BS EN 1621-1:2012

BSI Standards Publication

Motorcyclists' protective clothing against mechanical impact

Part 1: Motorcyclists' limb joint impact protectors — Requirements and test methods

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National foreword

This British Standard is the UK implementation of EN 1621-1:2012. It supersedes BS EN 1621-1:1998 which is withdrawn.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.

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Motorradfahrer-Schutzkleidung gegen mechanische Belastung - Teil 1: Gelenkprotektoren für Motorradfahrer - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 27 October 2012.

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.

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Foreword

This document (EN 1621-1:2012) 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of an identical text or by endorsement, at the latest by June 2013, and conflicting national standards shall be withdrawn at the latest by June 2013.

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 1621-1:1997.

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 the 1997 edition are listed below:

a) the scope has been restricted only to limb joint impact protectors;

b) requirements concerning innocuousness have been added;

c) requirements concerning the wet impact test (mandatory) and the high and low temperature impact tests (optional) have been added;

d) ergonomic requirements have been added.

EN 1621 consists of the following parts, under the general title *Motorcyclists’ protective clothing against mechanical impact:*

— *Part 1: Motorcyclists' limb joint impact protectors — Requirements and test methods* (the present document)

— *Part 2: Motorcyclists' back protectors — Requirements and test methods*

— *Part 3: Requirements and test methods for chest protectors*[1)]

— *Part 4: Motorcyclists' inflatable protectors — Requirements and test methods*

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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.

1) Under development.

Introduction

This European Standard is Part 1 of a standard containing requirements and test methods for motorcycle riders' impact protectors. Impact protectors meeting the requirements of this European Standard will provide some protection against injury caused by impacts with road surfaces in motorcycle accidents. They may also slightly reduce the injuries caused by impacts with objects such as other vehicles.

In order to encourage the adoption of certified protection by the highest possible number of users, two performance levels are specified for protectors. These are level 1 for protectors designed to give protection whilst having low ergonomic penalties associated with its use and level 2 for protectors providing an 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 specifies requirements and test methods for limb joint impact protectors incorporated or intended to be incorporated into motorcycle riders' clothing or used as separate items.

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 340, *Protective clothing — General requirements*

EN ISO 105-E01, *Textiles — Tests for colour fastness — Part E01: Colour fastness to water (ISO 105-E01)*

EN ISO 11642, *Leather — Tests for colour fastness — Colour fastness to water (ISO 11642)*

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

3 Terms and definitions

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

3.1
zone of protection
specific area of the protective equipment that is intended to provide protection to a part of the body and which is subject to specific testing

3.2
protector
arrangement of energy absorbing and/or impact spreading materials designed to offer some protection to the zones of protection

3.3
type A protector
protectors of smaller dimension; these are more commonly (although not exclusively) optimised for use with smaller riders

3.4
type B protector
protectors of larger dimension; these are more commonly (although not exclusively) optimised for use with larger riders

3.5
test area
area on which impact tests are performed; size and shape are defined by the template

3.6
template
auxiliary tool made of flexible material used to verify the minimum area of protection

4 Zones of protection and protectors

The following body regions are specified as zones of protection and protectors shall be categorised as follows:

a) shoulder: protector “S”;

b) elbow and forearm: protector “E”;

c) hip: protector “H”;

d) knee and upper tibia: protector “K”;

e) knee, upper and middle tibia: protector “K + L”;

f) leg below protector “K”: protector “L”.

The size of the zones of protection shall comply with 5.3, Table 1.

5 Requirements

5.1 General

Unless otherwise specified, all linear dimensions bigger than 50 mm in the whole text shall be provided with a deviation of ± 2 % and dimensions up to 50 mm with a deviation of ± 1 mm.

Limb joint protectors shall be provided with means of restraint capable of ensuring that the protector is maintained in position during use.

This requirement is not applicable for protectors to be inserted or incorporated into the garments.

Testing shall be carried out according to 6.4.

5.2 Innocuousness

5.2.1 The materials shall comply with the requirements for innocuousness of materials in EN 340, with the exception of the requirement concerning the colour fastness to perspiration which is replaced by 5.2.2.

5.2.2 The colour fastness to water of the constituent materials which could be likely to come into contact with the skin of the user shall be determined in accordance with 6.2 and shall be at least grade 4 of the Grey scale for the staining of any component of the multi-fibre reference fabric.

5.3 Minimum dimensions of zone of protection

Motorcyclist’s limb joint protectors shall provide a zone of protection with the minimum dimensions as specified in Table 1. Testing shall be carried out as described in 6.3.4.

In Table 1, the zones of protection are defined by the three dimensions r_1, r_2 and l, as illustrated in Figure1:

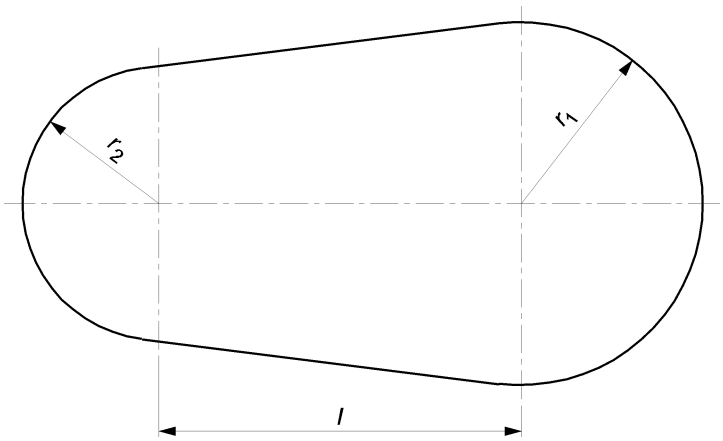


Figure 1 — Definition of the zone of protection by three key dimensions

Table 1 — Minimum dimensions of zone of protection

Protector	Type A protector mm			Type B protector mm		
	r_1	r_2	l	r_1	r_2	l
S	55	32	64	70	40	80
E	45	24	118	50	30	150
K	55	24	100	70	30	130
H	35	26	70	44	33	88
L	32	24	64	40	30	80
K + *L*	55	24	185	70	30	240

5.4 Impact attenuation

In terms of impact attenuation, this standard includes two performance levels. The degree of risk or hazards that a motorcyclist faces is closely linked to the type of riding and the nature of the accident. Level 1 performance is deemed as the minimum level required so that the protector provides useful protection in an accident and offers the protector with an optimum comfort level to suit all riding types. Where riders feel that their riding style exposes them to an increased accident risk, Level 2 has been provided, which offers increased performance. Level 2 may have an increased penalty for the weight and comfort.

When impact protection is tested in accordance with 6.3.4.2 (ambient impact test), 6.3.4.3 (wet impact test after hydrolytic ageing) and, if required, 6.3.4.4 (high temperature impact test) and/or 6.3.4.5 (low temperature impact test), the transmitted force shall conform to the values in Table 2. Level 1 or Level 2 can only be awarded provided that such level is achieved under all test conditions claimed.

Table 2 — Transmitted force and performance levels

	Level 1	Level 2
Overall mean value	≤ 35 kN	≤ 20 kN
Single strike area A[a]	≤ 35 kN	≤ 20 kN
Single strike area B[a] and C[a]	≤ 50 kN	≤ 30 kN
[a] Areas A, B and C correspond to the areas in Figure 3.		

After each test, there shall be no fragmentation of the sample and no sharp edges shall be formed. However, formation of cracks and loss of soft debris is permissible.

5.5 Ergonomic requirements

When examined and tested in accordance with 6.4, impact protectors shall be found satisfactory for the use intended; to confirm this requirement, each question of 6.5 needs to be answered with “yes”.

The following deficiencies are not admitted:

a) sharp edges;

b) any design feature which cause ergonomic problems to the assessor (see 6.4).

6 Test methods and equipment

6.1 General

For each of the required sequences of measurements performed in accordance with this standard a corresponding estimate of the uncertainty of the final result shall be determined. On request, this uncertainty (U_m) shall be given in the test report in the form $U_m = \pm X$. It shall be used in determining whether a “Pass” performance has been achieved. If the final result plus U_m is above the maximum Pass level, the sample shall be deemed to have failed.

Measuring instruments or their independent working components unless otherwise specified shall have an error limit of ± 4 % of the pass/fail level of the characteristic being measured.

In the following subclauses both testing methods and equipment are described.

6.2 Innocuousness

For colour fastness to water, materials of protective clothing shall be tested according to EN ISO 105-E01 for textiles and according to EN ISO 11642 for leather.

6.3 Impact attenuation

6.3.1 Equipment

6.3.1.1 Dropping apparatus

The apparatus shall be such that a falling mass (“drop striker”) may be released in order to drop along a guided vertical path with an energy of (50 ± 2) J onto the sample placed on a test anvil. The centre axis of the falling mass coincides with the centre axis of the anvil.

6.3.1.2 Drop striker

The drop striker shall have a mass of (5 000 ± 10) g. It shall be made of polished steel, with a flat striking face of 40 mm × 80 mm and rounded edges with (5 ± 0,5) mm radius.

6.3.1.3 Anvil

The anvil surface shall be hemispherical with a radius of 50 mm. The anvil shall be made of polished steel and have a total height of (180 ± 20) mm (see Figure 2). The anvil shall be attached through a force transducer to a mass of at least 500 kg. If applicable, the cell shall be preloaded according to the manufacturers' instructions.

Dimensions in millimetres

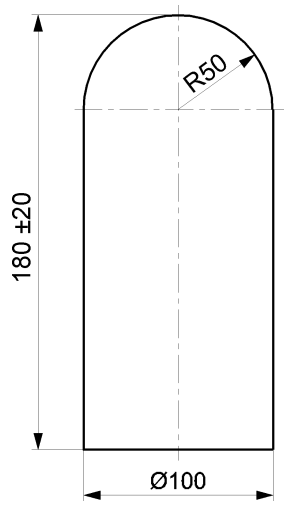


Figure 2 — Anvil

6.3.1.4 Force measurement instrumentation

The anvil shall be mounted so that during impact testing the whole force between the anvil and the massive base of the apparatus passes through a high speed force transducer (for instance piezoelectric quartz instruments) in line with its sensitive axis. The force transducer shall have frequency response of at least 7 kHz, a calibrated range of not less than 70 kN and a lower threshold of less than 1 kN. The output of the force transducer shall be processed by a charge amplifier and displayed and recorded on suitable instruments. The measuring system including the drop assembly shall have a frequency response in accordance with channel frequency class (CFC) 1 000 of ISO 6487.

6.3.1.5 Templates

6.3.1.5.1 General

Defining the minimum zone of protection and the test areas on the protector shall be done by use of templates as auxiliary tools.

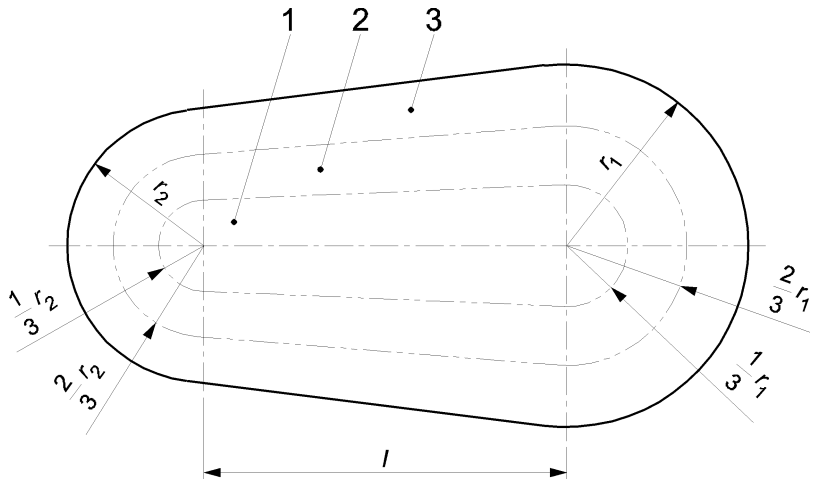
6.3.1.5.2 Template material

Templates shall be prepared from a non-fraying (e.g. coated) fabric of a quality which basically maintains its shape and dimensions during all use.

NOTE A suitable material is the polyurethane (PUR)-coated polyethersulfone (PES) fabric of 280 g/m^2 to 360 g/m^2 as used for truck tarpaulins.

6.3.1.5.3 Shape and dimensions of templates

Shape and dimensions of templates reflect the zones of protection and are therefore to be cut out in accordance with the dimensions specified in Table 1 and Figure 1. Furthermore, each template shall be marked with the three impact areas as shown in Figure 3.



Key

1 Test area A

2 Test area B

3 Test area C

Figure 3 — Template with indication of the test areas

6.3.1.5.4 Use of templates

The templates shall be used as auxiliary tools to draw up the perimeter of the protective zone and of the three test areas onto each sample of protector as follows: the protector shall be formed (if applicable) to its three-dimensional shape as it would be expected during riding. The sample is then fitted in accordance with the manufacturer's instructions onto the joint to be protected of the test person or a (display) dummy of suitable size. The template shall be placed on top of the protector such that it covers the part of the body which has to be protected. The template part with the larger radius shall be upwards with the exception of the shoulder and hip protector, where it may be positioned horizontally with the larger radius forward.

NOTE 1 The above procedure implies that any protector fails if it is smaller than the applicable template.

Once the correct position is ensured, the protective zone shall be evidenced by drawing the perimeter of the template onto the surface of the test piece. The three test areas are also marked onto the test piece, and finally the template is removed from the protector before proceeding with the impact testing.

NOTE 2 The following technique of marking has proven to be suitable: the test areas are marked on the protectors by dotted lines obtained with a pen through holes punched previously into the template along the area drawing.

6.3.2 Sampling

Samples of each model and each size of any joint protector shall be tested. Only whole and entire joint protectors shall be taken as test pieces. When the protector is integrated and cannot be removed from the garment, the sample may be cut out and tested as a composite of all layers/component parts, taking care that the composition of all layers of the test piece remain as originally assembled.

Table 3 — Minimum number of samples and impacts required

Test	Minimum number of samples	Impacts per sample	Total impacts
Ambient impact test	3	3 (1 each area)	9
Wet impact test	2	3 (1 each area)	6
High temperature impact test (optional)	2	3 (1 each area)	6
Low temperature impact test (optional)	2	3 (1 each area)	6

6.3.3 Positioning of the sample

If applicable, the protector shall be formed to its three-dimensional shape as would be expected during use. The samples shall be positioned on the test anvil in such a way that the intended point of impact is positioned over the centre axis of the anvil. If required to ensure correct position, a retention system may be used to hold the protector in position. The downward force exerted should be < 8 N.

NOTE A system of elastic straps has been found suitable. These are angled downwards around the anvil and pull the sample down to the anvil but do not compress the sample significantly. The straps may be connected to a flat elastic ring that surrounds the impact area, but should not cover it. Other systems may also be used.

Any weak visible point within the test areas shall be tested, without increasing the required number of impacts.

6.3.4 Impact Tests

6.3.4.1 General

Testing of the samples subjected to the following ambient conditionings (see 6.3.4.2 to 6.3.4.5) shall be carried out, using the equipment given in 6.3.1, at three different points of each sample. Minimum number of samples as well as number and position of impact points shall be in accordance with Table 3 and Figure 3. Impact points shall be at least 40 mm apart from each other. New samples shall be used for each of the applicable ambient conditionings.

6.3.4.2 Ambient impact test

The samples shall be conditioned for (48 ± 0,5) h in an atmosphere with a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %. If the tests are carried out in an atmosphere different from these specified values, the execution of the tests shall be started within 3 min after removal from the conditioning atmosphere.

6.3.4.3 Wet impact test after hydrolytic ageing

To test for resistance to wet conditions after hydrolytic ageing:

— store the samples for (72 ± 0,5) h in a closed chamber above water maintained at a temperature of (70 ± 2) °C;

— remove the sample, close it tightly in a water vapour proof bag and leave it in ambient temperature of (23 ± 2) °C for another (24 ± 0,5) h;

— remove the sample from the bag and start the wet impact tests within 5 min on the previously prepared impact test machine.

6.3.4.4 High temperature impact test (optional)

Where the manufacturer claims protection at higher ambient temperature:

— the samples shall be conditioned for (24 ± 0,5) h at (40 ± 2) °C;

— carry out the impact testing within 2 min after removing the sample from the oven; no hit shall be performed after that period.

— if necessary, within two more minutes, start to recondition the sample for a further period of 45 min to 60 min.

6.3.4.5 Low temperature impact test (optional)

Where the manufacturer claims protection at lower ambient temperature:

— the samples shall be conditioned for at least (24 ± 0,5) h at (-10 ± 2) °C;

— carry out the impact testing within 2 min after removing the sample from the freezing chamber; no hit shall be performed after that period;

— if necessary, within two more minutes, start to recondition the sample for a further period of 45 min to 60 min.

6.4 Ergonomic assessment

One pair per size of protectors is examined visually for the absence of any sharp edges and/or other design features that may cause problems.

The protector is then put on by an assessor of suitable size, using, if applicable, the restraint elements supplied with the protector. Otherwise, suitable fastening means, such as a suitable host garment provided by the manufacturer of the protector or elastic bands or elastic socks are to be used. The assessor shall have experience of riding a motorcycle and shall carry out the following tests.

6.5 Procedure

To obtain a positive result, each of the following questions needs to be answered with "yes":

All the following activities shall be carried out.

a) Do you confirm the protector fits you properly?

b) Can you easily get on and off a motorcycle?

c) Can you reach and operate the controls of the motorcycle?

d) Can you pick something up from the floor by bending forward?

e) For shoulder protector: while wearing a full face helmet, can you turn your head and/or torso left and right? (Requirement e) is not applicable for protectors to be inserted or incorporated into the garments).

f) Can you confirm that the adjustment system, if present, does not cause discomfort?

g) Does the adjustment system, if present, transmit confidence to the assessor that keeps the protector firmly and comfortably on its place during and after all of the above exercises?

6.6 Expression of test results

a) Innocuousness: detected values and pass or fail vote.

b) Ambient impact test: detected average and peak values and compliance with 6.3.4.2.

c) Wet impact test: detected average and peak values and compliance with 6.3.4.3.

d) High temperature impact test (if claimed): detected average and peak values and compliance with 6.3.4.4.

e) Low temperature impact test (if claimed): detected average and peak values and compliance with 6.3.4.5.

f) Ergonomic requirements: pass or fail vote.

6.7 Test report

The test report shall include the following information:

a) identification of the impact protectors including source, date of receipt, category of impact protectors;

b) the methods used by reference to this European Standard;

c) results of the tests;

d) specific reasons for failure of any of the ergonomic test;

e) any unusual features observed during the test;

f) date of the test report;

g) period of the execution of the tests;

h) identification of the laboratory carrying out this test.

7 Marking

Protectors shall be permanently and clearly marked with at least the following information:

a) number and year of this European Standard (EN 1621-1:2012);

b) name and trade mark of the manufacturer or his authorised representative in the European Union;

c) identification of the product type, commercial name or code;

d) a graphical representation, as shown in Figure 4, shall be included showing:

   1) the category of the protector in accordance with Clause 4 (e.g. "S" for shoulder protector) and the type A or B in accordance with Table 2,

2) the performance level concerning the ambient impact test in accordance with Table 2,

3) the symbol "T+" if the high temperature impact test is passed (if the test is not claimed, the space is vacant),

4) the symbol "T-" if the low temperature impact test is passed (if the test is not claimed, the space is vacant).

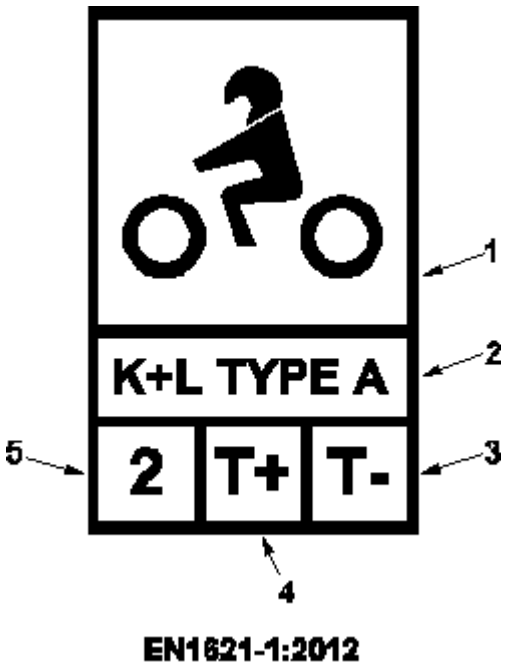
Each protector shall be marked. The marking shall be:

e) on the product itself or on labels permanently attached to the product;

f) affixed so as to be visible and legible;

g) durable to the appropriate number of cleaning processes.

The marking should be large enough to convey immediate understanding and to allow the use of readily legible numbers.



Key

1 protective equipment for motorcycle riders (ISO 7000-2618)

2 category and type of the protector

3 low temperature impact test passed (if the space is vacant, the test is not claimed)

4 high temperature impact test passed (if the space is vacant, the test is not claimed)

5 performance level

Figure 4 — Example of marking of a protector according to Clause 7, list entry d)

8 Information supplied by the manufacturer

The protector shall be supplied to the customer with information written at least in the official language(s) of the country of destination. All information shall be unambiguous.

The following information shall be given:

a) name and full address of the manufacturer and/or his authorised representative;

b) product identification in accordance with 7 c) and d);

c) number of the European Standard and year of publication (EN 1621-1:2012);

d) explanation of the graphical symbol and other symbols used;

e) instruction for use:

   1) fitting, how to put on and off, if relevant;

   2) performance of impact attenuation as recorded during technical tests;

   3) limitations on use (e.g. temperature range, exchange after being exposed to an impact, ageing);

   4) instructions for storage and maintenance;

   5) instruction for cleaning;

   6) appropriate warning against problems which could arise from particular properties or misuse, or alteration or ageing of the protector (e.g. cutting off parts, chemical contaminations);

   7) if helpful illustrations, part numbers etc. shall be added;

f) the type of packaging suitable for transport if relevant;

g) size of the user(s) for whom the protector is intended.

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

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 89/686/EEC, Annex II	Qualifying remarks/Notes
5.5	1.1.1 Ergonomics	
5.3	1.2.1 Absence of risks and other "inherent" nuisance factors	
5.2	1.2.1.1 Suitable constituent materials	
5.5	1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user	
5.5	1.2.1.3 Maximum permissible user impediment	
5.1	1.3.1 Adaptation to user morphology	
6.3.4.2; 6.3.4.3; 6.3.4.4	1.3.2 Lightness and design strength	
8	1.4 Information supplied by the manufacturer	
7	2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	
5.4	3.1.1 Impact caused by falling or projecting objects and collision of parts of the body with obstacles	

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

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