



# SLOVENSKI STANDARD

## SIST ISO 1924-2:1995

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Paper and board -- Determination of tensile properties -- Part 2: Constant rate of elongation method

### iTeh STANDARD PREVIEW

Papier et carton -- Détermination des propriétés de traction -- Partie 2: Méthode à gradient d'allongement constant

[SIST ISO 1924-2:1995](https://standards.iteh.ai/catalog/standards/sist/5d5584b9-291d-4482-9525-1290047dc11b/sist-iso-1924-2-1995)

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#### ICS:

85.060          Papir, karton in lepenka          Paper and board

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INTERNATIONAL  
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**1924-2**

Second edition  
1994-12-15

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**Paper and board — Determination of  
tensile properties —**

**Part 2:**

Constant rate of elongation method  
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*Papier et carton 1924 Détermination des propriétés de traction —*

*Partie 2: Méthode à gradient d'allongement constant*



Reference number  
ISO 1924-2:1994(E)

**ISO 1924-2:1994(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.

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International Standard ISO 1924-2 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*.

This second edition cancels and replaces the first edition (ISO 1924-2:1985), which has been technically revised.

ISO 1924 consists of the following parts, under the general title *Paper and board — Determination of tensile properties*:

- *Part 1: Constant rate of loading method*
- *Part 2: Constant rate of elongation method*

Annex A forms an integral part of this part of ISO 1924.

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## Introduction

The method specified in this part of ISO 1924 for the determination of tensile properties is related to the method specified in ISO 1924-1.

This method uses a test instrument operating at a constant rate of elongation, whereas the method described in ISO 1924-1 uses a constant rate of application of tensile force which causes failure in a mean time of  $20 \text{ s} \pm 5 \text{ s}$ .

Because of the different principles involved, the comparison of results obtained by using apparatus complying with ISO 1924-1 and this part of ISO 1924 is not recommended. Where such a comparison is necessary, it should only be undertaken when the time to fail is of the same order for the respective tests.

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# Paper and board — Determination of tensile properties —

## Part 2:

### Constant rate of elongation method

#### 1 Scope

This part of ISO 1924 specifies a method of measuring the tensile strength, stretch at break and tensile energy absorption of paper and board using a test instrument operating at a constant rate of elongation. It also specifies methods for calculating the tensile index, the tensile energy absorption index and the modulus of elasticity.

Testing in conformance with this part of ISO 1924 always includes the measurement of tensile strength. Measurement or calculation of other properties is subject to agreement between the parties concerned.

This part of ISO 1924 applies to all papers and boards, including papers with a high stretch at break if the results are within the capacity of the test instrument. It also applies to the components of corrugated board but not, however, to corrugated board itself.

#### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1924. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1924 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 186:1994, *Paper and board — Sampling to determine average quality.*

ISO 187:1990, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples.*

ISO 534:1988, *Paper and board — Determination of thickness and apparent bulk density or apparent sheet density.*

ISO 536:—<sup>1)</sup>, *Paper and board — Determination of grammage.*

ISO 5270:1979, *Pulps — Laboratory sheets — Determination of physical properties.*

#### 3 Definitions

For the purposes of this part of ISO 1924, the following definitions apply.

**3.1 tensile strength:** The maximum tensile force per unit width that paper and board will withstand before breaking under the conditions defined in the standard test method.

**3.2 tensile index:** Tensile strength (expressed in kilonewtons per metre) divided by grammage.

**3.3 stretch at break:** The measured elongation at the moment of rupture of a test piece of paper or

1) To be published. (Revision of ISO 536:1976)

board when extended under conditions defined in the standard method of test. It is expressed as a percentage of the initial test length.

**3.4 tensile energy absorption:** The amount of energy per unit surface area (test length × width) of a paper or board absorbed during straining it to rupture.

**3.5 tensile energy absorption index:** Tensile energy absorption divided by grammage.

**3.6 modulus of elasticity:** The ratio of the stretching force per unit cross-sectional area to the elongation per unit length.

## 4 Principle

A test piece of given dimensions is stretched to rupture at a constant rate of elongation using a tensile-testing apparatus that measures the tensile force and, if required, the elongation of the test piece. The maximum tensile force and, if required, the corresponding elongation are recorded.

If the tensile force and elongation are continuously recorded, the tensile energy absorption and the modulus of elasticity may be determined.

From the results obtained and a knowledge of the grammage of the sample, the tensile index and the tensile energy absorption index may be calculated.

## 5 Apparatus

**5.1 Tensile-testing apparatus,** designed to extend a test piece of given dimensions at an appropriate constant rate of elongation and to measure the tensile force and, if required, the elongation produced. The tensile force may be recorded as a function of the elongation on an electronic integrator or an equivalent device. The tensile-testing apparatus includes the items listed in 5.1.1 and 5.1.2.

**5.1.1 Means of measuring and indicating the tensile force** to an accuracy of  $\pm 1\%$  of the true force and, if required, the elongation to an accuracy of  $\pm 0,1\%$  stretch.

NOTE 1 The accuracy of measurement of elongation is very important. An appropriate extensometer, placed directly on the test piece, is recommended for accurate measurement of true elongation. This is to avoid the possibility of including, in the measurement, any apparent elongation which may result from undetected slippage of the test piece in the clamps or from the take-up in the joints of the apparatus. The latter is dependent upon the load applied and the error may increase due to wear of the joints of an apparatus which has been in use for some time.

**5.1.2 Clamps,** two in number, for holding a test piece of the required width (see clause 8). Each clamp shall be designed so as to be capable of gripping the test piece without damage or slippage along a straight line across the full width of the test piece and have means for controlling and adjusting the clamping force.

The clamping surfaces of the clamps shall be in the same plane and so aligned that they hold the test piece in that plane throughout the test.

NOTE 2 The clamps should preferably grip the test piece between a cylindrical and a flat surface, or between two cylindrical surfaces, with the plane of the test piece tangential to the cylindrical surface. Other types of clamps may be used provided no slippage of or damage to the test piece occurs during test.

The clamping lines shall remain parallel to within  $1^\circ$  while under load. In addition, the clamping lines shall remain perpendicular to the direction of the applied tensile force and to the long dimension of the test piece to within  $1^\circ$  while under load (see figure 1).

The distances between the clamping lines shall be adjustable to the test length required to within  $\pm 1$  mm.

**5.2 Device for cutting** test pieces to the dimensions required (see clauses 8 and 9).

**5.3 Means of measuring the work done** (for example an integrator) in stretching and rupturing the test piece, with an accuracy of  $\pm 1\%$ . Such devices should be capable of being programmed to take account of different initial test lengths.

This apparatus is required if tensile energy absorption is to be determined.

**5.4 Means of plotting the force/elongation curve and measuring the maximum slope of the curve.**

This is required only if the modulus of elasticity is to be determined.

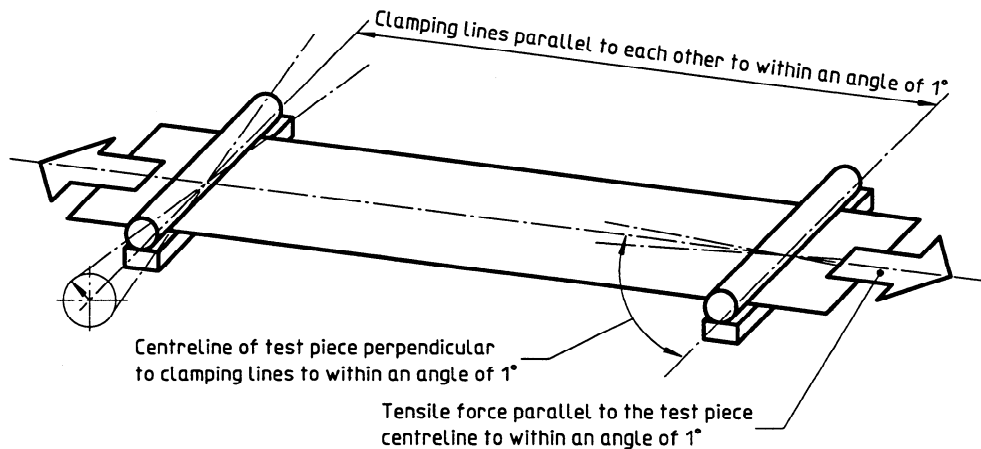
## 6 Sampling

If the test is to be done on a batch of paper or board, sample the batch in accordance with ISO 186.

## 7 Conditioning

Condition the sample in accordance with the requirements of ISO 187.





**Figure 1 — Relationship between the clamping lines and test piece**

## 8 Preparation of test pieces

Carry out the preparation of the test pieces in the same atmospheric conditions used for conditioning the sample (see clause 7).

If the tensile index or tensile energy absorption index is required, determine the grammage of the sample in accordance with ISO 536.

If the modulus of elasticity is required, determine the thickness of the sample in accordance with ISO 534.

**NOTE 3** It is necessary to measure the thickness of each test piece for accurate determinations of elastic modulus and not the mean thickness as in ISO 534. However, the anvil diameter in ISO 534 is 16 mm so that for a 15 mm wide test piece the pressure is slightly greater than the specified 100 kPa. The modulus of elasticity determined by this method is therefore only an approximation.

Prepare the test pieces from specimens taken at random from those selected in accordance with clause 6. No creases, obvious flaws or watermarks shall be included in the test area and test pieces shall not include any part of a specimen within 15 mm of the edge of any sheet or roll. If it is necessary to include watermarks, this fact shall be noted in the test report.

**NOTE 4** Laboratory hand sheets are excluded from the restriction that the test piece shall not include any part within 15 mm of the edge (see also ISO 5270).

Cut test pieces one at a time. Cut sufficient test pieces to ensure 10 valid results in each required principal direction of the paper or board, i.e. the machine and cross directions (see 9.2).

The long edges of the test pieces shall be straight, parallel to within  $\pm 0,1$  mm, cleanly cut and undamaged.

**NOTE 5** Some paper, for example soft tissue, is difficult to cut cleanly. In such cases, a pad of two or three sheets of the paper, interleaved with a harder paper, for example bond, may be prepared and test pieces cut from this pad.

The dimensions of the test piece shall be as follows:

- a) the width shall be  $15 \text{ mm} \pm 0,1 \text{ mm}$ ;

**NOTE 6** In certain circumstances or for paper such as tissue,  $25 \text{ mm} \pm 0,1 \text{ mm}$  or  $50 \text{ mm} \pm 0,1 \text{ mm}$  widths may be used and this fact should be noted in the test report. The results of such tests should not be considered to be identical to those obtained using the standard width.

- b) the length shall be such that the test piece can be clamped without handling the section of the test piece between the lines of clamping. When testing laboratory hand sheets, special instructions apply; see ISO 5270.

**NOTE 7** For some products, for example toilet tissue, dimensions are less than the required test length of 180 mm. In these cases, use the longest test piece that can be achieved consistent with note 8 and record the length in the test report.

## 9 Procedure

### 9.1 Calibration and adjustment of apparatus

Set up the apparatus as recommended by the manufacturer. If required, calibrate the force-measuring