Plastics — Film and sheeting — Determination of tear resistance —

Part 1: Trouser tear method

IMPORTANT NOTE. Before reading this method it is essential to read BS 2782-0, Introduction, issued separately.

The European Standard EN ISO 6383-1:2004 has the status of a British Standard.
This British Standard, having been prepared under the direction of the Plastics and Rubber Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 29 November 1991

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National foreword

This British Standard is the English language version of EN ISO 6383-1:2004. It is identical with ISO 6383-1:1983. It supersedes BS 2782:Method 360B:1980 which is withdrawn. The principal changes in this revision are concerned with the dimensions of the test pieces. The method is one of three for the determination of tear strength of sheet as follows:

Method 360A Elmendorf method (Identical to ISO 6383-2:1983)
Method 360B Trouser tear method (Identical to ISO 6383-1:1983)
Method 360C Initiation method

Cross-references

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<td>ISO 291:1977</td>
<td>BS 2782, Methods of testing plastics Part 0: 1982 Introduction (Appendix A is identical)</td>
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The British Standards which implement international or European publications referred to in this document may be found in the BSI Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the BSI Electronic Catalogue or of British Standards Online.

The Technical Committee has reviewed the provisions of ISO 1184:1983 to which reference is made in the text and has decided that they are acceptable for use in conjunction with this method.

WARNING NOTE. This British Standard method, which is identical with ISO 6383-1, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the method should be operated only by trained personnel.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN ISO title page, EN ISO foreword page, pages 1 to 6, an inside back cover and a back cover.

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Plastics - Film and sheeting - Determination of tear resistance -
Foreword

The text of ISO 6383-1:1983 has been prepared by Technical Committee ISO/TC 61 "Plastics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 6383-1:2004 by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

According to the CEN/CEENELC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 6383-1:1983 has been approved by CEN as EN ISO 6383-1:2004 without any modifications.

NOTE Normative references to International Standards are listed in Annex ZA (normative).
0 Introduction
ISO 6383 consists of the following parts:

Part 1: Trouser tear method;
Part 2: Elmendorf method.

1 Scope and field of application
This part of ISO 6383 specifies a method of determining the tear resistance of plastic film or sheet less than 1 mm thick, in the form of standard trouser-shaped test specimens, tested under defined conditions of pretreatment, temperature, humidity and speed of testing.

The method is applicable to film and sheeting of both flexible and rigid materials, provided that the material is not so rigid that brittle fracture occurs during the test, or so deformable, in an irreversible way, that the energy used in the deformation of the specimen legs is significant (i.e. is not negligible) with respect to the energy used in tearing.

The method may not be suitable for determining the tear properties of cellular sheet and film.

2 References

ISO 291, Plastics — Standard atmospheres for conditioning and testing.
ISO 4591, Plastics — Film and sheeting — Determination of average thickness of a sample and average thickness and yield of a roll by gravimetric techniques (gravimetric thickness).
ISO 4593, Plastics — Film and sheeting — Determination of thickness by mechanical scanning.

3 Definitions
For the purpose of this part of ISO 6383, the following definitions apply.

3.1 tearing force
the average force required to propagate a tear at a constant tearing speed across a test specimen conforming to Figure 1

3.2 tear resistance
the tearing force divided by the specimen thickness

4 Significance

4.1 This method may provide data for quality control, acceptance or rejection in accordance with the terms of specifications and for research and development.

4.2 Tear properties may vary with specimen preparation, speed of testing and environment of testing. Consequently, when precise comparative results are required, these factors shall be carefully controlled.

It is possible, in principle, to compare the tear resistance (see 3.2) of specimens of different materials, provided that their thicknesses do not differ by more than ±10 %. However, caution is necessary in interpreting such results, since the tearing energy may vary considerably with speed of testing for different materials.

5 Principle
A rectangular test specimen having a longitudinal slit extending over half its length, is subjected to a tensile test on the “trouser legs” formed by the slit. The average force required to tear the specimen completely along its length is used to calculate the tear resistance of the material under test (see Figure 1).
6 Apparatus

6.1 Tensile testing machine (not pendulum type), similar to that specified in ISO/R 1184, having the following characteristics.

6.1.1 It shall be power driven and capable of maintaining the appropriate rate of grip separation specified in Clause 9. It is essential that the load measuring device is equipped with an autographic recording device to record the load applied to the specimen as a function of elapsed time from the start of the test.

6.1.2 The grips shall be equipped with chucks designed to securely hold the legs of the test specimen without slip. The chucks shall be wider than the width of the test specimen and, in order that they remain parallel to each other during a test, they shall not be mounted on swivel joints.

6.2 Suitable equipment for measuring the thickness of specimens by the method described in ISO 4593. For embossed film or sheeting, the apparatus specified in ISO 4591 shall be used.

7 Test specimens

7.1 Test specimens shall have the shape and dimensions shown in Figure 1. The length of the slit in the centre of the specimen shall be 75 ± 1 mm.

7.2 The test specimens shall be cut so that the edges are smooth and free from notches. Examination with a low-power microscope is recommended to check freedom from nicks. It is important to pay particular attention to the tip of the slit in the centre of the specimen.

7.3 The properties of certain types of film and sheeting materials may vary with direction in the plane of the film (anisotropy). In such cases, it is essential to prepare two groups of test specimens with their major axes respectively parallel and perpendicular to the direction of some feature of the film or sheeting which is either visible or inferred from a knowledge of the method of its manufacture.

The direction of testing is defined as the direction of the long axis of the test specimen.

NOTE With some types of film, different tear resistance results may be obtained for any direction of testing (for example machine direction or transverse direction) dependent, for example in the case of machine direction test specimens, on whether the tear propagation is in the direction of processing or against the process direction (see Figure 2). When this is known to occur, two groups of test specimens shall be cut in the direction of testing and slit so that results can be obtained for the two possible directions of tear propagation.

8 Number of test specimens

8.1 A minimum of five test specimens shall be tested in each of the required directions of testing.

8.2 Specimens which show a tear out of line to the extent that the tear reaches one of the edges of the test specimen shall be discarded and further specimens tested (see 11.3).

9 Speed of testing

The speed of testing shall be one of the following:

200 or 250 mm/min ± 10 %

NOTE At the present time, both speeds of testing are common throughout the world. For the time being both are being allowed for the purpose of this part of ISO 6383. Subsequent revisions of this part of ISO 6383 may only incorporate the testing speed of 200 mm/min.

10 Conditioning

Unless otherwise specified, test specimens shall be conditioned and tested in accordance with ISO 291, using atmosphere 23/50, except that when a material is known not to be sensitive to humidity, atmosphere 23 may be used.
11 Procedure

11.1 Measure the thickness of the material under test using measuring devices complying with the requirements of ISO 4593. If, however, the film is very thin or if it is embossed, determine the thickness by the method of ISO 4591.

11.1.1 When using measuring devices complying with ISO 4593, measure the thickness of the test specimen at three equidistant points between the tip of the slit and the opposite end of the test specimen. Calculate the mean value.

11.1.2 When using the method of ISO 4591, the average thickness of the film sample shall be taken as the thickness of the test specimen.

11.2 Set the initial separation of the grips to 75 mm. Carefully clamp and align the test specimen legs in the grips so that its major axis coincides with an imaginary line joining the centre of the grips (see Figure 3).

11.3 Set to the required speed of testing (see Clause 9), start the machine and record the load necessary to propagate the tear through the entire unslit length of the specimen. If the tear deviates from the centre line to such an extent as to reach one of the edges of the specimen, discard the result and test another specimen.

12 Expression of results

12.1 The load-time graph from the autographic recorder of the tensile testing machine will show varying trace forms dependent on the nature of the materials tested and their thickness.

Disregarding the loads recorded in tearing the first 20 mm and the last 5 mm of the unslit length, determine the approximate mean value of the tearing load over the remaining 50 mm of the unslit length. When this part of the trace is a wavelike plateau, draw a median line, parallel to the abscissa, through the wavelike curve (see Figure 4). Read the load corresponding to this line and record it as the tearing force of the specimen.

12.2 Calculate the tear resistance of the specimen from the formula

\[ \frac{F_t}{d} \]

where

- \( F_t \) is the tearing force, in newtons, of the specimen;
- \( d \) is the thickness, in millimetres, of the specimen.

NOTE The tearing force may itself be reported, when results are not required to be expressed as the tear resistance.

12.3 Calculate the arithmetic mean for each set of test specimens.

12.4 If required, calculate the standard deviation and coefficient of variation for each set of test specimens.
13 Test report

The test report shall include the following information:

- a) a reference to this part of ISO 6383;
- b) complete identification of the material tested, including type, source, manufacturer's code, form and previous history;
- c) the thickness of the material tested;
- d) the number of specimens tested;
- e) the speed of testing;
- f) the mean tear resistance and/or tearing force for each direction of testing and tear propagation;
- g) individual test results;
- h) the standard atmosphere of ISO 291 used for conditioning and testing and any preconditioning treatment;
- i) the standard deviation and coefficient of variation of the test results, if required;
- j) any operational details not specified in this part of ISO 6383 that may have had an influence upon the results.

Figure 1 — Test specimen

Figure 2 — Direction of tear propagation
Figure 3 — Method of fixing test specimens in grips

Figure 4 — Load-time graph with plateau region
Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

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