BS EN 13594:2015

BSI Standards Publication

Protective gloves for motorcycle riders — Requirements and test methods

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 13594:2015. It supersedes BS EN 13594:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/3/9, Motorcyclists Personal Protective Equipment.

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

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

ISBN 978 0 580 77776 9

ICS 13.340.40; 43.140

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13594

August 2015

ICS 13.340.40

Supersedes EN 13594:2002

English Version

Protective gloves for motorcycle riders - Requirements and test methods

Gants de protection pour motocyclistes - Exigences et méthodes d'essai

Schutzhandschuhe für Motorradfahrer - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 3 July 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword

This document (EN 13594:2015) 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 February 2016 and conflicting national standards shall be withdrawn at the latest by August 2017.

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 13594:2002.

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.

The main technical changes with respect to EN 13594:2002 are listed below:

a) the restriction to professional motorcycle riders has been removed;

b) the definition of professional motorcycle rider has been deleted;

c) a second performance level has been introduced;

d) definitions concerning knuckle protection, fourchettes and wrist line have been added;

e) the artificial wrist for restraint test has been modified;

f) requirements on dye fastness have been removed;

g) former Annex A on motorcyclists’ injuries and selection of protective gloves has been deleted.

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

Introduction

Motorcyclists' gloves are intended to give protection against ambient conditions without unduly reducing the users' dexterity in operating the motorcycle's controls and switches. In addition, the gloves are intended to give mechanical protection to the hands and wrists in accidents. The particular hazards common to motorcycle accidents are impacts with the motorcycle, conflicting vehicles, road furniture, and/or the road surface.

The selection of the gloves by a rider depends on a variety of factors, such as the motorcycling discipline, the weather conditions, the frequency of putting on and taking off the gloves, and the duration that the gloves are typically worn. In order to encourage the adoption of certified protection by the highest possible number of users, two performance levels are specified for gloves. These are level 1 for gloves designed to give protection while having low ergonomic penalties associated with their use and level 2 for gloves providing increased protection with respect to level 1. There may be, however, weight and restriction penalties associated with level 2 protection.

1 Scope

This European Standard applies to protective gloves for motorcycle on-road use. It specifies the requirements for sizing, ergonomics, innocuousness, mechanical properties, impact protection, marking and information for users. It also describes the appropriate test methods.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 388, *Protective gloves against mechanical risks*

EN 420, *Protective gloves - General requirements and test methods*

EN 1621-1, *Motorcyclists' protective clothing against mechanical impact - Part 1: Motorcyclists' limb joint impact protectors - Requirements and test methods*

ISO 6344-2, *Coated abrasives - Grain size analysis - Part 2: Determination of grain size distribution of macrogrits P12 to P220*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 388 and EN 420 and the following apply.

3.1
zone of knuckle protection
zone of the glove that is intended to provide additional specific protection to the knuckles; this zone is subject to specific testing for impact resistance

Note 1 to entry: The knuckles are the 4 projections of the metacarpo-phalangeal joints on the back of the hand.

3.2
protective layer
any material (i.e. not necessarily the outer layer) in a single piece or multiple pieces and/or layers that, joined together by seams or other means, make up the continuous and mechanically strong structure of the glove from the fingertip to the top of the cuff

3.3
fourchettes
part of the gloves connecting front and back side in the interspaces between the four fingers excluding the thumb

3.4
wrist line
line coinciding with the first crease which occurs closest to the base of the palm

4 Requirements

4.1 General

All gloves shall meet the requirements of 4.2 to 4.4.

A level 1 glove shall meet all level 1 requirements of 4.5 to 4.10 and, where relevant, of 4.11.

A level 2 glove shall meet all level 2 requirements of 4.5 to 4.11.

4.2 Innocuousness

Gloves shall meet all of the innocuousness requirements laid down in EN 420.

4.3 Hard inclusions

Hard sharp edges or sharp points shall not be present as a part of the interior or exterior of the glove. Metallic, ceramic, plastic or similar hard materials present as studs, staples, rivets, plates, or similar structures, used to form part of the protective layer of the glove shall not present a hazard to the hand. Examination shall be carried out in accordance with 6.3.

4.4 Ergonomic requirements

When tested in accordance with the method described in Annex A, the assessor shall be able to carry out all the defined movements without any significant problem or hazard being encountered.

4.5 Sizing and cuff length

Motorcyclists gloves shall comply with the sizing system as defined in EN 420 or other suitable sizing system as described in the user's information. When worn by an assessor with appropriate hand size, the cuff length measured from the wrist line of the assessor shall be in conformity with Table 1.

Table 1 — Minimum cuff length

Level 1	≥ 15 mm
Level 2	≥ 50 mm

4.6 Restraint

An adjustable restraint system shall be incorporated into the wrist or cuff.

When tested in accordance with 6.5, the restraint system shall meet the requirements of Table 2.

Table 2 — Minimum restraint force

Level 1	≥ 25 N
Level 2	≥ 50 N

4.7 Tear strength

When tested in accordance with 6.6, the protective layer shall meet the requirements of Table 3.

Table 3 — Minimum requirements of tear strength

Tear strength (protective layer)	**Level 1**	**Level 2**
Palm and palm side of fingers	≥ 25 N	≥ 35 N
Cuff, back and back side of fingers	≥ 18 N	≥ 30 N
Fourchettes	≥ 18 N	≥ 25 N

4.8 Seam strength

When tested in accordance with 6.7 and Annex B, all seams or joints between pieces of material forming the protective layer shall meet the requirements of Table 4.

Seams attaching decorative overlays to the protective layer are not subject to this requirement.

Table 4 — Minimum requirements of seam strength

Seam strength (protective layer)	Level 1	Level 2
Main assembly seams	≥ 6 N/mm	≥ 10 N/mm
Fourchettes	≥ 4 N/mm	≥ 7 N/mm

4.9 Cut resistance

Testing all layers together in accordance with the relevant method of EN 388, the minimum index of cut resistance shall meet the requirements of Table 5.

This requirement does not apply to the fourchettes.

Table 5 — Minimum requirements of cut resistance

Index of cut resistance (all layers together)	Level 1	Level 2
Palm face	≥ 1,2	≥ 1,8
Back face	not required	≥ 1,2

4.10 Impact abrasion resistance

When tested in accordance with 6.8, the mean abrasion time and any single abrasion time shall meet the relevant requirements of Table 6.

Table 6 — Minimum requirements of resistance to impact abrasion (in seconds)

Impact abrasion resistance (palm face / all layers)	Level 1	Level 2
single abrasion time	≥ 3,0 s	≥ 6,0 s
mean abrasion time	≥ 4,0 s	≥ 8,0 s

4.11 impact protection of knuckles

The following requirements for impact attenuation are optional for level 1 gloves; they are mandatory for level 2 gloves and for all gloves designed and constructed to attenuate impact energy in the knuckle area. The correct position of the protection of the four knuckles shall be assessed in accordance with 6.9 and Table A.1, question 7.

When tested in accordance with 6.9 with an impact energy of 5 J, the mean peak of transmitted force and each single test result shall meet the requirements of Table 7.

Table 7 — Minimum requirements of impact attenuation

Impact attenuation resistance (knuckle protection / all layers)	Level 1 (optional)	Level 2 (mandatory)
single result	≤ 9,0 kN	≤ 5,0 kN
Mean transmitted force	≤ 7,0 kN	≤ 4,0 kN

In addition, no part of the glove shall crack or shatter producing sharp edges, and the soft split leather (substance 0,8 mm ± 0,1 mm) between the test piece and the anvil shall not be torn or holed.

5 Test Equipment

5.1 General

Measuring instruments, unless otherwise specified, shall be accurate to ± 2 % of the pass/fail level of the characteristic being measured. Unless otherwise specified, a tolerance of ± 3 % applies to the indicated dimensions. The testing equipment shall comply with the specifications given by this standard or the normative references cited in it.

5.2 Glove restraint testing wrist

The test wrists shall be made of aluminium with polished surfaces. Each test wrist shall consist of a cylindrical body with a hook or other means of attachment at one end and a “mushroom” shaped extension at the other end (see Figure 1) The dimensions are given in Table 8.

If necessary, smaller or bigger test wrists may be used, provided their dimensions maintain the same relative proportions as given in Table 8.

Dimensions in millimetres

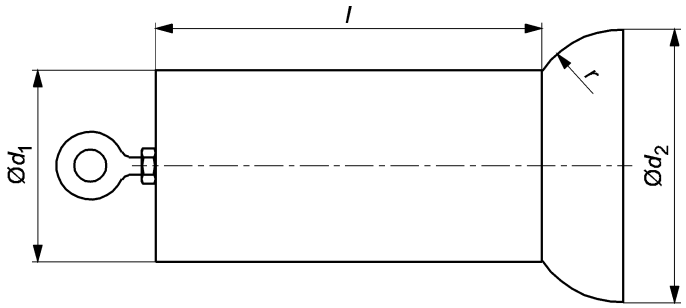


Figure 1 — Glove restraint testing cone

Table 8 — Dimensions of test wrist in mm

Test wrist n°	Cylindrical part diameter d_1	Widest part diameter d_2	Length l
1	44 ± 1	58 ± 1	80 ± 4
2	50 ± 1	66 ± 1	86 ± 4
3	56 ± 1	74 ± 1	92 ± 4
4	62 ± 1	82 ± 1	98 ± 4
5	68 ± 1	90 ± 1	104 ± 4
6	74 ± 1	98 ± 1	110 ± 4
The radius r of the rounded “mushroom” head shall be half of d_2.			

5.3 Impact test apparatus

The apparatus and instrumentation shall be as specified in EN 1621-1 for impact testing, except that the mass of the striker shall be 2,5 kg ± 0,01 kg, the striker shall have a flat face that is 80 mm ± 2 mm in diameter, and the top surface of the anvil shall have a radius of convex dome curvature of 100 mm ± 1 mm.

6 Test Procedures

6.1 Test samples and test pieces

As far as compatible with the size range of the model under examination, samples to be tested shall be of different sizes and test pieces shall be taken from different sizes.

Whenever possible, test pieces shall be taken from whole gloves; where this is not possible, samples of equivalent materials and assemblies as the glove to be tested may be used.

6.2 Conditioning glove samples and test pieces

Only when possible cleaning is claimed, the cleaning method indicated in the manufacturer's information for use shall be applied to the samples as a pre-treatment to testing; the number of treatments shall meet the maximum number of treatments indicated by the manufacturer. In absence of such indication the cleaning cycle (each cycle including complete drying) shall be carried out 5 times. Pre-treatments are not required where the user's information recommends only trivial surface cleaning (e.g. wiping with a damp sponge), which is not considered to affect the performance of the gloves.

Unless otherwise specified in the particular test procedure, gloves and test pieces shall be conditioned in an atmosphere of 23 °C ± 2 °C and 50 % ± 5 % relative humidity for a minimum period of 24 h before testing except for the procedure in Annex A (ergonomic testing). Testing shall be carried out in the conditioning environment or shall be started within 10 min after removal of the test pieces from that environment.

6.3 Hard inclusions

The gloves shall be examined visually and by carrying out the ergonomic exercises of Table A.1 to detect any hard or sharp edges, seams, buckles or other items that might injure the user or other persons. The gloves shall be examined for hard inclusions such as studs, rivets and staples. The results of the examinations shall meet the requirements in 4.3 and shall be recorded in the test report.

6.4 Sizing, length examination of cuff, position of knuckle protection

Gloves shall fit in accordance with relevant instructions supplied by the manufacturers. The cuff length shall meet the requirements of Table 1. Measurement is carried out, with the adjustment system being fastened, from the anatomical wrist line (palm side) of an assessor of appropriate hand size to the end of the cuff. (See also 3.4.)

If knuckle protection is present, its appropriate position covering all of the four knuckles on the hand back shall be assessed in accordance with Table A.1, question 7. The results of the examinations shall be recorded in the test report.

6.5 Restraint

Two samples of different sizes of the glove model shall be tested. The whole glove is fitted onto the testing wrist (see 5.2) which best fits to its size. The larger part ("mushroom" shape) of the testing wrist lies inside the glove. The restraint system of the glove shall be securely fastened around the cylindrical section of the test wrist. A clamp is attached to the digits 2 to 5 of the glove sample, or wires or laces are threaded through those digits, or another equivalent clamping system is used to attach the digits to a single fixation point. The other fixation point is connected to the end of the cylindrical part of the test wrist; both fixation points are then pulled

apart gradually over a period of 3 s to 10 s until the applicable separating force of Table 2 (25 N + 2 N for level 1 or 50 N + 2 N for level 2) has been reached and maintained for 30 s. A tensile testing machine with a speed of 100 mm ± 10 mm per minute may be used, provided that such testing device allows to maintain the applicable separating force for 30 s after reaching it.

The test shall be carried out three times on each glove and it shall be readjusted for each test. The glove shall not pull off the test wrist in any of the three tests.

The pass/fail result, the glove sizes and the numbers of the test wrists used shall be recorded in the test report.

6.6 Tear strength

Three test pieces of each type of material forming the protective layer shall be tested in accordance with the relevant method of EN 388. The lowest result obtained on a single test piece shall comply with the applicable performance requirement in Table 3 (4.7) for the listed parts of the glove.

If necessary, the size of the test pieces may be reduced to not less than 50 % of the linear dimensions given in EN 388, otherwise testing may be carried out on test pieces cut from sheet material of equivalent quality.

6.7 Seam strength

Three test pieces of each seam type shall be tested according to the test procedure in Annex B. Each type of seam or joint between materials forming the protective layer (see 3.2 and 4.8) shall be tested. When the material on one or both sides of the seam includes more than one layer (e.g. cover material and liner), that composition shall be maintained in the test piece and those layers shall be tested together. Test pieces shall be cut from whole gloves wherever possible (see also 6.1). The seam strength shall be calculated by dividing the breaking force by the length of the tested seam. The calculated mean value of each seam type shall comply with the applicable performance requirement of 4.8.

6.8 Impact abrasion resistance

Resistance to impact abrasion shall be tested in accordance with Annex C.

6.9 Determination of Impact attenuation

Impact testing shall be carried out according to EN 1621-1, modified however by the requirements given in 4.11, the impact test apparatus given in 5.3 and the following instructions:

a) Principle: The impact test shall be performed in a way that the centre of the falling weight hits directly the zone where the glove covers the centre of one of the four knuckles.

b) Number of samples and tests:

   1) use 4 sample gloves, each one to be hit once;

   2) as far as possible the 4 sample gloves shall be of different sizes;

   3) each one out of the 4 single tests shall be carried out on a different knuckle.

c) defining the test spot on gloves without a visible impact protection element: The glove sample shall be donned by an assessor with appropriate hand size who shall then firmly grip a cylindrical bar of diameter 32 mm ± 5 mm and length ≥ 120 mm and the position of the most prominent points of the knuckles to be tested shall be marked on the back of the glove. The same procedure shall be repeated with 2 other assessors. The triangle between the 3 marked points on the chosen knuckle will be the area to be placed onto the centre of the testing anvil.

d) defining the test spot on gloves with a visible impact protection element: once the correct position of the protection element has been confirmed by the ergonomic assessment of Table A.1, question 7, the most prominent part of the shield over the chosen knuckle shall be marked as the point which will have to be placed onto the centre of the anvil.

e) Preparation of samples: The glove samples previously marked as described above shall be opened out flat, e.g. by cutting along the junction of palm and back;

f) Place a piece of soft split leather (0,8 – 1,0 mm, e.g. chamois leather) over the 100 mm radius dome of the anvil. Position the sample with the previously marked impact point onto the centre of the dome. Raise the 2,5 kg striker with a flat impactor face to a height that will provide the required impact energy of 5 J ± 0,1 J when touching the test piece. Release the impactor and record the peak force detected by the load cell or other sensor beneath the anvil. Check and record if the soft split leather is torn or holed. Repeat the procedure for the remaining glove samples to be tested and record all results.

g) Concerning any other applicable detail refer to the method in EN 1621-1 (ambient condition).

h) In accordance with 4.11, two results expressed in kN with one decimal place shall be recorded:

   1) the highest peak force obtained on a single sample;

   2) the calculated mean force obtained on all four samples.

   Also any tear or hole in the soft split leather beyond the test piece shall be noted in the test report and shall lead to a “fail” result.

7 Marking

Each glove shall be permanently and conspicuously marked with at least the following:

a) Name and/or registered trade mark of the manufacturer or his authorized representative;

b) glove designation, commercial name or code;

c) size designation;

d) the pictogram (see Clause 9);

e) the number of this European Standard, i.e. EN 13594:2015 (see Clause 9).

8 Information supplied by the manufacturer

Gloves for motorcycling shall be supplied with information and instructions for use. Instructions shall be precise, comprehensible and in the official language(s) of the country of destination. They shall contain at least the following information:

a) the full address of the manufacturer or his authorized representative in the European Union;

b) a statement on the intended use of the gloves;

c) information of the specific hazards against which protection is given;

d) advice on how to select the correct size of the glove and how to check its fit;

e) advice on how to adjust the restraint system on the gloves;

f) advice about the use in combination with a jacket or other PPE, if applicable;

g) a warning about the limits of the protection provided by the gloves;

h) care and cleaning instructions; if applicable, also the maximum number of cleaning cycles;

i) instructions on how to examine the gloves for wear and degradation to identify gloves which are no longer suitable to use;

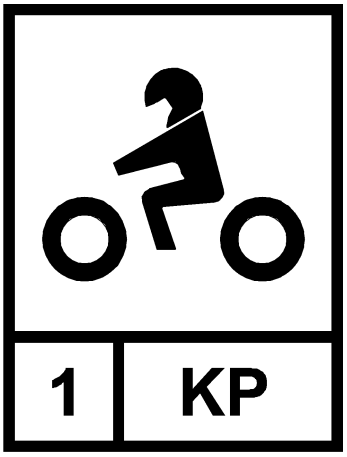
j) explanation of markings and pictograms on the glove;

k) if applicable, information concerning impact protection.

9 Pictogram

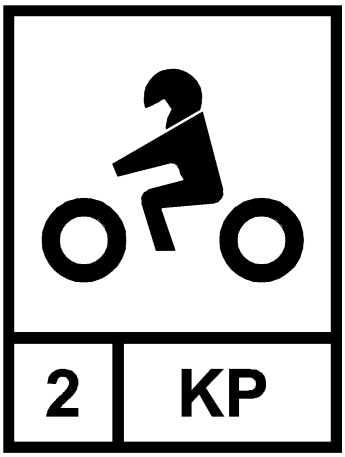
Gloves fulfilling the requirements of this European Standard shall be marked with the pictogram shown in Figure 2. The pictogram is to be placed permanently on the gloves and it shall be at least 10 mm across.

Below the pictogram the number and year of this European Standard shall be written by printing, embossing or other legible and durable technique.



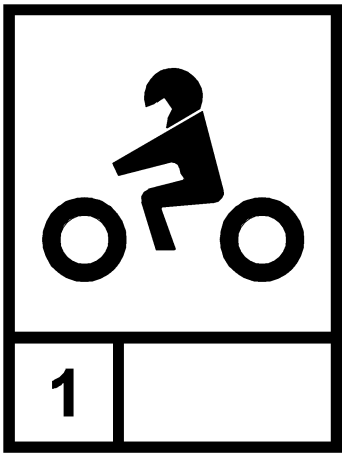
EN 13594:2015

a) Level 1 with knuckle protection



EN 13594:2015

b) Level 2 with knuckle protection



EN 13594:2015

c) Level 1 without knuckle protection

Figure 2 — Pictogram

Annex A
(normative)

Ergonomic and size testing

A.1 Principle

The fit of gloves is verified on at least 2 sizes of the range through examination by subjects with appropriate hand sizes. The ergonomic properties of the gloves are evaluated by an assessor of suitable size and with experience of riding a motorcycle performing a number of tasks simulating riding motorcycles and answering a number of questions (see Table A.1).

A.2 Procedure for ergonomic evaluation

After putting on a pair of gloves of proper size, at least one assessor shall carry out the tasks in Table A.1. If at any time features of the gloves are found that could make riding hazardous, the description of such unsafe features shall be included in the test report and the glove shall be deemed to have failed. However this kind of negative assessment by one subjective tester shall be rechecked by two other inspectors and may turn to become positive if both inspectors do not confirm the problem but decide for a positive assessment. This proceeding shall be applied also with reference to the questionnaire of Table A.1.

All the questions of the Table A.1 need to be answered “yes”, in order to get a pass result.

Table A.1 — Questionnaire

1.	Are the insides of the gloves free from rough, sharp, hard or otherwise irritant parts?
2.	Can both gloves be put on, adjusted and taken off without help?
3	Can you confirm that your wrist does not suffer from excessive pressure by the restraint system?
The following tasks are to be evaluated with the gloves donned and sitting on a motorbike (real or simulated).	
4.	Can you satisfactorily feel and operate the handlebars, accelerator, clutch, and brake levers?
5.	Can you confirm that no parts of the glove catch on or interfere with any controls or switches?
6.	Can you confirm that there are no other features, which might make riding hazardous?
If knuckle protection is available according to 4.11:	
7.	While firmly gripping a cylindrical bar of Ø 32 mm ± 5 mm / length ≥ 120 mm: Do you feel the knuckle protection is properly positioned to protect the knuckles?

A.3 Test report

The test report shall include the results of the size verification of all the glove sizes supplied and the final ergonomic evaluation as determined above. Details of reasons for failure of gloves shall be given.

Annex B
(normative)

Test method for determination of seam strength

B.1 Scope

This annex contains a method for measuring the breaking strength of stitched seams in gloves.

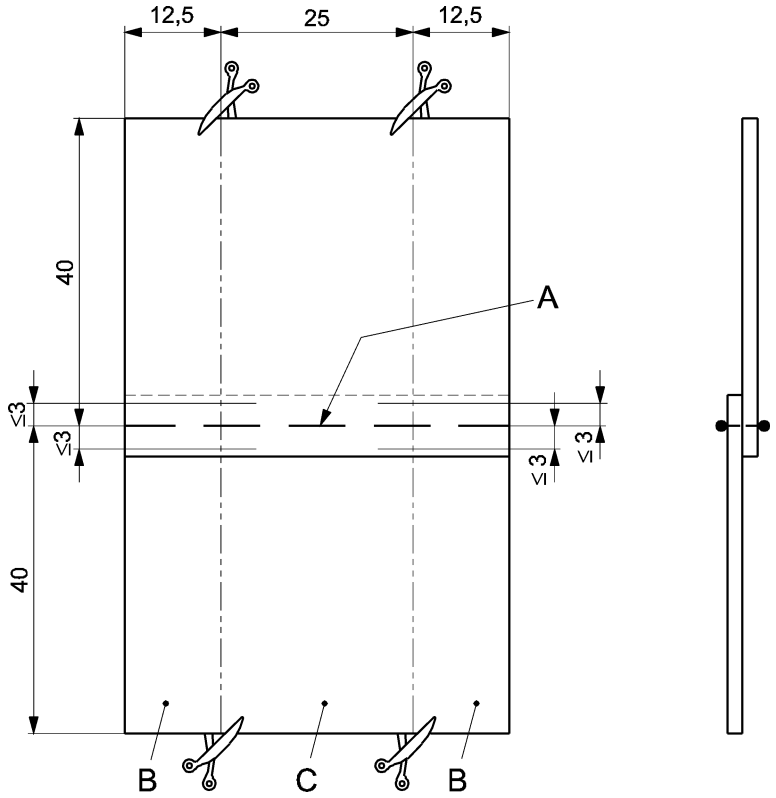
B.2 Preparation of Test Pieces

Rectangular test pieces shall, whenever possible, be cut from gloves with the seam to be tested across the centre of the test piece. The test pieces should have the dimensions shown in Figure B.1. If the glove is not large enough, the width of the central area of the test piece may be reduced, but not to less than 10 mm. The material either side of the seam is ideally 40 mm long, but this length may be reduced to 20 mm if longer samples are not available. In exceptional circumstances, seams sewn in stock material may be tested, provided the dimensions and properties of material, yarn and workmanship are equivalent to those of the glove.

To prevent the seam from opening, both extremities may be fixed by a drop of glue or other suitable means; however, such auxiliary alteration of the seam is admissible only in the outer part of the edge piece and in no case shall enter or reach the central area.

The test pieces shall then be cut at an angle of 90° (see Figure B.1) or slightly more (see Figure B.2) to the seam, so that the central areas are separated from the edge pieces. The cuts shall stop not more than 3 mm from the seam.

Dimensions in millimetres



Key

A seam

B edge piece

C central area

Figure B.1 — Example of a test piece cut at 90°

Dimensions in millimetres

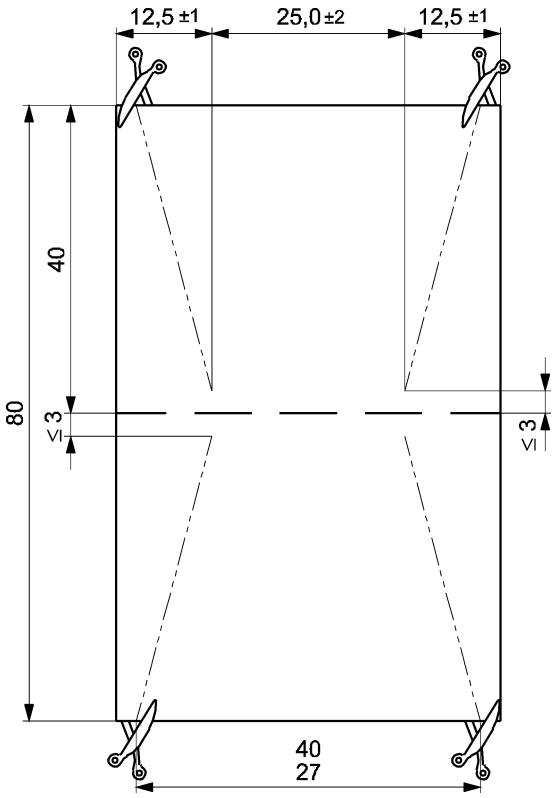


Figure B.2 — Example of alternative cutting technique (trapezium type)

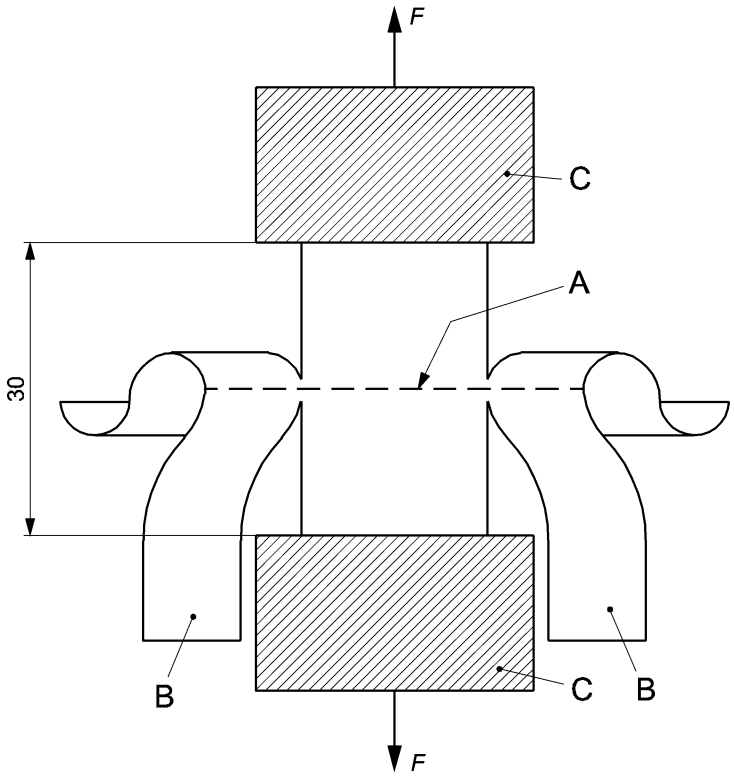
B.3 Apparatus

A tensile testing machine with at least a range of 0 N to 2 kN and a rate of traverse of 100 mm/min ± 20 mm/min. The clamping jaws shall be at least 30 mm wide.

B.4 Procedure

Measure the width of the central seam of the test piece. Set the jaws of the machine 30 mm apart. Place the test piece in the jaws so that the seam is parallel to the jaws and ca. equidistant between them. Clamp the jaws on the central part leaving the edge pieces to hang freely (see Figure B.3). Operate the machine and record the force at which failure occurs, independently from the kind of failure. Repeat the test until three results have been obtained on each seam type present in the glove.

Dimensions in millimetres



Key

A seam
B edge pieces
C jaw

Figure B.3 — Clamping of a rectangular test piece as shown in Figure B.1

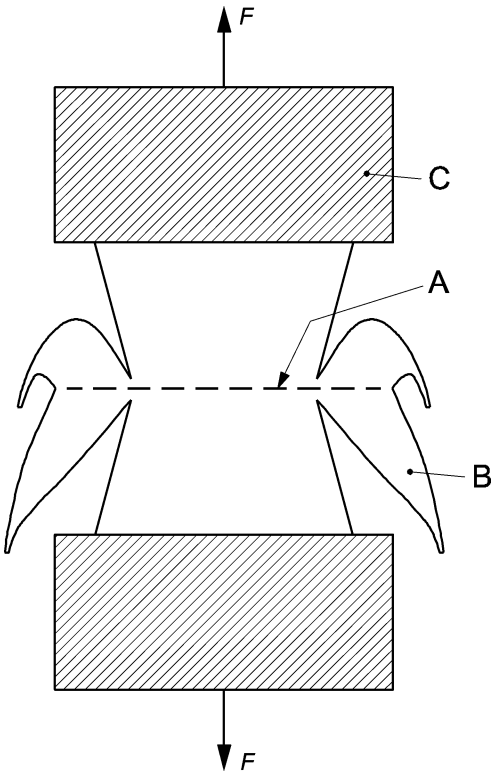


Figure B.4 — Clamping of a trapezium shaped test piece as shown in Figure B.2

B.5 Calculation of results

For each test piece, calculate the seam strength by dividing the breaking force by the length of the tested seam (corresponding to the initial width of the central part of the test piece). Calculate and record the mean value in N/mm of the three results obtained for each type of seam present in the glove

B.6 Test report

The test report shall include at least the following information:

a) description of the seam type (see also Table 4 and 6.7);

b) the mean value of seam strength for each kind of seam;

c) in case of “fail”: the type(s) of failure.

Annex C
(normative)

Test method for determination of impact abrasion resistance

C.1 Scope

This annex details the method for measuring the impact abrasion resistance for gloves.

C.2 Samples

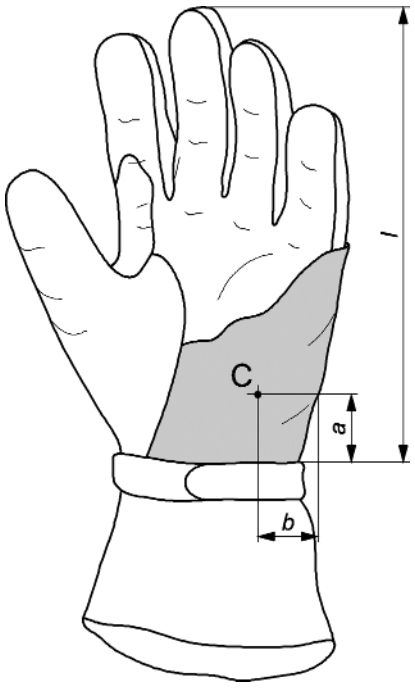
Testing shall be carried out on four samples. The general rule to obtain test pieces from different sizes of gloves shall be applied as far as possible, except in cases where technical problems prohibit the use of small sizes and provided that the constructional properties between all sizes of the range are equivalent. Preliminary washing or cleaning cycles as to 6.2, if applicable, shall be carried out on whole gloves before cutting out the test pieces.

C.3 Test pieces

All layers of the area to be tested (see Figure C.1) - including any lining - shall be tested together, but no additional material (e.g. from the rear side) shall be part of the test piece.

C.4 Area to be tested

The area on the palm to be tested is defined by the contact surface of the sample holder of the testing machine. The position on the palm of that test area is given by the position of its centre point “C” in accordance with Figure C.1; the distance “a” from the wrist line is 18 % (with a tolerance of 3 mm) of the total length “l” between wrist line and fingertip. The distance “b” from the lateral edge is 13 % of “l” (with a tolerance of 3 mm, see C.5).



Key

l overall length from wrist to fingertip

C centre of area to be tested

a distance of C from the wrist line

b distance of C from the lateral edge

Figure C.1 — Center of the test area for impact abrasion

C.5 Marking point “C” as the centre of the area to be tested

While the glove is worn by an assessor of appropriate size, measure the length l with extended fingers in accordance with Figure C.1; calculate the distances “a” and “b” and mark on the palm the centre point of the area to be tested; this point will later have to match the centre of the contact surface of the sample holder of the testing machine.

The distance “b” shall be measured with the donned glove laying on its side on a flat surface, with a 90° inclination between the palm and the surface, such that “b” is the linear distance between the flat surface and point C**.**

In order to favour the correct positioning of the sample on the contact surface of the sample holder it is recommended to draw on the palm two auxiliary lines: One is a straight line parallel to the axis of the middle finger passing through point “C” or close to it. The other one is a circle of ca. 40 mm radius around point “C”.

C.6 Cutting the test piece out of the glove sample

Open the glove by cutting the rear part of the glove in a size and shape that allows the correct clamping on the sample holder of the test machine. In cases where the clamping of the test piece is not possible due to technical problems (e.g. due to size, shape, consistency of the test piece etc.), one of the following measures may be applied:

a) Using another glove size;

b) positioning the test piece with a deviation of up to 5 mm of the point “C” from the centre of the contact plate of the sample holder;

c) sewing the test piece onto a larger support, leaving a hole in it in order to make sure that the area exposed to abrasion will be free from such added supporting material.

NOTE In most cases, it has proven advisable to cut and remove fingers and other protruding parts only after the clamping of the test piece.

C.7 Conditioning

Condition the test piece in accordance with 6.2 (not necessary if preparation was done in standard ambient atmosphere on previously conditioned gloves).

C.8 Test apparatus

C.8.1 Principle

The test machine is designed such as to allow the test piece to be dropped from a set height with defined energy onto an abrasive belt moving at a fixed speed over a rigid horizontal surface. The time for the test piece to abrade is measured as the period from the moment the test piece is released to fall onto the moving abrasive belt until the breakage of an electrical trigger wire positioned between the test piece and the sample holder of the machine.

C.8.2 Apparatus

C.8.2.1 Apparatus conforming to the following characteristics:

Belt speed:	8 m/s ± 0,5 m/s
Abrasion area:	1 620 mm^2 approx. (see Figures C.3 to C.4 / pt. “h” and “j”)
Static force on sample:	49 N ± 1N
Static pressure on sample:	25 kPa ± 1 kPa
Drop height:	50 mm ± 1 mm
Abrasive belt type:	see C.8.2.2

The following list of components of a suitable apparatus (see Figures C.2, C.3 and C.4) also includes some elements of the testing procedure; numbers in parentheses refer to those indicated in the figures. Unless specified differently, a tolerance of ± 3 % is applicable to all dimensions.

a) A 650 W motor or larger driving a steel roller (2) with a diameter of 150 mm or more.

b) Another steel roller (3) that is not driven. Centering of the running belt shall be ensured by suitable means (e.g. both rollers to be cambered, i.e. with a larger diameter in the middle).

c) An abrasive belt of given quality (see C.8.2.2) passing around the two rollers and tensioned.

d) A firmly fixed massive horizontal steel plate (5) of not less than 15 mm substance (over which the top run of the belt passes), capable to withstand the impact of the “falling weight”.

e) A belt cleaning and dust removing system as follows:

   1) A cylindrical brush (6) ca. 200 mm in diameter, driven by a second motor. The polymeric bristles of the brush are ca. 0,1 mm to 0,2 mm in diameter with a free length of ca. 45 mm; there are approximately 150.000 bristles in a ≥ 150 mm long brush matching the belts used. The brush is run

so that the bristles just touch the belt as it passes over the roller. The bristles have a tip speed ca. three times that of the belt and in the same direction.

2) Two dust extraction tubes across the belt, one (7) before and one (8) after the brush. These tubes are grounding down across the belt so that a slit is formed facing the belt. They are closely approaching but not touching the running belt. The first tube removes coarse material and the second fine dust lifted by the brush. (The first tube can be replaced by a high flow wide bore extraction.)

f) A rigid pendulum (9) with the sample holder (12) mounted at its end. The pendulum is horizontal during abrasion and can be raised to a given height and released by a suitable mechanism (10). Its horizontal pivot (11) permits movement only in a vertical plane, but a lateral adjustment is possible in order to use 2 or 3 tracks on each belt. The pendulum is of light construction with adjustable masses (13) attached above the sample holder to give the required static force of 49 N ± 1 N measured without the test piece. It is equipped with a system capable to start the time measurement automatically in the moment of release.

g) The sample holder is constructed of metal with the dimensions given in Figure C.3. It consists of a top plate (14) and a sample holder (15) with the contact face of 75 mm in overall diameter (16) screwed firmly to its lower body.

h) The contact face with its flat centre of 40 mm in diameter (17) is surrounded by a 17,5 mm wide area curved upwards with a 35 mm radius (18). The contact area ends with the transition to the vertical (19).

i) The contact face is covered with one layer of soft split leather (e.g. chamois leather) 0,8 mm to 1,0 mm thick (20), attached with suitable glue or thin double-faced adhesive tape.

j) Two 160mm disks of cotton denim fabric ((21), see also C.8.2.3 “break in material”) are then stretched over the (leather covered) contact face and clamped by suitable means (e.g. strong elastic tapes) around the body of the sample holder. After 10 preliminary impacts, as during testing but without a belt in place, the contact area will be flat with a diameter of ca. 44 mm to 46 mm and will remain constant thereafter.

k) A varnished copper wire ca. 0,14 mm in diameter (23) is placed over the denim (21), so as to lie flat at ca. 45° to the direction of travel of the belt. It is held in place laterally by suitable means (e.g. adhesive tape).

l) The test piece (12) is stretched evenly over the denim and held in place by suitable means (e.g. a hose clamp or cable-tie (22)).

NOTE 1 Test pieces are often disks of 160 mm in diameter, but this may vary due to the clamping technique. Also, bulky composite test pieces may need to be larger.

m) The wire (23) is connected to a measuring system capable to measure the time between the release of the pendulum and the breakage of the wire to an accuracy of 0,05 s.

n) An automatic or manual mechanism (26) for lifting the sample holder off the moving belt right after the break of the wire.

o) Suitable provisions to protect operators and environment from flying fragments, moving parts and dust (e.g. a complete enclosure (27) to cover the apparatus, with dust extractor (28)).

p) Common earthing of the metal parts in the entire apparatus and, if applicable, earthed metal shielding of the dust collection systems.

NOTE 2 Earthing is applied also to reduce the risk of false triggering of the recording apparatus by electrostatic discharges in the apparatus and in the dust extraction systems.

C.8.2.2 Abrasive belt

The abradant belt shall meet the following specifications:

Grain material:	aluminium oxide
coating:	closed
Bonding:	resin, suitable for high speed application
Backing:	Textile, cotton or synthetic, suitable for high speed application
Grit size:	corresponding to P120 (see ISO 6344-2)
Width	≥ 80 mm

NOTE An example of suitable abradant is “KLINGSPOR LS 309 XH P120” This information is given for the convenience of users of this standard and does not constitute an endorsement by CEN/TC 162 of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Due to the complex dynamics of the involved parameters, compliance with the above listed general requirements does not sufficiently qualify an abrasive belt. Suitable abrasives for this method need to be approved by CEN/TC 162/WG9 or shall be validated by comparative performance tests.

C.8.2.3 Break in material

A suitable material is cotton canvas as specified in EN 388 with the following characteristics; for the scope of this standard a tolerance of ± 10 % applies to all numerical data.

fabric warp and weft:	cotton spun from open end fibres;
linear mass warp and weft:	161 tex;
twist warp and weft	double twist S 280 t/m;
single yarn:	Z 500 t/m;
warp:	18 threads / cm;
weft:	11 threads / cm;
crimp warp:	29 %;
crimp weft:	4 %;
tensile strength in warp:	1.400 N;
tensile strength in weft:	1.000 N;
mass per unit area:	540 g/m^2;
thickness:	1,2 mm.

NOTE Such a canvas is made by Collamtis, P. O. Box 3, 59930 La Chapelle d'Armantières, France, and is available after verification under reference LEM 6 from L'Institut Français Textile-Habillement, Avenue Guy de Collongue, 69134 Ecully, CEDEX, France. This information is given for the convenience of users of this standard and does not constitute an endorsement by CEN/TC 162 of the product named. Equivalent products may be used if they can be shown to lead to the same results.

C.9 Test pieces

Whenever possible, test pieces shall be taken from whole gloves; where this is not possible, samples of equivalent materials or assemblies as the glove to be tested may be used.

Four test pieces from, if available, 4 pairs of different size shall be used for each test.

C.10 Testing procedure

C.10.1 Preparation of the sample holder

Prepare the sample holder as follows:

Clean the sample holder without unscrewing it from the test arm.

Cover the contact face of the sample holder with a layer of 0,8 mm to 1,0 mm thick soft split leather (e.g. “chamois” leather) attaching it firmly by using glue or thin double-faced adhesive tape (C.8.2.1 i)).

Clamp a double layer of denim cotton fabric over the, leather-covered, lower face of the sample holder (see also C.8.2.1 j)).

In order to flatten the added layers, adjust the height of the hinged arm and carry out 10 impacts without the abrasive belt, so that there is contact on a smooth flat surface. In order to check the size of the impression, add another impact placing a sheet of white paper and a sheet of carbon paper between the “falling” sample holder and the contact surface beneath. The footprint shall have a diameter of ca. 44 mm to 46 mm. If the footprint does show a regular shape or does not fall within such tolerance, check the adjusted height of the hinged arm and/or change the leather and/or the 2 layers of denim fabric and repeat the procedure until the required criteria are met.

C.10.2 Preliminary run

Take a new abrasive belt of the specified quality (see C.8.2.2).

Mount the abrasive belt on the drums, taking care that the arrows printed on the inside of the belt are pointing into the direction of movement. Before applying the full tension to the belt, run the system for a few seconds, in order to stretch the abrasive belt progressively.

Prepare the sample holder as to C.10.1 and mount onto it the trigger wire (see C.8.2.1 k)), positioning it at an angle of 45° to the direction of movement of the abrasive belt. The insulation of the wire shall prevent undesired electrical contact with any part of the testing apparatus. The wire shall be fixed to the sides of the test piece holder by suitable means (e.g. adhesive tape).

Take two pieces of break-in-cotton canvas (see C.8.2.3) and draw two circles, with a diameter of 160 mm. Mark the warp direction and then cut out the disks.

Clamp the two cotton disks onto the sample holder as a double layer with the warp fibres approximately aligned with the direction of movement of the abrasive belt. Start the abrasive belt to reach its required test speed, then release the sample holder arm. By such release the time measurement shall automatically be started. It shall stop when the trigger-wire breaks; right after that the hinged arm with the sample holder shall be lifted.

NOTE The cotton disk run is intended to break in the surface of the abrasive belt.

Clean the abrasive belt thoroughly using compressed air. This shall be repeated after each test, regardless of the test duration or the lack of visible debris on the belt.

C.10.3 Impact abrasion test

For each type of glove, prepare 4 test pieces following the instructions of C.2 to C.7 and making sure that each test piece is marked with point “C” and the auxiliary markings recommended in C.5.

Prepare the sample holder (see C.10.1) and mount onto it the wire (see C.10.2). Position and clamp the test piece under the contact face of the sample holder so that

a) the centre point C of the area to be tested matches the centre of the contact face of the sample holder with a tolerance of 3 mm;

b) the abrasion will occur in the direction of the length-axis (tolerance ± 15°) of the glove from the tip to the wrist.

After only one preliminary run as described in C.10.2, start the abrasive belt and the cleaning devices. After the belt has reached its required speed, the pendulum is released and the test piece is abraded to perforation, as signalled by the breakage of the trigger wire between test piece and denim. Raise the pendulum immediately and record the perforation time to the nearest 0,05 s.

Abrade all four specimens as described, without repeating the preliminary run as to C.10.2.

For testing the following 4 test pieces of another model, a new track on the abrasive belt or a new belt shall be used.

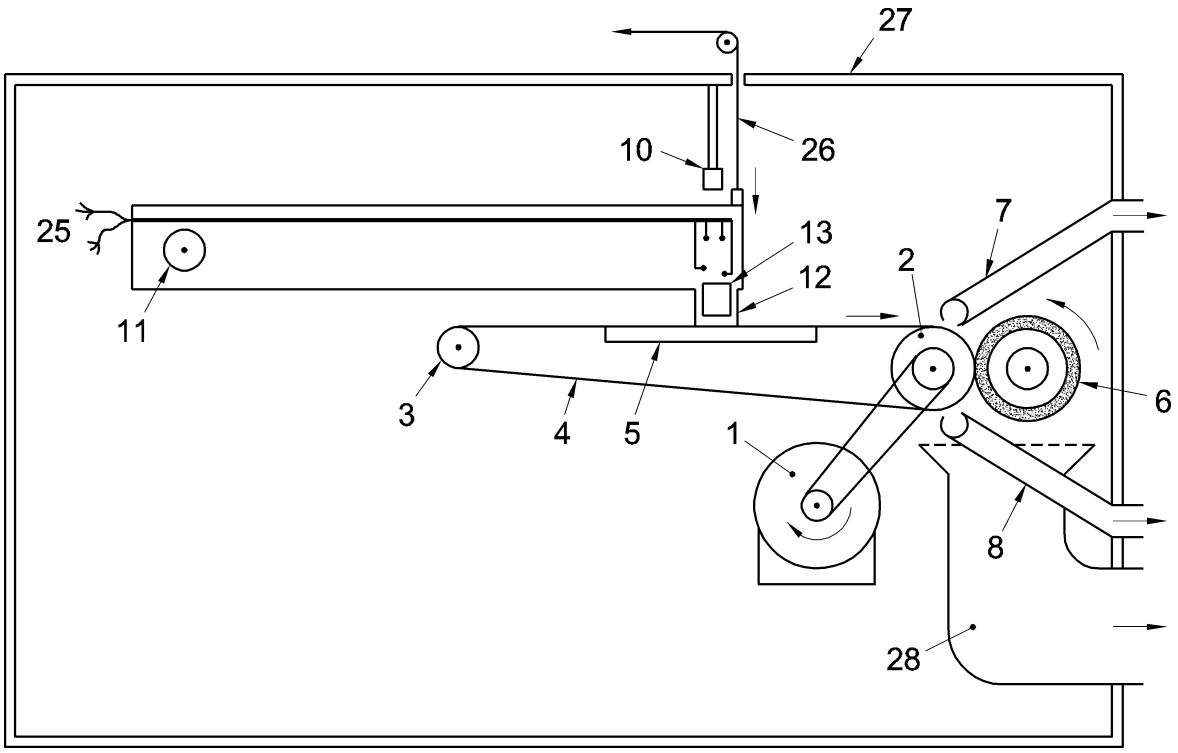
C.11 Test report

The test report shall include at least the following information:

a) code and/or denomination of the glove model,

b) average abrasion time of all four samples in seconds with one decimal,

c) lowest single abrasion time measured of one test piece.

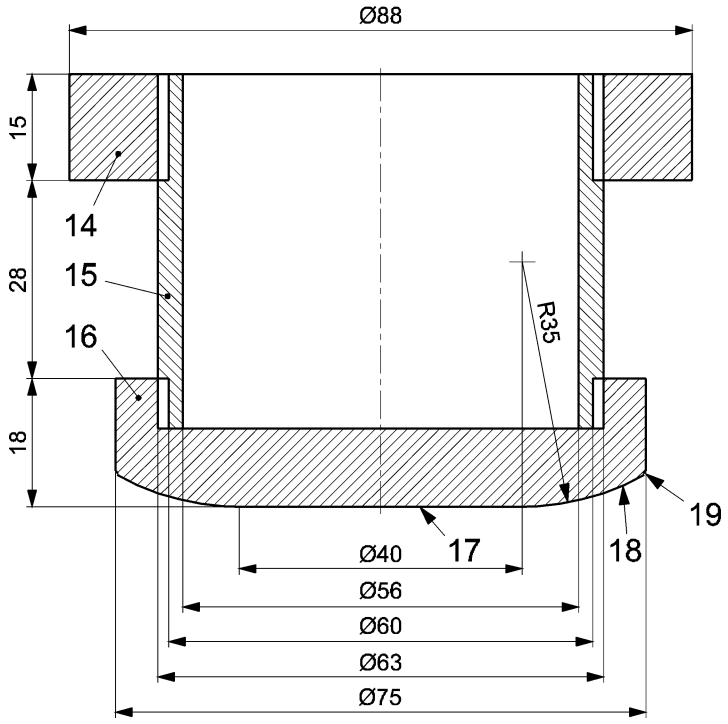


Key

1	motor	11	pivot
2	driven roller	12	specimen
3	free roller	13	falling mass
4	grit belt	25	plugging to timer
5	steel plate	26	manual lifter
6	cylindrical brush	27	overall cover
7 and 8	extraction tube	28	dust extractor
10	release device		

Figure C.2 — Schematic diagram of the main parts of the abrasion apparatus

Dimensions in millimetres

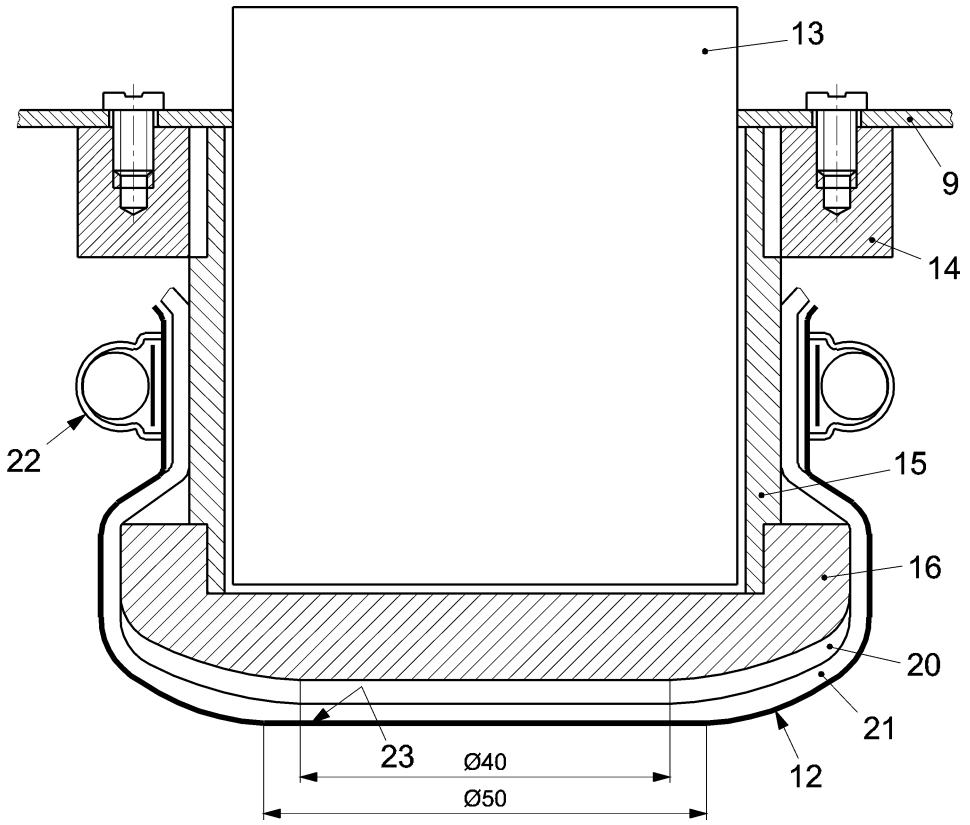


Key

14 top plate
15 specimen holder
16 face plate
17 flat face of 16
18 curved area
19 vertical side of 16

Figure C.3 — Dimensions of sample holder

Dimensions in millimetres



Key

9 rigid pendulum
12 test piece
13 falling mass
14 top plate
15 sample holder
16 face plate
20 thin leather
21 two cotton disks
22 hose clamp
23 trigger wire

Figure C.4 — Detail of the clamping system for samples on the sample holder

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 clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 89/686/EEC

EU Directive 89/686/EEC, Annex II		Clauses of this European Standard
1.1.1	Ergonomics	4.4
1.1.2.1	Highest level of protection possible	4.4
1.1.2.2	Classes of protection appropriate to different levels of risk	4.1
1.2.1	Absence of risks and other 'inherent' nuisance factors	4.11
1.2.1.1	Suitable constituent materials	4.2
1.2.1.2	Satisfactory surface condition of all PPE parts in contact with the user	4.3
1.2.1.3	Maximum permissible user impediment	4.4
1.3.1	Adaptation of PPE to user morphology	4.4, 4.5, 4.6
1.3.2	Lightness and design strength	4.7, 4.8
1.4	Information supplied by the manufacturer	6.2, 8
2.4	PPE subject to ageing	6.2, 8
2.12	PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	7, 9
3.1.1	Impact caused by falling or protruding objects and collision of parts of the body with an obstacle	4.11
3.3	Protection against physical injury (abrasion, perforation, cuts, bites)	4.9, 4.10

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™