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**Rubber, vulcanized or  
thermoplastic — Determination of  
tear strength —**

**Part 2:  
Small (Delft) test pieces**

*Caoutchouc vulcanisé ou thermoplastique — Détermination de la  
résistance au déchirement —  
Partie 2: Petites éprouvettes (éprouvettes de Delft)*

ISO 34-2:2022

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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.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fifth edition cancels and replaces the fourth edition (ISO 34-2:2015), which has been technically revised.

The main changes are as follows:

- the mandatory “Terms and definitions” clause has been added;
- the NOTE and keys on [Figures 1](#) and [2](#) have been modified;
- the explanation of  $b_3$ , the total width outside the slit, has been detailed in [7.2.2.1](#) and [Clause 10](#).

A list of all parts in the ISO 34 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Rubber, vulcanized or thermoplastic — Determination of tear strength —

## Part 2: Small (Delft) test pieces

**WARNING 1** — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of any other restrictions.

**WARNING 2** — Certain procedures specified in this document can involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

### 1 Scope

This document specifies a method for the determination of the tear strength of small test pieces (Delft test pieces) of vulcanized or thermoplastic rubber.

**NOTE** The method does not necessarily give results agreeing with those given by the method described in ISO 34-1, which uses trouser, angle and crescent test pieces. It is used in preference to ISO 34-1 when the amount of material available is limited, and can be particularly suitable for testing small finished products.

### 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.

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

ISO 18899:2013, *Rubber — Guide to the calibration of test equipment*

ISO 23529:2016, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

### 3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 4 Principle

The force required to tear across the width of a small test piece containing a slit in the centre is measured.

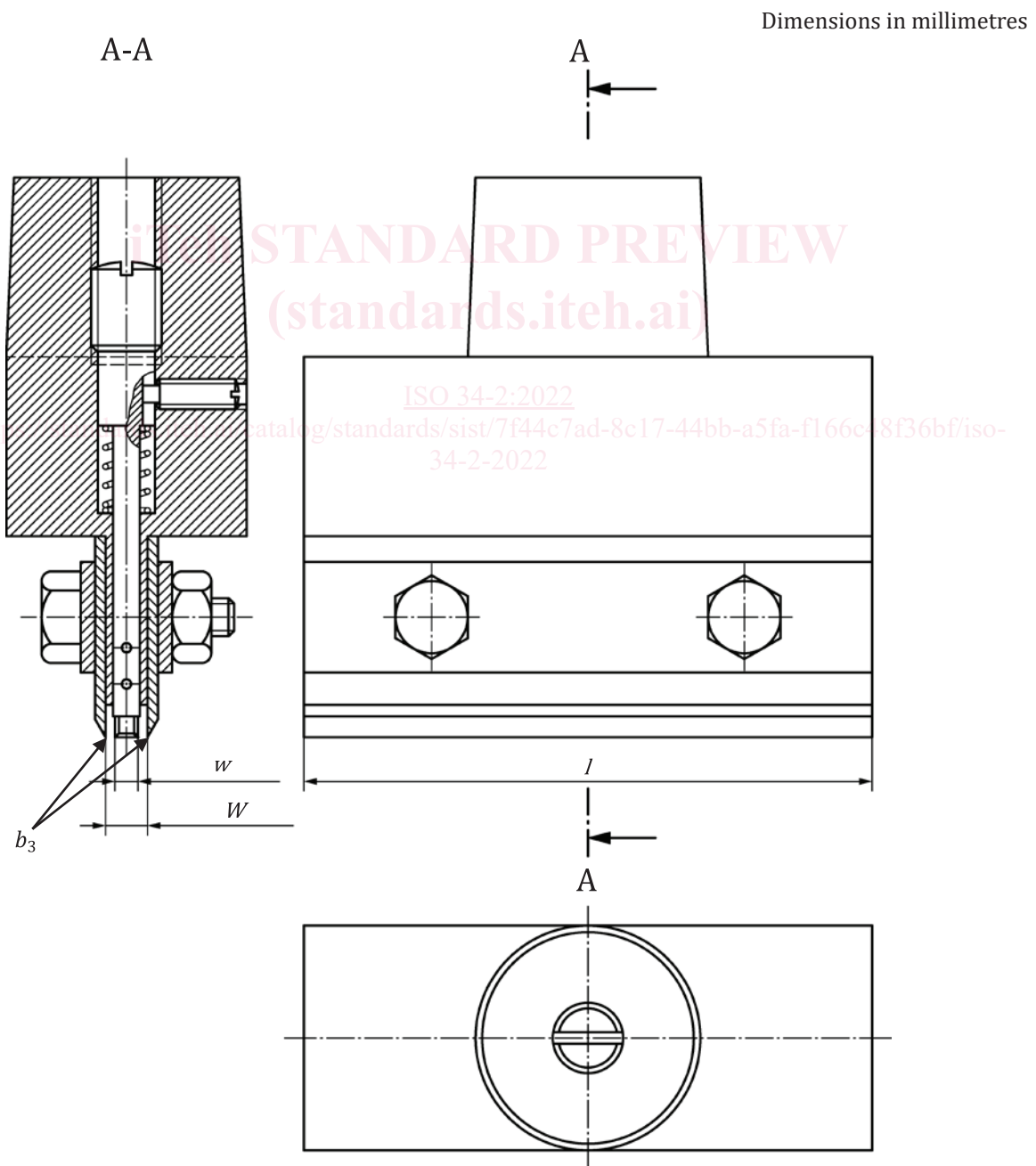
## 5 Apparatus

**5.1 Tensile-testing machine**, in accordance with the requirements of ISO 5893, capable of measuring force with an accuracy corresponding to class 1 as defined in ISO 5893, and with a rate of traverse of the moving grip of 500 mm/min  $\pm$  50 mm/min.

**5.2 Die**, for cutting the test piece. The construction of the die and the knife which cuts the slit is shown in [Figures 1](#) and [2](#).

**5.3 Micrometer gauge**, in accordance with the requirements of ISO 23529 and having a circular foot approximately 6 mm in diameter which exerts a pressure of 22 kPa  $\pm$  5 kPa.

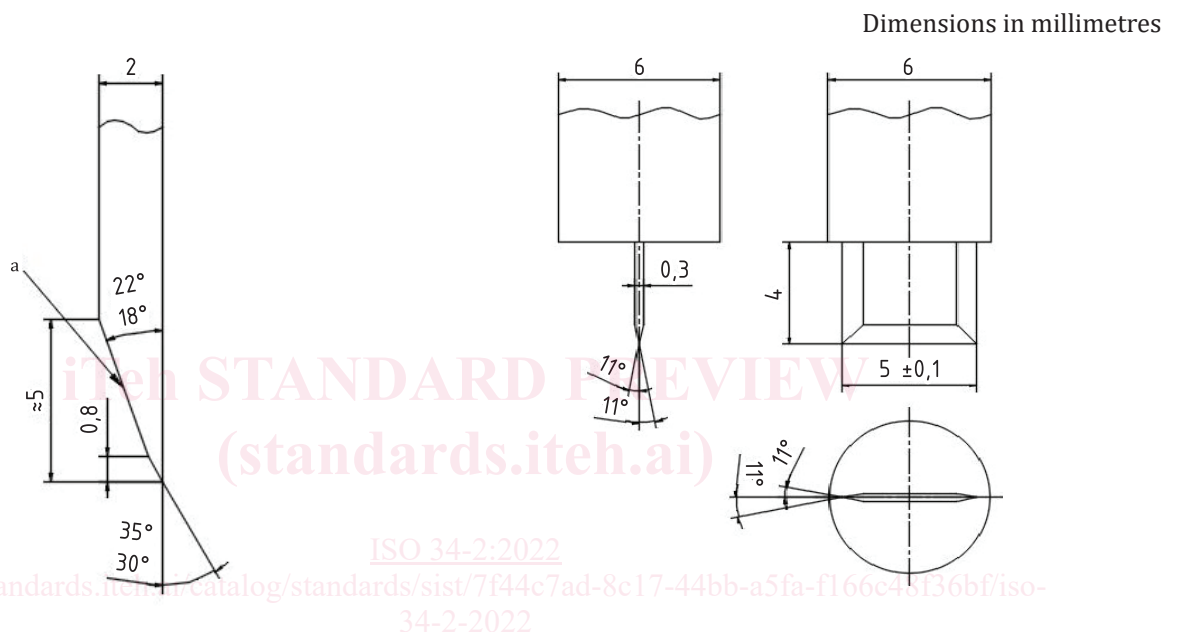
**5.4 Travelling microscope**, giving at least 10  $\times$  magnification, fitted with a graticule graduated at 0,01 mm intervals.



Dimension		Value in millimetres
w	width of the blade for cutting the slit	$5,0 \pm 0,1$
W	Width of the cutting edges of the die	$9,0 \pm 0,1$
l	Length of the die	< 120

**Key**

$b_3$  uncut distance  $b_3 = W - w$  (7.2.2.3 method 2)

**Figure 1 — Die for Delft test pieces**

a) Enlarged detail of blade for cutting out test piece

b) Enlarged detail of small blade for cutting slit

a Cutting edge.

**Figure 2 — Details of Delft test piece die cutting edges**

## 6 Calibration

The test apparatus shall be calibrated in accordance with the schedule given in [Annex B](#).

## 7 Test pieces

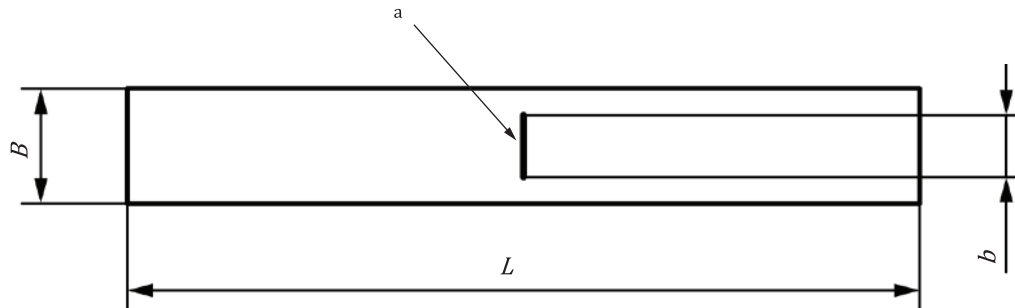
### 7.1 Shape and dimensions

The test pieces shall be rectangular and shall conform to the dimensions shown in [Figure 3](#) and [Table 1](#).

The test pieces shall be cut from a sheet by punching with the die (5.2), using a single blow of a mallet or (preferably) a single stroke of a press. The rubber may be wetted with water or a soap solution, and shall be supported on a sheet of slightly yielding material (for example leather, rubber belting or cardboard) on a flat, rigid surface.

The tear strength is particularly susceptible to grain effects in the rubber. Normally, all test pieces are prepared with the grain at right angles to their length, but, in cases where grain effects are significant and are to be evaluated, two sets of test pieces shall be cut from the sheet, one at right angles to the grain and the other parallel to the grain.

The thickness  $d$  of the test pieces shall be  $2,0 \text{ mm} \pm 0,2 \text{ mm}$ .



a Slit symmetrical with the width.

Figure 3 — Test piece

Table 1 — Dimensions of test piece

Dimension	Value mm
L Length	60
B Width	$9,0 \pm 0,1$
b Slit length	$5,0 \pm 0,1$

## 7.2 Measurement of dimensions

### 7.2.1 Measurement of thickness

Measure the thickness of the test piece in accordance with ISO 23529:2016, method A. Take at least three gauge readings in the region of the slit. If an even number of readings is taken, use the average of the two median values as the result. If an odd number of readings is taken, use the median value. No reading shall deviate by more than 2 % from the value used. When the test results are to be used for comparative purposes, the thickness of any test piece shall not vary by more than 10 % from the mean thickness of all the test pieces.

### 7.2.2 Measurement of the total width outside the slit

#### 7.2.2.1 General

The total width outside the slit  $b_3$  calculated by [Formula \(1\)](#) (see [7.2.2.3](#)) corresponds to the rubber to be torn.

Two methods of measurement may be used. Method 1 is theoretically more exact but is difficult to use in practice. Method 2, which is in common use, is simpler but can give different results. Unless otherwise specified, use method 2.

Results obtained using test pieces measured by different methods shall not be compared.



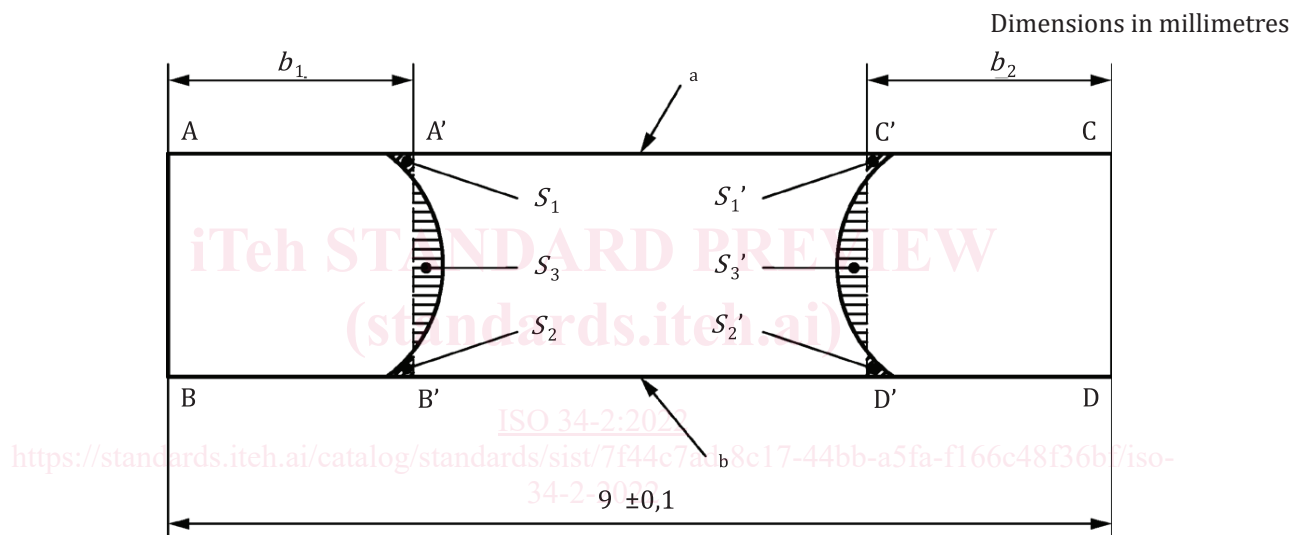
### 7.2.2.2 Method 1: Measurement by travelling microscope

Variations occur in the length of the slit and in the total width of the test piece when the same die is used to prepare test pieces from rubber of different hardness. Moreover, the slit cannot be uniform throughout its depth, but can be wider at one surface. Take one test piece which has been cut out with the die and use it to measure the width to be torn by cutting the test piece through with a sharp razor blade in the plane of the slit and measuring the cut surfaces (width on either side of the slit) with a travelling microscope. The ends of the slit are curved as shown in Figure 4, and an attempt shall be made to allow for this curvature when measuring the width on either side of the slit, as follows.

Take the width on the left-hand side  $b_1$ , which is the distance from the line AB to an imaginary line A'B' which is situated so that the total area  $S_1 + S_2 = S_3$ .

Similarly, on the right-hand side, imagine a line C'D' situated so that the total area  $S_1' + S_2' = S_3'$  and  $b_2$  is the width.

The total width  $b_3$  outside the slit (i.e. the rubber to be torn) is then  $b_1 + b_2$ .



a Top.

b Bottom.

NOTE  $b_3 = b_1 + b_2$  (method 1).

Figure 4 — Section through slit in Delft test piece

### 7.2.2.3 Method 2 (simpler): Measurement from the dimensions of the die used to cut the test piece

Calculate  $b_3$  from the dimensions of the die (see Figure 1), using Formula (1):

$$b_3 = W - w \quad (1)$$

where

$W$  is the measured distance between the cutting edges of the die;

$w$  is the measured width of the blade for cutting the slit.

### 7.3 Time interval between vulcanization and testing

The time between vulcanization and testing shall be in accordance with ISO 23529.

### 7.4 Number

At least three and preferably six test pieces shall be tested.

## 8 Temperature of test

The test is normally carried out at a standard laboratory temperature as specified in ISO 23529.

If the test is to be carried out at a temperature other than a standard laboratory temperature, condition the test piece, immediately prior to testing, for a period sufficient for it to reach substantial temperature equilibrium at the test temperature. Keep this period as short as possible in order to avoid ageing the rubber (see ISO 23529).

Use the same temperature throughout any one test, as well as any series of tests intended to be comparable.

## 9 Procedure

Mount the test piece in the testing machine so that the free length between the points of contact of the grips on the test piece is 30 mm, i.e. so that each grip is 15 mm from the slit. Stretch the test piece in the machine. Do not interrupt the stretching before the test piece has torn completely through. Note the maximum force reached during tearing.

## 10 Expression of results

The tearing force depends on the thickness of the test piece and the width of the rubber torn, and the result is therefore expressed as the force necessary to tear a test piece of standard width and thickness. This value, the tear strength  $F_0$ , in newtons, is given in [Formula \(2\)](#):

$$F_0 = \frac{8F}{b_3d} \quad (2)$$

where

8 is the product of the nominal values of  $b_3$  (4 mm) and  $d$  (2 mm);

$F$  is the force, in newtons, required to tear the test piece;

$b_3$  is the actual width, in millimetres, of the rubber torn in the test piece (see [7.2](#));

$d$  is the actual thickness, in millimetres, of the test piece.

Arrange the results in order of increasing value and take as the result the average of the two median values if the number of test pieces is even, or the median value if the number of test pieces is odd. If only three test pieces are tested, give the individual results.

## 11 Precision

See [Annex A](#).