

**BS EN 530:2010**



BSI Standards Publication

# **Abrasion resistance of protective clothing material — Test method**

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### **National foreword**

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The UK participation in its preparation was entrusted to Technical Committee PH/3/5, Mechanical Impact Personal Protective Equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

## Abrasion resistance of protective clothing material - Test methods

Résistance à l'abrasion du matériau constitutif d'un vêtement de protection - Méthodes d'essai

Abriebfestigkeit von Material für Schutzkleidung - Prüfverfahren

This European Standard was approved by CEN on 19 June 2010.

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## Foreword

This document (EN 530:2010) has been prepared by Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 530:1994.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Annex A provides details of significant technical changes between this European Standard and the previous edition EN 530:1994.

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## Introduction

This document describes testing of abrasion resistance of materials for protective clothing. It should be noted that in order to carry out the abrasion test according to this document the following parameters are to be specified:

- abradant;
- replacement of the abradant;
- conditioning and testing atmosphere;
- debris removal;
- pressure applied;
- judgement of deterioration in case of using method 1;
- number of cycles in case of using method 2.

In general these parameters are specified in product standards.

## 1 Scope

This European Standard describes two test methods on abrasion resistance of materials using the same abrasion apparatus. The first method describes the determination of the abrasion resistance of protective clothing materials. The second method describes abrasion pre-treatment of these materials where the test specimens are used afterwards in other test methods or for evaluating the remaining protective properties.

The abradant is regarded to be a woven wool fabric for the purposes of this standard.

If other abradants (e.g. glass paper) are used, they should be specified in the requirement standard. Mounting instructions of special abradants should be described in requirement standards.

This European Standard is applicable as a reference standard on abrasion for standards and specifications on protective clothing textile materials.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

EN ISO 139:2005, *Textiles — Standard atmospheres for conditioning and testing (ISO 139:2005)*

EN ISO 12947-1:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus (ISO 12947-1:1998)*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1 specimen breakdown

- in woven fabrics, when two separate threads are completely broken;
- in knitted fabrics, when one thread is broken down causing a hole to appear;
- in pile fabrics, when the pile is fully worn off;
- in nonwovens, when the first hole resulting from the wear is of a diameter at least equal to 0,5 mm;
- in coated material, when coating surface has the first hole resulting from the wear of a diameter at least equal to 0,5 mm (hole does not have to be through material)

### 3.2 abrasion rub

one revolution of the outer drives of the Martindale abrasion tester

### 3.3 test interval

amount of rubs to be preset for mandatory abrasion stop for breakdown evaluation and for cleaning the specimen and abradant or to change it

## 4 Methods of test

### 4.1 Principles

The abrasion test using the Martindale abrasion machine is presented in two methods of operation.

#### Method 1: Determination of abrasion resistance

Determination of abrasion resistance employs the instrument in the conventional manner and produces an abraded disc of material 38 mm in diameter. This is convenient where only the loss of finish or appearance, or the mass or volume of abrasion loss, is to be determined and requires only small amounts of material to be tested.

#### Method 2: Pre-treatment procedure

Pre-treatment procedure employs the instrument in inverted mode, i.e. the specimen is placed on the abradant table instead of in the test piece holder and the abradant is mounted in the test piece holder. This provides an abraded area which allows post-abrasion testing or evaluation to be carried out.

### 4.2 Conditioning and testing atmosphere

Condition the material to be tested, and the abradant, in the standard atmosphere in accordance with EN ISO 139:2005 unless otherwise specified in the requirement standard. Conduct the test in the same atmosphere.

If other atmosphere is used, it shall be stated in the test report.

## 5 Apparatus and materials

### 5.1 Abrasion machine

Martindale abrasion machine as described in EN ISO 12947-1.

### 5.2 Abradant

Woven wool fabric conforming to EN ISO 12947-1:1998, Table 1.

If other abradants are used, these shall be specified in the specific product requirement standard.

### 5.3 Foam

Polyetherurethane foam material as specified in EN ISO 12947-1:1998, Table 3.

Foam is used in test pieces holders under specimen or abradant.

When tested material or abradant have a mass per unit area more than 500 g/m<sup>2</sup>, foam is not used.

### 5.4 Felt

Felt backing as specified in EN ISO 12947-1:1998, Table 2.

Felt is used in abrasion tables under the tested material or abradant.

### 5.5 Cutter

Punch or press cutter, to cut a circle of  $(38^{+0,5}_0)$  mm in diameter.

## 5.6 Magnifying glass or microscope

Magnifying glass or stereo microscope, e.g., 8x magnification.

## 5.7 Useful life of auxiliary materials

Renew the abradant for every test. For abrasion tests with more than 50 000 rubs, change the abradant after every 50 000 rubs.

Inspect the felt for soiling and wear after every abrasion test. If soiling or detectable wear shows visible or touchable change (e.g. pilling) in the surface of the felt, replace the felt.

When foam is used in abrasion testing, use a new piece for every abrasion test.

# 6 Procedure of Method 1: Determination of abrasion resistance

## 6.1 Test specimen

Using the punch or press cutter, take at least four pieces for test specimens. Exclude the selvedge area at least 100 mm from the edge when cutting the specimens at random from the entire material. For woven fabrics, take the specimens so that they each contain different warp and weft threads. Specimens shall not include seams.

If the end point of the test is expressed in terms of mass loss, determine the mass of each specimen taken, to an accuracy of 1 mg before the test starts.

## 6.2 Setting up the machine

### 6.2.1 Mounting specimen in test piece holder

Place the ring of the test piece holder in position on the mounting plate provided on the base of the machine. Insert the specimen face side downwards, centrally on the ring. Place the foam backing on top. Foam shall not be used for test specimens with a mass per unit area of more than 500 g/m<sup>2</sup>.

Place the metal insert carefully and centrally on top of the specimen or on top of the foam and specimen, so that its hollowed side faces upwards, and press down.

Ensure that the specimen is retained in a wrinkle-free condition during the further assembly with the test piece holder.

NOTE When screws are used for this assembly, the following procedure should be followed:

Hold the ring containing the specimen and the metal insert firmly in the mounting plate, start to screw the top of the test piece holder on to the ring, taking care that the screw threads are not crossed. Having started the screwing down operation, use both hands to maintain a continuous downward pressure on the assembly, against the mounting plate.

### 6.2.2 Mounting the woven wool fabric abradant on abrading table

Cut circular pieces with a diameter of (140 ± 5) mm of abradant to fit the abrading table and cut the same number and size of felt backings. Use a new abradant on the abrasion tables.

Place the felt backing on the abrading table and place the abradant over the felt. Check that weft and warp of the woven wool abradant lie parallel to the edges of the machine frame.

Compress the felt and abradant on the abrading table with a pressing weight described in EN ISO 12497-1. Fit the clamping ring (or appropriate device) and secure the felt and abradant firmly. Remove the pressing weight. Ensure that the abradant is retained in a wrinkle-free condition.

### 6.2.3 Wrinkles

If the specimen or the abradant cannot be mounted in a wrinkle-free position, the foam or felt backing shall be omitted, but this shall be stated in the test report.

### 6.2.4 Preparation of the abrasion machine

After mounting the specimens in the test piece holders and the abradant on the abrading table, place the test piece holder guide plate in position on the Martindale apparatus. Correctly position the test piece holders and spindles with additional loading pieces (9 kPa or 12 kPa) at their respective work stations.

Use pressure spindle 9 kPa unless otherwise specified in the requirement standard.

NOTE Spindles and additional loading pieces (9 kPa or 12 kPa) are described in EN ISO 12947-1.

## 6.3 Procedure

Preset intervals of rubs to the abrasion machine as the requirement standard states. If intervals are not given in the requirement standard, apply the relevant test series given in Table 1.

Estimate the possible breakdown point of the test material and choose a suitable test series.

The test may be repeated if the estimation is inaccurate.

**Table 1 — Test series**

Test series	Number of rubs $n$ at which specimen breakdown occurs	Test intervals rubs
a	$n \leq 5\,000$	Every 1 000
b	$5\,000 < n \leq 20\,000$	Every 2 000
c	$20\,000 < n \leq 40\,000$	Every 5 000
d	$40\,000 < n$	Every 10 000

NOTE For diagnostic purposes the test interval for each test series may be reduced as the end point is approached.

After preparing the Martindale machine, set the first test interval according to Table 1 or the requirement standard. Switch on the machine.

Continue the abrasion test without interruption until the preselected number of rubs is reached.

Carefully remove the test piece holder with the mounted specimen from the testing machine, and without damaging or disturbing the specimen, clean the debris from the specimens and abradants with compressed air.

Regular removal of abrasion debris and replacement of the abradant are necessary to obtain reproducible test results.

Examine the whole area of the specimen for signs of breakdown with a magnifying glass or microscope. If no breakdown has yet been established, replace the holders in the machine and start the next test interval. Continue this test and assessment sequence until a breakdown is observed in all specimens.

## 7 Procedure of Method 2: Pre-treatment procedure

### 7.1 Test specimen

Select at least four circular test specimens with a diameter of  $(140 \pm 5)$  mm to fit the abrading table. Cut the same number of felt backings to the same size as the specimens.

Exclude the selvedge area at least 100 mm from the edge when cutting the specimens at random from the entire material. For woven fabrics, take the specimens so that they each contain different warp and weft threads. Specimens shall not include seams.

### 7.2 Setting up the machine

#### 7.2.1 Mounting specimens on abrading tables

Carefully position the felt backing on the abrading table and place the specimen over the felt.

Compress the felt and specimen on the abrading table with a pressing weight described in EN ISO 12497-1. Fit the clamping ring (or appropriate device) and secure the felt and specimen firmly. Remove the pressing weight. Ensure that, wherever possible, the specimen is retained in a wrinkle-free condition (see 7.2.3).

#### 7.2.2 Mounting the woven wool fabric abradant on test piece holder

Using the punch or press cutter take at least four pieces of abradant.

Place the ring of the test piece holder in position on the mounting plate provided on the base of the machine. Insert the abradant face side downwards, centrally on the ring. Place the foam backing on top.

Place the metal insert carefully and centrally on top of the foam and abradant, so that its hollowed side faces upwards, and press down. Ensure that the abradant is retained in a wrinkle-free condition during the further assembly with the test piece holder.

NOTE When screws are used for this assembly the following procedure should be followed:

Hold the ring containing the abradant and the metal insert firmly in the mounting plate, start to screw the top of the test piece holder on to the ring, taking care that the screw threads are not crossed. Having started the screwing down operation, use both hands to maintain a continuous downward pressure on the assembly, against the mounting plate.

#### 7.2.3 Wrinkles

If the specimen or the abradant cannot be mounted in a wrinkle-free position, the use of the foam or felt backing shall be omitted, but this shall be stated in the test report.

#### 7.2.4 Preparation of the abrasion machine

After mounting the abradant in the test piece holders and the specimen on the abrading tables, place the test piece holder guide plate in position on the Martindale apparatus. Correctly position the test piece holders and spindles with additional loading pieces (9 kPa or 12 kPa) in their respective work stations.

Use pressure spindle 9 kPa unless otherwise specified in the requirement standard.

NOTE Spindles and additional loading pieces (9 kPa or 12 kPa) are described in EN ISO 12947-1.

### 7.3 Procedure

Preset intervals of rubs to the abrasion machine as the relevant requirement standard states.

After preparing the Martindale machine, set the first test interval from the requirement standard. Switch on the machine. Continue the abrasion test without interruption until the preselected number of rubs is reached.

Carefully remove the test piece holder with the mounted specimen from the testing machine, and without damaging or disturbing the specimen, clean the debris from the specimens and abrasants with compressed air.

Regular removal of abrasion debris and replacement of the abrasant are necessary to obtain reproducible test results.

Replace the holders in the machine and start the next test interval. Continue this test and cleaning sequence until the total amount of rubs is reached.

## 8 Method of assessment

The end of the testing shall be stated in the relevant product standard or specification.

NOTE The following end points are recommended:

- a) a judgement of specimen breakdown in case of method 1;
- b) a number of rubs in the case of method 2.

## 9 Test report

The test report shall at least include following information:

- a) description of the material;
- b) reference to this standard and the method of test;
- c) standard atmosphere;
- d) pressure applied, i.e. 9 kPa or 12 kPa;
- e) reference to woven wool abrasant; if any other abrasant was employed; description as stated in the product specification;
- f) details of any deviation from the standard test (i.e. omission of foam or felt, mounting specimen or abrasant);
- g) in the case of method 1:
  - amount of rubs and cause of ending from each specimen;
  - if used, weight loss of each specimen and the mean value;
- h) in the case of method 2:
  - number of rubs of abrasion applied.

## **Annex A** (informative)

### **Significant technical changes between this document and the previous edition of this European Standard**

The following list gives significant technical changes between this European Standard and its previous edition EN 530:1994:

- a) the Martindale abrasion machine according to EN ISO 12947-1:1998 has been specified as abrasion machine;
- b) the terms "specimen breakdown", "abrasion rub" and "test interval" have been defined;
- c) the conditioning and testing atmosphere has been specified by reference to EN ISO 139:2005;
- d) test series have been specified with numbers of rubs at which specimen breakdown occurs and with test intervals;
- e) the annex regarding assembly, maintenance and calibration of the Martindale abrasion machine has been deleted.

**Annex ZA**  
(informative)

**Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements 1.3.2 and/or 3.3 of that Directive and associated EFTA regulations.

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