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Self adhesive tapes — Measurement of breaking strength and elongation at break

Rubans auto-adhésifs — Mesure de la résistance à la rupture et de l'allongement à la rupture

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 29864:2007) of which it constitutes a minor revision.

The changes compared to the previous edition are as follows:

— the Introduction has been editorially revised;

— the normative references in Clause 2 have been updated;

— a definition has been added for “self adhesive tape” in Clause 3;

— the text has been editorially revised to comply with the most recent editing rules.

Introduction

The breaking strength of adhesive tape is of value as an indication of its uniformity and quality, and its ability to withstand stresses during application and use.

The elongation at break of the adhesive tape is of value as an indication of its uniformity and quality as well as a rough indication of its ability to conform to curved and irregular surfaces. It is usually determined at the same time as the breaking strength.

The procedure specified in this document combines the determination of breaking strength and elongation at break.

Method A is the measurement of breaking strength and elongation at break of tapes other than filament tapes.

Method B is the measurement of breaking strength and elongation at break of filament reinforced tapes.

Self adhesive tapes — Measurement of breaking strength and elongation at break

1 Scope

This document specifies methods to measure the breaking strength and elongation at break of a self adhesive tape when it is subjected to a tensile force sufficient to cause it to break.

These test methods describe a procedure for testing 12 mm or 24 mm wide samples cut from supplied rolls of self adhesive tapes. Alternatively rolls of self adhesive tape up to 50 mm wide can be directly tested in their original width. In these circumstances the practical breaking strength and elongation will be typical of the manufacturer's cut edges. When newly cut sample pieces are tested, because of the better cutting of the edges, the results can be higher than would be found on commercial tape.

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.

EN 12481, *Self adhesive tapes — Terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12481 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
breaking strength
ability to resist breaking when subject to load under prescribed conditions

3.2
elongation at break
increase in length of the adhesive tape at the time of breaking as a percentage of the original length

3.3
self adhesive tape
pressure sensitive adhesive
adhesive which in a dry state is permanently tacky at room temperature and adheres readily to surfaces under brief and light pressure

4 Significance and use

These methods provide a means of assessing the uniformity of breaking strength and elongation at break of a given type of pressure sensitive tape and may be used to compare one product with another.

They may be used to determine particular backing materials or tape widths appropriate to a desired end use.

When relative strength is of interest, the testing should be on tape in the width received to avoid discrepancies as described above.

NOTE 1 Comparison of tapes by different procedures should be avoided because test parameters such as test piece dimension or jaw speed determine the result. Different levels will produce different results for the same test tape. It is usual to find breaking strength increasing significantly with increasing jaw speed.

NOTE 2 Elongation measurements become difficult to perform on stretchy materials (greater than 200 % elongation at break) when the ratio of test piece length to width is small (approaching 2). The results show high variability and do not allow for practical use of this information except when one wishes to demonstrate large differences between materials.

5 Principle

The method consists of holding the adhesive tape vertically by the two clamps of a tensile testing machine. A tensile test is carried out until the adhesive tape breaks.

Method A: A strip of tape is mounted between two clamps aligned in a straight flat plane and a force is applied at a specified rate until the tape breaks.

Method B: A strip of filament reinforced tape is applied to two drums aligned in a flat plane and a force is applied at a specified rate until the tape breaks.

6 Apparatus

6.1 Tensile testing machine

A constant rate of extension (CRE) tension tester shall be used. The tester shall have two clamps with centres in the same plane, parallel with the direction of the motion on the stressing clamp and so aligned that they will hold the specimen wholly in the same plane, a means of moving the stressing clamp at a uniform rate of 5 mm/s ± 0,2 mm/s and a device for recording load and clamp displacement. The instrument shall be calibrated such that a maximum error of 2 % is allowed on the reading.

6.2 Clamps

Preferably of the pneumatic action type. Clamp faces should be at least 50 mm wide and 38 mm deep. The faces should have a light cross-hatched serration to minimise the risk of slippage.

NOTE Plastic materials are reduced in width and thickness as they stretch. This causes them to draw down out of the clamps. Pneumatic clamps minimize this effect. It can be further reduced by the appropriate choice of surface on the clamps. The greatest improvement, both with respect to the above mentioned shrinkage problem and simple slippage, may be found from the use of urethane film which can be obtained as a self adhesive tape approximately 0,5 mm thick. This material has a very high coefficient of friction, is somewhat malleable and is easily replaced. Alternative materials are coated abrasives, rubber (or other synthetic types) or other tapes.

The use of clamps for testing reinforced tapes is discouraged because the strength of reinforced tapes requires excessive clamping pressure which can cause crushing of the reinforcing filaments. When this occurs, the tape usually breaks at the jaw edge which can result in lower breaking values. Hence the use of cylinders described in method B and in 6.3 is recommended for reinforced tapes.

6.3 Cylinders

Used in place of clamps in method B for reinforced tapes. Each of the two cylinders shall be approximately 100 mm in diameter and approximately 38 mm wide held in the position ordinarily occupied by the clamps so that the tape, when applied to the cylinders and extended between them falls in the line of stress otherwise occupied by the test piece when clamps are used. See Figure 1.

6.4 Scale

A scale approximately 22 mm in length divided into 2 mm increments is attached to the surface of each cylinder. The zero point shall be at the point of tangency of the tape with the cylinder during the test and the scale shall increase upwards on the lower cylinder and downwards on the upper cylinder.

NOTE These scales will be used to observe and measure the tape slippage during the determination of breaking strength of reinforced filament tapes.

6.5 Cutting tool

An appropriate test piece cutter shall hold two single edge razor blades in parallel planes a precise distance apart, to form a cutter of exact specimen width; two cutters, 12 mm and 24 mm cutting width, shall be available or appropriate alternates which will not cause edge damage. The precision on the razor blade separation shall be the nominal width ±0,10 mm.

When intending to characterize the material from which the tape is made, the test should be performed on a specimen cut from within the sample material boundaries using a sharp razor blade cutter as defined above.

Some of the traditional tools for test piece preparation should be avoided when the backing comprises thin plastic sheeting. These include chopping dies and sample cutters operating on a shearing principle. The reason for this restraint is that edges sufficiently ragged and damaged resulting from shearing or chopping cause tearing to occur before the true tensile strength level is reached. Tapes with fibrous backings may be cut to satisfactory test pieces with these tools.

7 Test sample and test pieces

7.1 Condition the sample rolls of tape in the standard conditions of 23 °C ± 1 °C and 50 % ± 5 % relative humidity (RH) Test at these conditions unless otherwise specified. If these tolerances cannot be maintained, the closest possible tolerances shall be used and these revised tolerances quoted in the report.

7.2 Discard at least three but no more than six outer wraps of tape from the sample roll before taking the test pieces for testing

7.3 Take from each roll five test pieces. For method A, each test piece shall be 200 mm long and normally the same width as the adhesive tape. For test pieces used with method B, each test piece shall be 700 mm long. For test pieces used with method A, the ends that will be in the clamps may be covered with a layer of paper or be folded back on themselves (in this case the test piece would need to be longer).

The covering shall be wrinkle free so that uniform pressure is exerted by the clamps and leave the entire area exposed between the clamps uncovered.

For method B, the reinforced tape test piece requires no further preparation other than to have the appropriate dimensions and to ensure that the adhesive is not contaminated so that it will adhere to the cylinders.

7.4 Unless the roll is to be tested as supplied, a test piece 12 mm or 24 mm wide shall be cut longitudinally from the roll. Test pieces will not normally be narrower than 3 mm.

8 Procedure

8.1 Testing conditions

The test shall be carried out at the standard conditions of 23 °C ± 1 °C and 50 % ± 5 % RH.

8.2 Preparation of test pieces

Remove the test pieces radially from the roll at an approximate speed of 300 mm/s.

When testing easily extensible self adhesive tapes such as those based on plasticised PVC, PE, etc. it is recommended that the sample pieces be further conditioned for 2 h to remove strain and distortion due to unrolling.

8.3 Method A for non-filament tapes

Set the clamps 100 mm apart. Clamp the test piece firmly so that the longitudinal axis is vertical and in line with the direction of the applied force. Apply no more tension the test piece than is necessary to remove slack.

Start the machine into motion at 5 mm/s and check that the clamps move in the same plane and parallel to the applied force.

Reject all test pieces which break within 5 mm of the clamps and carry out sufficient further tests to obtain 5 test pieces which break in the correct manner.

Note the final load at the break and the distance between the clamps at break. (This may be reported directly by the instrument).

8.4 Method B for filament tapes

8.4.1 Set the cylinders 150 mm apart so that at the start of the test 250 mm of tape will extend between and without contact with the cylinders.

The upper cylinder should be counterbalanced in order that the line of tape contact on the cylinders intersects an imaginary line running between the points of the cylinder attachment to the tester and no side forces are exerted during the test. See Figure 1.

8.4.2 Adhere approximately 230 mm of the test piece on the upper cylinder beginning at the line of tape contact, and wrap the test piece around the surface of the cylinder. Repeat this with the free end of the test piece on the lower cylinder, except wrap the test piece around the bottom surface of the cylinder. The applied test piece shall be centred on the centre line around the cylinder surface. This elimination of skewness prevents non-uniform stress loading across the width of the test piece. The test piece shall also be sufficiently taut to remove slack. See Figure 1.

8.4.3 Mark the test piece (and the cylinder if not already done), with a marking pen making a line approximately 1 mm wide at the line where the tape contacts each cylinder. These benchmarks will be 250 mm apart and shall be checked to ensure this.

8.4.4 Start the machine into motion at 5 mm/s and run until the test piece breaks. Observe the benchmarks on the test piece to determine their change in position relative to the marks on the cylinder. Use the scales appended to the cylinders.

8.4.5 Note the final load and displacement at break. Note also and record the sum of the upper and lower benchmark changes to the nearest 2 mm. This will be the correction for the elongation calculation.

9 Expression of results

9.1 Expression of results for non-filament tapes

Take as the breaking strength the arithmetic mean (average) of the measurements made, as prescribed above. Express the result in N/10 mm.

Take as the elongation at break the arithmetic mean of the displacement in each test, expressing this as a percentage of the original sample length.

9.2 Expression of results for filament tapes

Take as the breaking strength the arithmetic mean (average) of the measurements made, as prescribed above. Express the result in N/10 mm.

The elongation at break is calculated by subtracting the average correction as determined in 8.4.5 from the average displacement recorded by the instrument or chart. This number is expressed as a percentage of the original sample length.

10 Test report

The test report shall include the following information:

a) a reference to this document;

b) which method was used A or B;

c) all information necessary to identify the test sample;

d) the date and place of the test;

e) the breaking strength in N/10 mm;

f) the elongation at break in percentage;

g) any optional operation e.g. newly cut samples or strip conditioning of extensible tapes or any deviation from the prescribed method;

h) the name and signature of the person conducting the test.