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Textiles — Test methods for nonwovens —

Part 18: Determination of breaking strength and elongation of nonwoven materials using the grab tensile test

Textiles — Méthodes d'essai pour nontissés —

Partie 18: Détermination de la résistance à la rupture et de l'allongement de matériaux nontissés par l'essai de traction à l'arrachement

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Contents

Page

Foreword iv
1 Scope 1
2 Normative references 1
3 Terms and definitions 1
4 Principle 2
5 Material and reagents 2
6 Apparatus 2
7 Procedure 3
8 Calculation 4
9 Test report 4
Annex A (informative) **Possible reasons for low precision of grab tensile test** 6

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 9073-18 was prepared by Technical Committee ISO/TC 38, *Textiles*.

ISO 9073 consists of the following parts, under the general title *Textiles — Test methods for nonwovens*:

— *Part 1: Determination of mass per unit area*

— *Part 2: Determination of thickness*

— *Part 3: Determination of tensile strength and elongation*

— *Part 4: Determination of tear resistance*

— *Part 5: Resistance to mechanical penetration (ball burst procedure)*

— *Part 6: Absorption*

— *Part 7: Determination of bending length*

— *Part 8: Determination of liquid strike-through time (simulated urine)*

— *Part 9: Evaluation of drapability including drape*

— *Part 10: Lint and other particles generation in the dry state*

— *Part 11: Run-off*

— *Part 12: Demand absorbency*

— *Part 13: Repeated liquid strike-through time*

— *Part 14: Coverstock wetback*

— *Part 15: Determination of air permeability*

— *Part 16: Determination of resistance to penetration by water (hydrostatic pressure)*

— *Part 17: Determination of water penetration (spray impact)*

— *Part 18: Determination of breaking strength and elongation of nonwoven materials using the grab tensile test*

Textiles — Test methods for nonwovens —

Part 18: Determination of breaking strength and elongation of nonwoven materials using the grab tensile test

1 Scope

This part of ISO 9073 specifies a grab tensile test procedure for determining the breaking strength and elongation of most nonwoven materials. It includes instructions for the testing of wet specimens.

This grab tensile test procedure is applicable for most nonwovens, but is not recommended for nonwovens which have a high percentage of stretch.

2 Normative references

The following referenced documents are indispensable for the application 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 10012:2003, *Measurement management systems — Requirements for measurement processes and measuring equipment*

3 Terms and definitions

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

3.1
grab test
tensile test in which only the centre part of the test specimen is gripped in the jaws of the testing machine

NOTE Normally, the grab tensile strength is determined using a 100 mm wide strip of material. This tensile load is applied at the midpoint of the 100 mm specimen. This is done using 25 mm wide jaw faces that are used to clamp the specimen at each end.

3.2
elongation
deformation in the direction of load caused by a tensile force

NOTE Elongation is generally expressed as a percentage, as a ratio of the length of the stretched material to the length of the unstretched material. Elongation may be determined by the degree of stretch under a specific load, or the point where the stretched material breaks.

3.3
breaking force
maximum force applied to a material when it is carried to rupture

NOTE Materials that are brittle usually rupture at the maximum force. Materials that are ductile usually experience a maximum force before rupturing.

3.4
tensile strength
strength of a material when subjected to either pulling or compressive stress

NOTE It measures the stress a material can bear without breaking or tearing.

4 Principle

Using a tensile testing machine, mount a 100 mm wide specimen centrally with 25 mm clamps at each end of the specimen. The tensile testing machine applies force until the specimen breaks. Values for the breaking force and the elongation of the test specimen are obtained from tensile test instruments by recording charts, or a computer interface.

This test is performed to simulate the stress a medical doctor would place on the elbow of his surgical gown or other similar pressure points. This stress on the elbow of the surgical gown is not replicated by a strip tensile test because, in the grab tensile test, the adjacent material is providing added strength.

The grab test procedure is applicable to the determination of the operative strength of the nonwoven material. There is no straightforward relationship between grab tests and strip tests.

5 Material and reagents

5.1 **Distilled water**, for wet testing.

5.2 **Non-ionic wetting agent**, for wet testing.

5.3 **Container**, for wetting the specimens.

6 Apparatus

6.1 **Tensile testing machine**, with a constant rate of extension and designed for operation at a speed of (300 ± 10) mm/min. Metrological confirmation of the testing apparatus shall be in compliance with Clause 7 and Figure 2 and Annex A of ISO 10012:2003.

This instrument should be able to be calibrated and supplied with a fact sheet indicating that it meets the specified requirements of ISO 10012:2003. This calibration should be maintained in accordance with the manufacturer's specifications.

6.2 **Clamps and jaw faces**, capable of holding the test piece securely without damaging or altering the results of the nonwoven. The faces shall be parallel and have matching centres with respect to one another in the same clamp, and to the corresponding jaw face of the other clamp. Each clamp shall have a front (or top) jaw face measuring (25 ± 1) mm perpendicular to the direction of the application of force, and not less than 25 mm parallel to the direction of the application of force. The back, or bottom, jaw face of each clamp should be at least as large as its mate, but using a larger face for the second jaw reduces the problem of front and back jaw-face misalignment.

NOTE If slippage occurs while the specimen is being tested, the parallel direction width can be changed from 25 mm to 50 mm.

7 Procedure

7.1 Bring the specimens from the prevailing atmosphere to moisture equilibrium for testing in the standard atmosphere as specified in ISO 139. Specimens to be tested in wet conditions shall be immersed in water at room temperature until thoroughly wetted. To thoroughly wet a specimen, it may be necessary to add no more than 0,05 % of a non-ionic wetting agent to the water. A test of any specimen shall be completed within 2 min after its removal from the water.

7.2 Set the distance between the clamps (gauge length) at (75 ± 1) mm.

7.3 Set the testing machine for an extension rate of (300 ± 10) mm/min unless otherwise specified.

7.4 Select the force range of the testing machine for the break to occur between 10 % and 90 % of full-scale force. Calibrate or verify the testing machine for this range.

7.5 Sample in accordance with ISO 186 and, unless otherwise specified, use 5 as the minimum specimen size.

7.6 Handle the test specimens carefully at the edges, to avoid changing the natural state of the test area of the nonwoven material.

7.7 From each sample, prepare five specimens in the machine direction and five specimens in the cross-direction for each testing condition (dry and wet if needed).

7.8 Cut each specimen (100 ± 1) mm wide by at least 150 mm long with the long dimension parallel to the direction of testing and force application. The length of the specimen depends on the type of clamps being used. The specimen should be long enough to extend through the clamps by at least 10 mm at each end.

7.9 Mount the specimen in the top and bottom clamps (jaws) so that the front 25 mm clamps are centred across the width of the specimen.

Carefully mount the specimen so that all the slack in the material is removed, but care should be taken so that pretension is not applied to the specimen. Placing of the specimen into the upper and lower jaws of the tensile machine can be a large source of error in performing this method. The elongation measurement is taken from the point where the force curve leaves the zero line. Mounting the specimens carefully and methodically into the jaws can reduce some of the technician error.

7.10 Trace a mark across the specimen at the front inner edge of each jaw, to check for specimen slippage. When slippage occurs, the mark will move away from the jaw edge and the results of this specimen should be discarded.

7.11 Engage the machine to “run” and break the specimen.

7.12 Read the breaking force, and elongation if required, from the mechanism provided for such a purpose. Record the machine-direction and cross-direction results separately. For most testing machines, data will be obtained using an interface with a computer.

If a specimen slips in the jaws, or breaks at the edge of or in the jaws, or if for any reason the result falls markedly below the average for the set of specimens, discard the result and take another specimen. Continue this until the required number of acceptable breaks has been obtained. The decision to discard a break should be based on observation of the specimen during the test, and upon the inherent variability of the material. In the absence of other criteria for rejecting a jaw break, any break occurring within 5 mm of the jaws which results in a value below 50 % of the average of all the other breaks should be discarded. No other break should be discarded, unless it is known to be faulty.

7.13 If a material manifests any slippage in the jaws, or if more than 25 % of the specimens break at a point within 5 mm of the edge of the jaw, one of the modifications listed below may be tried. If any of these modifications are used, state the method of modification in the test report.

— The jaws may need to have rubber pads applied to each jaw surface.

— The surface of the jaws may be serrated or notched to better hold the material.

— The surface of the jaws may have a sharp edge that could be causing these breaks.

It is sometimes difficult to determine the precise reason for certain specimens to break near the edge of the jaws. If such a break is caused by damage to the specimen by the jaws, then the results should be discarded. If, however, the break is due merely to randomly distributed weak places, it is a legitimate result. In some cases, it may also be caused by a concentration of stress in the area adjacent to the jaws, because the jaws prevent the specimen from contracting in width as the force is applied. In such cases, a break near the edge of the jaw is inevitable and should be accepted as a characteristic of the particular material and the test method.

8 Calculation

8.1 Breaking force

Calculate the average of the breaking force observed for all acceptable specimens. That is, the maximum force exerted on the specimen as read directly from the testing machine.

8.2 Measurement of apparent elongation at break (unless some other force is specified):

Measure the apparent elongation of acceptable specimens at the breaking force. Measure the increase in length from the start of the force-extension curve to a point corresponding with the breaking force, or other specified force. Calculate the apparent elongation as the percentage increase in length based on the gauge length.

8.3 Wet specimens

If tests were performed on wet specimens, the results should be calculated in the same way as for dry specimens (i.e. the average of the breaking force and the average apparent elongation at the breaking force).

9 Test report

The test report shall include all information needed to duplicate the test procedure and its results:

a) a reference to this part of ISO 9073;

b) type and size of test specimen;

c) characteristics of the tensile testing machine used;

d) size of jaw faces used;

e) size of the load cell used to perform the test;

f) if software was used to calculate the results, record the name and version;

g) laboratory conditions under which the testing was done (temperature and humidity);

h) whether or not the samples were conditioned prior to testing and for how long;

i) number of specimens tested for each test condition;

j) average breaking force for specimens giving acceptable breaks for each testing condition;

k) average percent apparent breaking elongation of acceptable specimens for each test condition, if requested;

l) maximum force obtainable in the range used for testing;

m) types of modification used in the jaws, if needed.