequent doses of simulated urine are discharged at a prescribed rate, and under specified conditions, onto a test specimen of nonwoven which is placed on a reference absorbent pad. The time taken for each of the liquid doses to penetrate the nonwoven is measured electronically, using conductometric detection. The absorbent pad remains unchanged and wet between the doses.

5 Reagents and materials

Use reagents of recognized analytical grade, unless otherwise specified, and demineralized water.

5.1 Absorbent pad (blotter paper), consists of 7 layers of blotter paper (100 mm × 100 mm) with the smooth side up.

The blotter paper shall meet the following specifications:

a) The mass per unit area of the paper is (139 ± 11) g/m^2.

b) The liquid absorption capacity, of the paper, as determined by NWSP 010.1 is at least of 480 %.

c) The mean first strike-through time is 2 s or less, using test procedure NWSP 070.7, but without a test specimen.

NOTE Information concerning a potential source of suitable blotter paper can be obtained from the nonwovens industry associations. See References [2] and [3].

5.2 Simulated urine, consisting of a 9 g/l solution of sodium chloride in water (5.3), with a surface tension of (70 ± 2) mN/m at (23 ± 2) °C. This surface tension should be checked before each series of tests, as it can alter during storage.

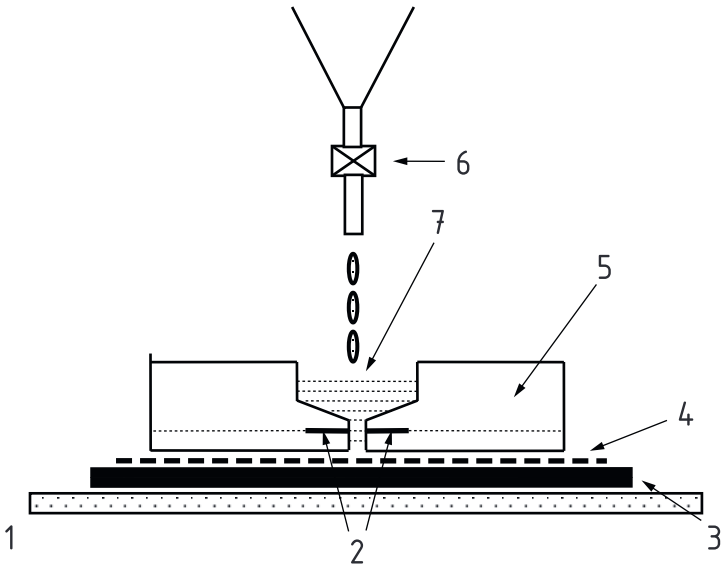
5.3 Grade 3 water, in accordance with ISO 3696.

6 Apparatus

6.1 Burette, 50 ml capacity with supporting stand, or a 5 ml pipette.

6.2 Strike-through tester (see Figure 1)**,** designed such that it releases a standard aliquot of simulated urine into a cavity. Through a (star-shaped) opening in the bottom of the well that rests on the test piece, liquid drains through the test piece into an absorbent pad. The presence and disappearance of the test liquid in the well is detected conductometrically. The time required for the liquid to drain from the well is determined by an electronic timer that is connected to the conductometer.

NOTE More details of an example of apparatus can be found in the Annex B, Figure B.1 and Figure B.2.



Key

1 base plate
2 electrodes
3 absorbent
4 nonwoven
5 electrode plate
6 valve
7 saline solution

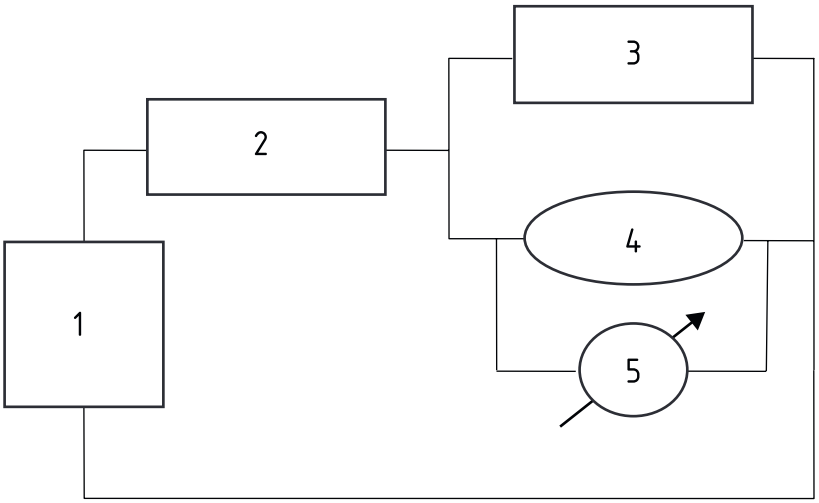
Figure 1 — Strike-through tester

The instrument consists of the following parts.

a) Funnel, fitted with a magnetic exit valve, capable of discharging 25 ml of saline solution in (3,5 ± 0,25) s.

b) Support for the funnel so the funnel position can be adjusted vertically. The distance between the funnel exit and the base plate shall be adjustable from 4,5 cm to at least 15 cm.

c) Electronic conductivity detector capable of detecting saline solution with 0,05 s response time. The detector should be connected with the electrodes in the strike-through plate 6.2 f). The principle of electrical wiring should be as indicated in Figure 2:



Key

1 voltage generator: 1 V, 300 Hz
2 programming resistance 100 kΩ
3 resistance 25 kΩ
4 strike-trough cell
5 voltage metre

Figure 2 — Electrical wiring

d) Typically, a threshold value is defined for V. Below the threshold value the cell condition is "conducting" which corresponds with presence of liquid. Above the threshold, the cell condition is "non-conducting", i.e. absence of liquid. A threshold value of 0,150 V has proven to be successful.

e) Equivalents are allowed. To be successful, the applied voltage shall alternate with a frequency of about 300 Hz, the cell current shall be about 10 µA and the voltage drop across the strike-through cell shall be steep enough when going from a "conducting" to a "non-conducting" condition, such that the disappearance from fluid from the cell can be detected with an accuracy of 0,05 s.

f) Electrode plate (see Figures B.1 and B.2) constructed of 25 mm thick transparent acrylic sheet of total mass (500 ± 5) g, fitted with corrosion-resistant electrodes consisting of 1,6 mm diameter platinum or stainless-steel wire.

g) The electrodes shall be positioned as shown in Figures B.1 and B.2.

h) The plate surface, electrode surface and the star-shaped cavity shall be clean and free from deposits and particulate matter. Clean regularly, e.g. with a mildly abrasive car polish and a dry cloth, and/or hot water.

i) The voltage drop across the electrodes shall be (0,2 ± 0,01) V when the electrode compartment is empty and < 0,140 V when the compartment is filled with 0,9 % saline solution.

j) Baseplate made of transparent acrylic sheet, approximately 125 mm × 125 mm square and about 5 mm thick.

k) Electronic timer for measuring the STT, accurate to 0,01 s. The timer is connected with the conductivity detector [see 6.2 c)] such that as conductive liquid closes/opens the contact between the electrodes, the timer starts/stops.

6.3 Calibration orifice (see example in Figure B.3), gives a specified time for the passage of 10 ml of saline solution. The exact time shall be provided with the orifice with an accuracy of 0,01 s; an expected value is (2 ± 0,2) s. This is for verification of the correct operation of the test equipment.

The orifice shall fit leak-tight, (e.g. with an "O-ring) onto the electrode plate.

NOTE A suitable instrument, is provided under the name "Lister AC"[1)].

6.4 Stopwatch, capable of measuring 60 min with the accuracy of 1 s.

NOTE Depending on the model, a stopwatch might be incorporated in the Lister.

7 Conditioning

Bring samples to moisture equilibrium in the standard atmosphere for testing nonwovens as directed in ISO 139.

NOTE While conditioning for a fixed time cannot be accepted in cases of dispute, it can be sufficient in routine testing to expose the material to the standard atmosphere for testing textiles for a reasonable period of time before the specimens are tested, i.e. 4 h.

8 Sampling

8.1 General

Carry out sampling in accordance with ISO 186. Ensuring that the areas from which samples are taken, have no visible flaws and are not creased.

8.2 Lot size

A lot should be established based on a logical break in the process or as prescribed by a regulation or traceability requirements. There shall be 3 test specimens for this test.

Test specimens shall be selected in accordance with NWSP 005.0, if applicable.

8.3 Sampling

If provided in the customer specification, take random sample as directed. If no requirements are provided, ISO 2859-1, or ISO 3951-1 shall be used. In and of themselves, these are not valid sampling plans by default. An agreement between the purchaser and supplier requires taking into account process stability, producer's risk, consumer's risk, acceptable quality level and also the cost needs to be established.

In general, if the test characteristic can be considered normally distributed, the sampling procedures for inspection by variables will require fewer samples. However, small samples may not reflect that normal distribution and the estimated percent defective can therefore be over or underestimated. In this case, as well as for attribute data, the sampling procedures for inspection by attributes should be used.

In the absence of any sampling size requirement, Table 1 and Table 2 can be used. Switching rules are required to maintain the AQL protection.

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1) Lister AC is the trade name of a product supplied by Lenzing Instruments GmbH & Co. KG, Technologiepark 4, A-4851 Gampern, Austria This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results This company can also provide the calibration orifice.

Table 1 — Attributes (1.0 AQL, General Inspection Level II)

Number of units in the lot inclusive	Number of units that comprise the lot sample
1 to 150	13
151 to 280	32
281 to 500	50
501 to 1 200	80

Table 2 — Variables ("s" method, General Inspection Level II)

Number of units in the lot inclusive	Number of units that comprise the lot sample
1 to 15	3
16 to 25	4
26 to 50	6
51 to 90	9
91 to 150	13
151 to 280	18
281 to 500	25
501 to 1 200	35

NOTE An adequate specification or other agreement between the purchaser and supplier requires taking into account the variability between rolls of nonwoven fabric and between specimens from a swatch from a roll of material to provide a sampling plan with meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

9 Instrument calibration verification

This check shall be carried out regularly for verifying correct operation of the instrument. The actual checking frequency can be derived from a control chart, as it depends on the type of products tested, and the likeliness of contamination of the electrode plate. In addition, it is done.

1) for new electrode plates,

2) when the instrument has not been used for a couple of days, and

3) after cleaning of the electrode plate.

The check intends to provide the operator an independent verification of instrument accuracy in case of unexpected or suspicious test results.

a) Place the electrode plate on top of the calibration orifice as indicated in Figure B.4 in Annex B. Then place the assembly on a suitable receiver, e.g., a Petri dish, such that liquid can run freely from the bottom of the orifice.

b) Make sure that the electronic timer and conductivity detector are switched on, and the electrode plate is connected to the detector.

c) Position the funnel such that the exit tube is 45 mm above the top of the orifice plate and over the middle of the electrode cavity.

d) Pipette 10 ml of simulated urine into the funnel, with the discharge valve closed.

e) Release the liquid by opening the valve. The test liquid runs into the electrode cavity and further through the orifice. The timer starts electronically as soon as the simulated urine closes the contact between the electrodes.

   After all of the test liquid has passed through the orifice, the timer stops.

f) Repeat steps c) through e) two more times for conditioning the equipment.

g) Repeat steps c) through e) ten times. Each time, record the time required for the 10 ml aliquot to run through the orifice, as given by the electronic timer, to an accuracy of 0,05 s.

h) Calculate the average time and the relative standard deviation.

i) Verify whether the average result fits with the reference value that is provided with the orifice.

   If the average result is within ±7 % of the specified value, the instrument is working correctly.

j) After the test series, rinse the orifice with warm water (max. 60 °C).

10 Procedure

10.1 Position the funnel so that the dispensing tip is (45 ± 1) mm above the top of the instrument baseplate.

10.2 Cut a nonwoven test specimen with dimensions 125 mm × 125 mm.

10.3 Prepare the absorbent pad (see 5.1). Stack the paper layers on top of each other, smooth side upwards.

10.4 Place the nonwoven test specimen on top of the absorbent pad that is placed on the baseplate of the instrument. Position the nonwoven such that the direction of liquid flow during the test corresponds with the intended use of the nonwoven, e.g., for personal hygiene products the side of the nonwoven that is intended to be in contact with the user's skin shall be facing upwards.

10.5 Place the strike-through plate on top of the nonwoven with the centre of the plate approximately over the centre of the test piece. Centre the funnel over the cavity in the plate.

10.6 Check whether the timer display shows zero. Usually, the display shows the latest time and resets automatically. If not, re-set.

10.7 Prepare the simulated urine.

10.8 Dispense with the pipette or burette 5,0 ml of simulated urine into the funnel, while keeping the discharge valve of the funnel closed.

10.9 Open the magnetic discharge valve of the funnel to discharge the 5,0 ml of liquid. The initial flow of liquid will close the electrical circuit and start the electronic timer.

The timer will stop when the liquid has penetrated through the nonwoven and dropped below the level of the electrodes in cavity of the strike-through plate. As the timer stops, start the stopwatch.

10.10 Record the time indicated by the electronic timer (STT-1), to an accuracy of 0,01 s.

10.11 Use the stopwatch to record a time interval of 60 s (use stopwatch) during period, dispense a fresh aliquot of 5,0 ml of test liquid into the funnel.

10.12 As the stopwatch reads 60 s, repeat steps 10.8 to 10.10 for measuring the STT of the second dose (STT-2) and repeat this step up to STT-5 when required.

10.13 Clean and dry the bottom of the electrode plate with a dry tissue or cloth before testing the next piece of nonwoven.

10.14 Repeat the test procedure for the required number of test specimens (at least 3).

10.15 Upon recurrence, clean the electrode as indicated under 6.2 h).

NOTE Occasionally, the conductivity detector might not detect an endpoint, or the STT comes out exceedingly long (> 5 × the intra-lab standard deviations away from the average), and well after the visually detected endpoint. In that case, discard the result.

Upon recurrence, clean the electrode as indicated under 6.2 h).

11 Expression of results

Calculate the average value for all test specimens, including the standard variation.

12 Precision

The data for the repeatability and reproducibility of this test method were first established by inter-laboratory tests carried out in 2003 by EDANA, and later on updated by collaborative studies carried out in 2018. These data are given in Annex A. The evaluation of the laboratory tests was carried out according to ISO 5725-2.

13 Test report

In addition to the precise test results, the report shall include the following information:

a) a reference to this document, i.e. ISO 9073-13:2023;

b) the manufacturer of the blotter paper and number of blotter paper layers used for the absorbent pad;

c) complete identification of all materials tested and method of sampling;

d) name and address of testing institution;

e) the date of test;

f) make and model of testing equipment;

g) laboratory testing conditions, including the conditioning atmosphere used; number of specimens tested and note CD and/or MD if significant;

h) for computer processed data, identify the software used and the version;

i) any deviation from the standard test procedure;

j) when calculated, the standard deviation or the coefficient of variation;

k) whether or not samples were conditioned prior to testing and, if so, for how long;

l) any unusual features noted during the testing;

m) when photos are used as the standard, attach copies;

n) surface tension of simulated urine, if different from the value specified in 5.2;

o) individual STT for each of the doses (STT-1, STT-2 and STT-3), to an accuracy of 0,01 s;

p) calculate the average and standard deviation for all of the STT-1, STT-2 and STT-3, for replicate test specimen from the same material portion/lot, if required;

q) whether or not samples were conditioned prior to testing and, if so, for how long.

SI values are regarded as the official standard system of measurement for this standard procedure. If other systems of measurement are used in place of SI units (including inch-pound), their values shall be reported independently. Systems of measurement shall not be combined in any way, but shall be regarded and reported separately.

Annex A
(informative)

Precision

Figures for the repeatability and reproducibility of this method are the results of collaborative studies carried out in 2018 by EDANA, with the following data (see Table A.1).

In this study, three participating laboratories tested the performance of their instruments, using 7 plies from the same absorbent paper without nonwoven. Only simulated urine was used as test fluid, for assessing the influence of the finish from the nonwoven.

1) Test cell (electrode plate), each its own cell.

2) Simulated urine (No surfactant) as test fluid.

Table A.1 — Precision data

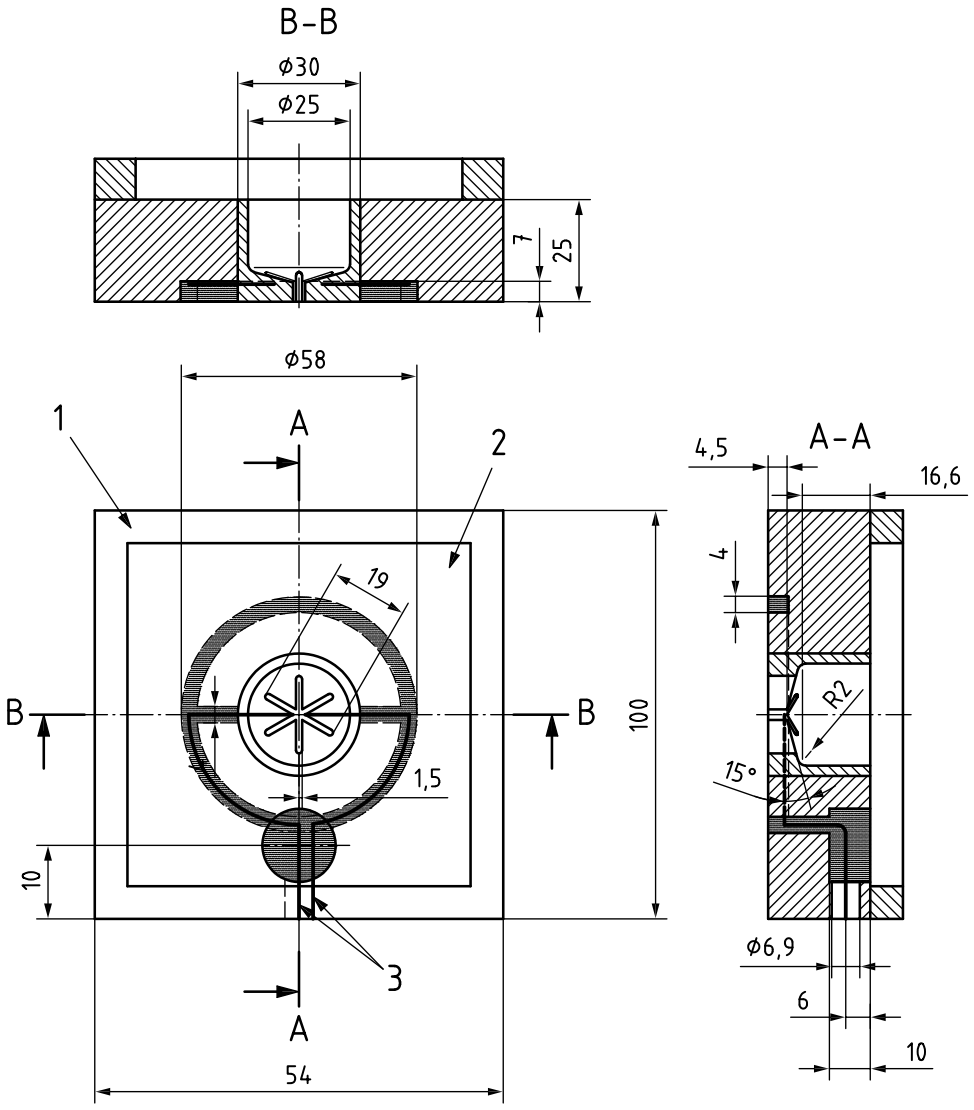
	7 blotter paper				
Number of participating laboratories	3	3	3	3	3
	STT 1	STT 2	STT 3	STT 4	STT 5
Number of single values	40	40	40	40	40
Mean (s)	1,83	3,10	3,50	3,74	4,02
Standard deviation of repeatability (s)	0,18	0,31	0,31	0,32	0,34
Coefficient of repeatability CV_r (%)	9,97	10,11	8,97	8,46	8,50
Min value (s)	1,40	2,44	2,86	3,12	3,28
Max value (s)	2,15	3,95	4,41	4,43	4,81

Annex B
(informative)

Detailed figures of strike-through tester apparatus

The different parts of strike-through tester are shown in Figure B.1, Figure B.2, Figure B.3 and Figure B.4.

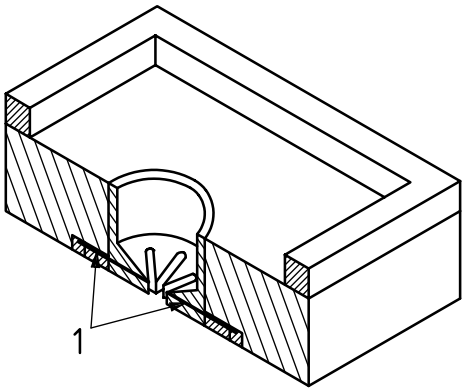
Dimensions in millimetres



Key

1 optional weighting strips
2 strike-through plate (transparent acrylic sheet)
3 electrodes Ø 1,6 mm (see 6.4)

Figure B.1 — Strike-through plate

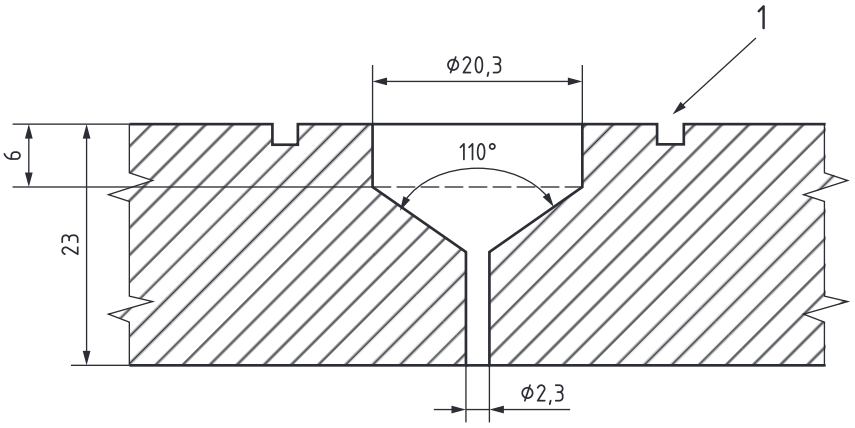


Key

1 wire electrodes Ø 1,6 mm

Figure B.2 — Section across strike-through plate on centre-line of 25 mm cavity

Dimensions in millimetres



Key

1 groove with O-ring seal

Figure B.3 — Calibration orifice

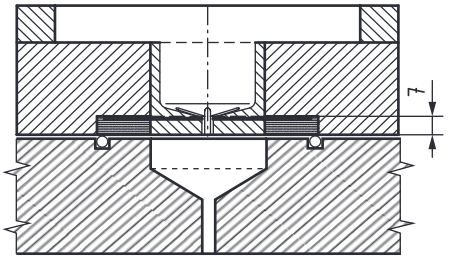


Figure B.4 — Assembly of electrode plate and calibration orifice

Bibliography

[1] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

[2] EDANA www.edana.org

[3] INDA www.inda.org

[4] NWSP 001.0, *Standard Terminology Relating to the Nonwoven Industry, EDANA's and INDA's Standard Procedures*

(*Continued from second cover*)

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

International/Other Standard	*Title*
ISO 9092	Nonwovens — Vocabulary
ISO 11224	Textiles — Web formation and bonding in nonwovens — Vocabulary
NWSP 010.1	Three standard test methods for nonwoven absorption
NWSP 005.0	Nonwoven sampling
NWSP 070.7	Repeated liquid strike-through time (simulated urine)

In reporting the result of a test or analysis made in accordance with this standard, if the final value; observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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Amendments Issued Since Publication

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