
**Imaging materials — Photographic films
and papers — Wedge test for brittleness**

*Matériaux pour l'image — Films et papiers photographiques — Essai par la
méthode dite «du coin»*

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Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope	1
2 Normative reference	1
3 Term and definition	1
4 Principle.....	1
5 Apparatus	1
6 Sampling.....	2
7 Conditioning and test conditions.....	4
8 Procedure	5
9 Test report	6
Annex A (informative) Numbering system for related International Standards.....	7
Bibliography	9

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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 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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 18907 was prepared by Technical Committee ISO/TC 42, *Photography*.

This first edition cancels and replaces the second edition of ISO 6077:1993 of which it constitutes a minor revision.

This International Standard is one of a series of standards dealing with the physical properties and stability of imaging materials. To facilitate identification of these International Standards, they are assigned a number within the block from 18900 to 18999 (see annex A).

Annex A of this International Standard is for information only.
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Introduction

In the case of photographic films and papers, brittleness is an undesirable property since satisfactory performance in equipment or in handling requires sufficient flexibility (or lack of brittleness) to ensure good tolerances to bending stresses under the atmospheric conditions likely to be encountered in practice.

Photographic films and papers are laminates of two or more different materials, usually a plastic or paper support and firmly bonded gelatin layers that contain image forming and other substances. These laminate structures must have sufficient flexibility to withstand the stresses imposed by bending and flexing during use. However, under low relative humidity and low temperature conditions, the gelatin layers and/or support tend to become brittle. This can cause the formation of cracks and/or breaks when the laminate is stressed beyond its diminished capacity to withstand bending and flexing.

Different types of brittle failure occur when film and paper are subjected to stress in different ways. For example, failure can consist of very fine cracks in the emulsion (without a break in the support) which are objectionable when the photograph is viewed. Under different conditions or with different materials, failure can consist of cracks in the support or a complete break of all components of the laminate.

Brittleness is not an absolute physical property. The apparent brittleness of photographic material is very dependent upon the manner in which it is mechanically treated as well as the ambient conditions of temperature and relative humidity. As a result, no one test for brittleness is capable of ranking a variety of types of photographic material as they would behave under widely different practical conditions.

The wedge test for brittleness specified in this International Standard subjects the photographic material to a high rate of strain in a simple folding action. It has been an accepted method of rating brittleness for many years and has correlated with product behaviour under many practical applications. It is a widely accepted method in the photographic industry. Other methods used have consisted of flex tests in which the specimen is subjected to a repeated folding action until it breaks, or the bending over mandrels of different diameters. There are a considerable number of flexibility tests available and standardization is not possible at this time.

Brittleness is affected adversely by both reduced temperature and reduced relative humidity. Brittleness at low relative humidity is encountered more frequently than brittleness at low temperature in most applications. Moreover, a marked change in brittleness can occur with only a very small change in relative humidity below a level of about 25 %. Consequently, brittleness tests are carried out only in an atmosphere which is very accurately controlled with respect to both temperature and relative humidity.

Brittleness is also very dependent on the sample thickness, increasing with increasing thickness of either support or emulsion. For this reason, the thickness of the layers must be considered when comparing the behaviour of different materials. The thermal and moisture exposure history of the material between manufacture and testing can also affect the brittleness, even though the sample is reconditioned to a standard temperature and humidity.

Gelatin is generally more brittle than the support, so that photographic products having a gelatin layer on only one side are usually more brittle when bent with the gelatin side out (that is, gelatin under tension).

Brittleness can vary with the bend axis depending upon the orientation of the support. There is generally no directional effect in the brittleness of the emulsion.

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Imaging materials — Photographic films and papers — Wedge test for brittleness

1 Scope

This International Standard specifies a method for determining and expressing quantitatively the brittleness of photographic film and papers. It does not, however, specify a universal brittleness test for all types of stress encountered for which special tests can be required to correctly rate the material for brittleness.

The method is applicable to films with or without a gelatin backing and to fibre-based or resin-coated (RC) photographic papers. It may also be applied to either raw or processed materials although the brittleness level can be quite different after processing from that before processing.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For a dated reference, subsequent amendments to, or revisions of, the publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For an undated reference, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 483:1988, *Plastics — Small enclosures for conditioning and testing using aqueous solutions to maintain relative humidity at constant value.*

3 Term and definition

For the purposes of this International Standard, the following term and definition applies.

3.1

brittleness

property of materials that causes them to break or crack when deformed by bending

4 Principle

Measurement of the opening of a wedge at which a specimen loop fails when subjected to high strains.

5 Apparatus

5.1 Wedge tester for brittleness

The wedge tester for brittleness consists of two non-parallel metal plates or jaws, which form a wedge or V as shown in Figures 1 and 2. A clamp is attached to one jaw at the narrow end of the wedge to hold one end of the specimen. A scale is provided which gives the wedge separation between the two jaws at any point (see [1] in the bibliography).

The dimensions for the wedge tester are standardized for both a narrow and a wide tester. The narrow wedge (see Figure 1) has a wedge angle of 9° and a maximum wedge opening of 25 mm. It is generally satisfactory for most films. For more brittle films and papers, a wide wedge (see Figure 2) is recommended. It has a wedge angle of 28° and a maximum wedge opening of 74 mm.

5.2 Test chamber

An air-conditioned box or walk-in room shall be used for both conditioning and testing. The temperature shall be controlled within ± 1 °C and the relative humidity to within ± 1 %¹⁾ of the specified values. The linear air velocity shall be at least 15 cm/s.

If a walk-in conditioned room is used, the air velocity shall be adequate to maintain the conditions specified. The number of personnel permitted in the room during testing shall be limited and precautions shall be taken to prevent the operator's breath reaching the material.

6 Sampling

6.1 Preparation of specimens

Specimens shall be cut in an atmosphere of 20 °C to 23 °C and from 40 % to 55 % relative humidity.

NOTE If the specimens are cut at relative humidities lower than 40 %, it can be difficult to obtain smooth edges. Handling under these conditions can also cause emulsion cracking which will affect the subsequent brittleness results. Exposure to relative humidities greater than 55 % can permanently alter the subsequent brittleness behaviour of some films and photographic papers.

The cutter shall be of a precision type and shall be kept sharp so that the specimens' edges are smooth and free of nicks. Rubber gloves shall be worn by the operator when handling the specimens, both in their preparation and testing.

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6.2 Selection of specimens

A set of ten specimens shall be prepared for each test. If there is sufficient material, one set of specimens should be cut in the machine direction and a second set in the transverse (cross) direction. If the film has a discrete backing layer, a separate set of specimens shall be cut in at least one of the two principal directions to enable testing with the backing convex.

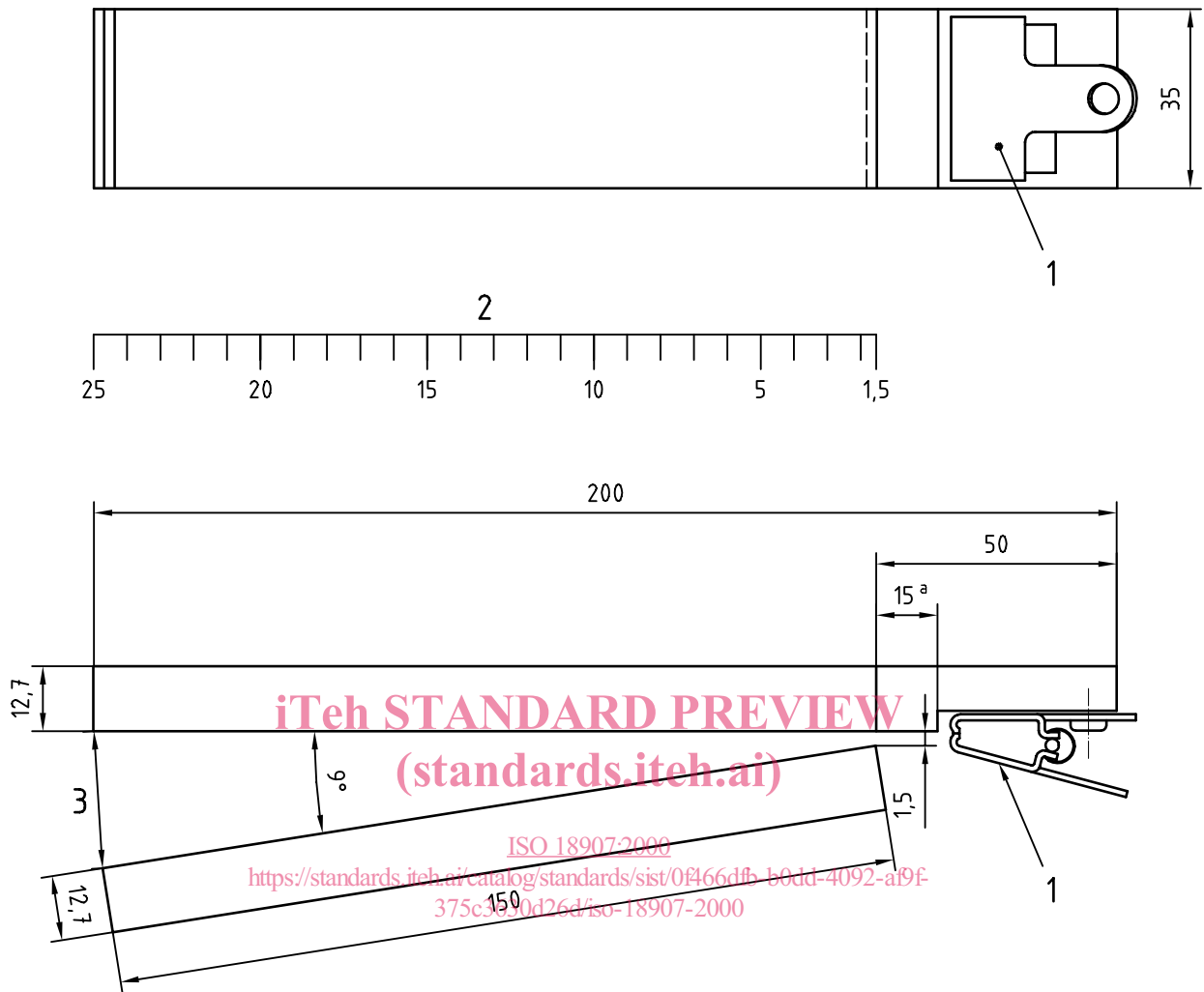
6.3 Size of specimens

The standard specimen size shall be 350 mm long by 15 mm to 16 mm wide. If the sample size available does not permit a 350 mm specimen length, the length can be effectively increased by taping a film or paper leader to the specimen and placing the specimen end in the clamp.

Although not recommended, 16 mm perforated film may be tested for comparative purposes only, by cutting off the perforated edges and testing a specimen 9 mm wide. Similarly, 35 mm film may be tested, but the results are not necessarily comparable to the standard 15 mm to 16 mm width.

¹⁾ To control the relative humidity to this accuracy usually requires a dewpoint method.

Dimensions in millimetres



^a This dimension may vary from 2,5 to 25.

Key

- 1 Clamp
- 2 Wedge opening scale
- 3 Wedge opening 25

Figure 1 — Narrow-wedge tester for brittleness