



Plastics — Film and sheeting — Determination of tear resistance — Part 1 : Trouser tear method

Plastiques — Film et feuille — Détermination de la résistance au déchirement — Partie 1 : Méthode de déchirement pantalon

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6383/1 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in February 1979.

It has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	Poland
Austria	Greece	Romania
Belgium	Hungary	South Africa, Rep. of
Brazil	India	Spain
Canada	Israel	Sweden
China	Italy	Switzerland
Czechoslovakia	Japan	Turkey
Egypt, Arab Rep. of	Korea, Rep. of	United Kingdom
Finland	Netherlands	USA
France	New Zealand	USSR

No member body expressed disapproval of the document.

Plastics — Film and sheeting — Determination of tear resistance —

Part 1 : Trouser tear method

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/R 1184, *Plastics — Determination of tensile properties of films*.

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 $\pm 10\%$. 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 specimens. 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;
- j) the standard deviation and coefficient of variation of the test results, if required;
- k) any operational details not specified in this part of ISO 6383 that may have had an influence upon the results.

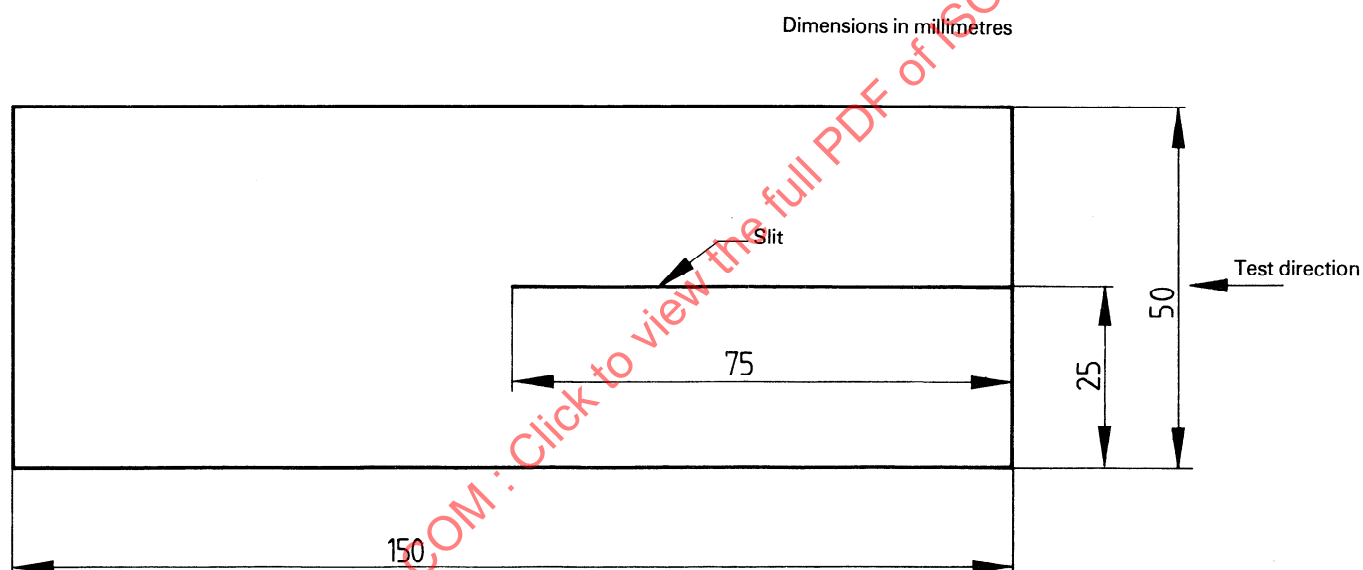


Figure 1 — Test specimen

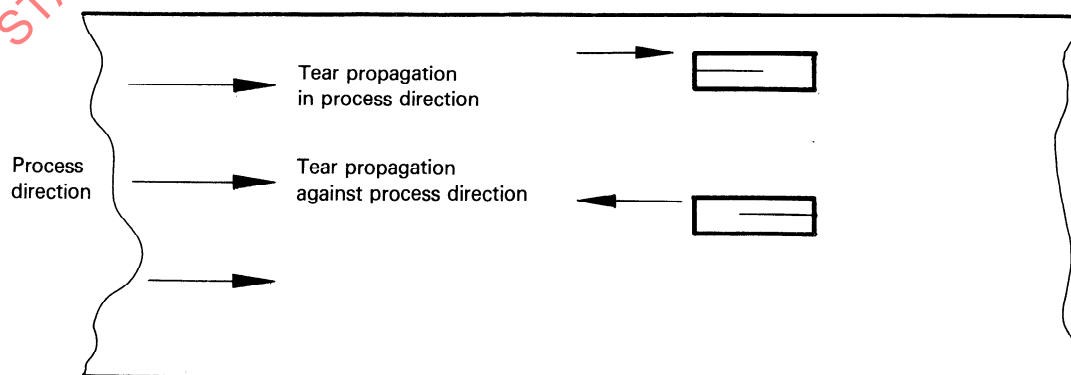


Figure 2 — Direction of tear propagation

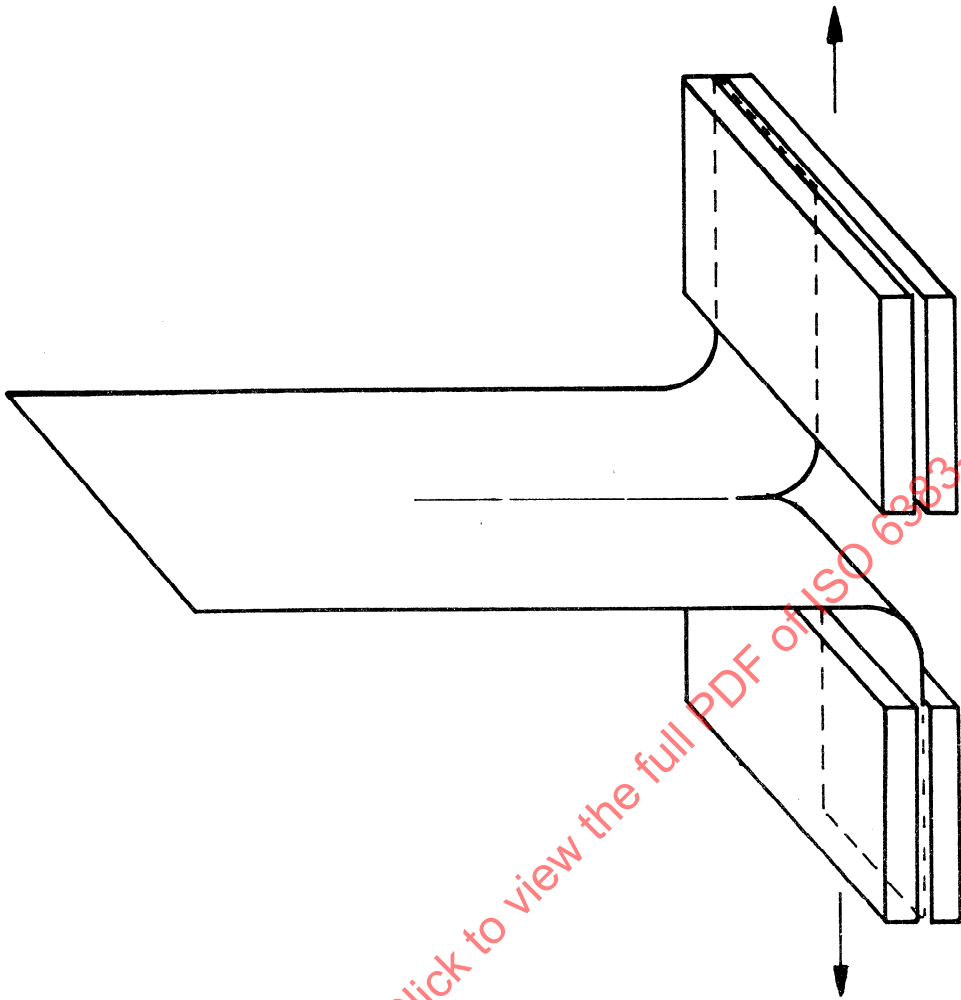


Figure 3 — Method of fixing test specimens in grips

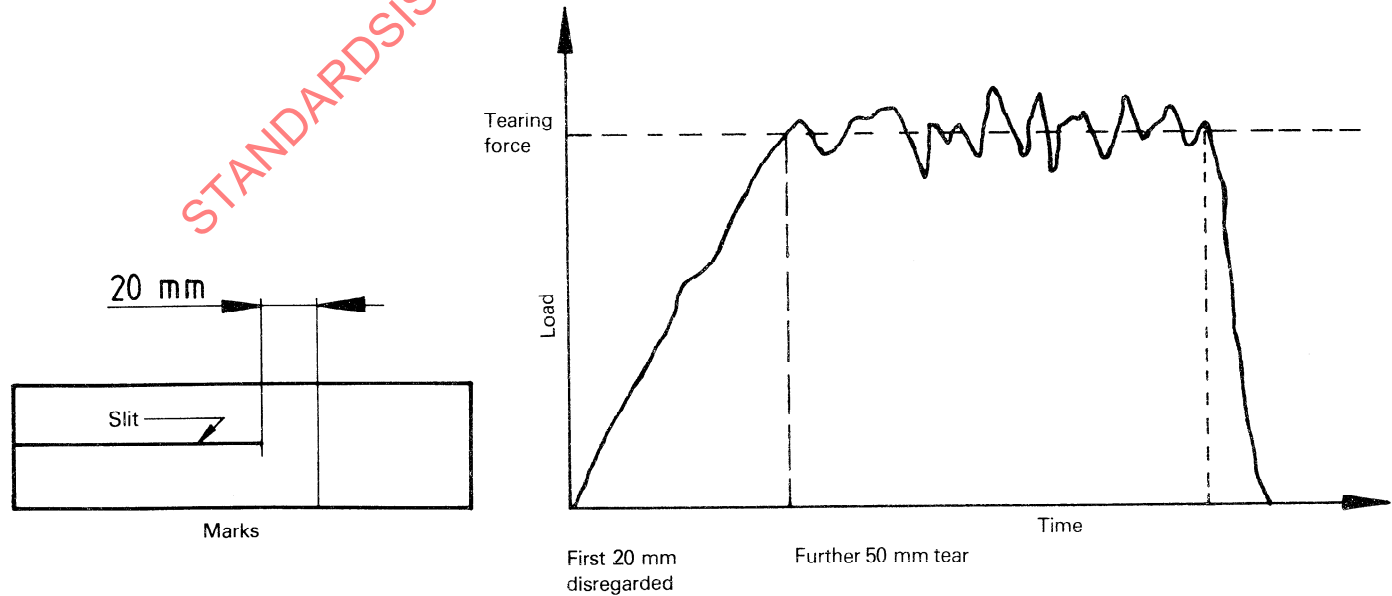


Figure 4 — Load-time graph with plateau region