



BSI Standards Publication

## Protective clothing - Protection against rain

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EUROPEAN STANDARD

**EN 343**

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English Version

## Protective clothing - Protection against rain

Habillement de protection - Protection contre la pluie

Schutzbekleidung - Schutz gegen Regen

This European Standard was approved by CEN on 5 November 2018.

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## **European foreword**

This document (EN 343:2019) 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of an identical text or by endorsement, at the latest by September 2019, and conflicting national standards shall be withdrawn at the latest by September 2019.

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

This document supersedes EN 343+A1:2007.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Regulation (EU) 2016/245.

For relationship with Regulation (EU) 2016/245, see informative Annex ZA, which is an integral part of this document.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



## Introduction

In this document the measured properties of materials and seams of protective clothing and their subsequent classification are intended to ensure an adequate protection level. Water proofness and water vapour resistance are the essential properties tested and marked on the label.

Water proofness is the most important property and it is measured on material of the outer garment layer. Tests are made on pretreated fabric samples and on parts with seams.

A test method for an optional readymade garment test after cleaning is described (rain tower test). Some waterproof materials are impermeable to water vapour transmission. However other materials on the market combine water proofness with water vapour permeability. This property expressed by low water vapour resistance enhances sweat evaporation and significantly contribute to body cooling. This is valuable, because it contributes to better comfort and less physiological strain and prolongs the wearing time in certain climatic conditions (see Annex A).

## 1 Scope

This document specifies requirements and test methods for the performance of materials and ready-made garments for protection against the effects of precipitation (e.g. rain, snowflakes), fog and ground humidity. Garments for protection against other effects than precipitation (e.g. water splashes, waves) are excluded from this standard. The protective effects and requirements of footwear, gloves and separate headwear are excluded from the scope of this document.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 388:2016, *Protective gloves against mechanical risks*

EN 530:2010, *Abrasion resistance of protective clothing material - Test methods*

EN 14360:2004, *Protective clothing against rain - Test method for ready made garments - Impact from above with high energy droplets*

EN 20811:1992, *Textiles — Determination of resistance to water penetration — Hydrostatic pressure test*

EN ISO 1421:2016, *Rubber- or plastics-coated fabrics - Determination of tensile strength and elongation at break (ISO 1421:2016)*

EN ISO 4674-1:2016, *Rubber- or plastics-coated fabrics - Determination of tear resistance - Part 1: Constant rate of tear methods (ISO 4674-1:2016)*

EN ISO 7854:1997, *Rubber- or plastics-coated fabrics - Determination of resistance to damage by flexing (ISO 7854:1995)*

EN ISO 11092:2014, *Textiles - Physiological effects - Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test) (ISO 11092:2014)*

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)*

EN ISO 12947-2:2016, *Textiles - Determination of the abrasion resistance of fabrics by the Martindale method - Part 2: Determination of specimen breakdown (ISO 12947-2:2016)*

EN ISO 13688:2013, *Protective clothing - General requirements (ISO 13688:2013)*

EN ISO 13934-1:2013, *Textiles - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1:2013)*

EN ISO 13935-2:2014, *Textiles - Seam tensile properties of fabrics and made-up textile articles - Part 2: Determination of maximum force to seam rupture using the grab method (ISO 13935-2:2014)*

EN ISO 13938-1:1999, *Textiles - Bursting properties of fabrics - Part 1: Hydraulic method for determination of bursting strength and bursting distension (ISO 13938-1:1999)*

EN ISO 13938-2:1999, *Textiles - Bursting properties of fabrics - Part 2: Pneumatic method for determination of bursting strength and bursting distension (ISO 13938-2:1999)*



ISO 1817:2015, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 7000:2014, *Graphical symbols for use on equipment — Registered symbols*

### 3 Terms and definitions

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

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

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

#### 3.1

##### **water vapour resistance**

##### **$R_{et}$**

water-vapour pressure difference between the two faces of a material divided by the resultant evaporative heat flux per unit area in the direction of the gradient

Note 1 to entry: It is a quantity specific to textile materials or composites, which determines the “latent” evaporative heat flux across a given area in response to a steady applied water-vapour pressure gradient. The evaporative heat flux can consist of both diffusive and convective components.

Note 2 to entry: The water-vapour resistance is expressed in square metres pascal per watt.

[SOURCE: EN ISO 11092:2014, 2.2]

#### 3.2

##### **resistance to water penetration**

##### **WP**

hydrostatic pressure supported by a material as a measure of the opposition to the passage of water through material

Note 1 to entry: WP is expressed in pascal.

#### 3.3

##### **outer shell material**

outermost material of which the protective clothing is made

#### 3.4

##### **liner**

insert with a waterproof property

#### 3.5

##### **thermal liner**

layer with a waterproof property providing additional thermal insulation

#### 3.6

##### **lining**

innermost material without waterproof property

4 Performance assessment and requirements

4.1 General requirements and innocuousness

4.1.1 General requirements

When tested in accordance with 6.2.1 the requirements according to EN ISO 13688 and the following requirements shall be met:

- the garment shall not have rough, sharp or hard surfaces that irritate or injure the user;
- all pockets shall be constructed to avoid water inside the garment;
- closures, such as slide fasteners, fasteners, buttons etc. shall not open inadvertently.

NOTE 1 Hoods are not a mandatory part of rain protection garments.

NOTE 2 Protective garments against rain typically consist of the outermost shell of a garment ensemble containing additional layers underneath. It has been demonstrated that the garment layers underneath can support the overall breathability and comfort if they provide a moisture management capability.

For material testing the application of the single tests to each component is shown in Table 1.

Table 1 — Application of performance tests on the components

Property	Reference clause	Outer shell material	Liner or thermal liner	Lining
Resistance to water penetration (before and/or after pretreatment)	4.2	X	X	
Water vapour resistance	4.3	X	X	X
Tensile strength	4.4	X		
Tear resistance	4.5	X (wovens)		
Bursting strength	4.6	X (knits)		
Dimensional change	4.7	X	X	X
Seam strength	4.8	X		

4.1.2 Innocuousness

When tested in accordance with 6.2.2 the requirements of EN ISO 13688:2013, 4.2, shall be met with regard to innocuousness.

4.2 Resistance to water penetration, WP

When tested in accordance with 6.3, resistance to water penetration WP of the outer shell material together with any applied waterproof layer shall be in accordance with Table 2.

For each class all requirements given in Table 2 shall be met.



If a specimen gets different classes of classification in the different tests for marking in accordance with Clause 8, the lowest value of water penetration shall be used to classify the garment.

Table 2 — Classification of resistance to water penetration

Water penetration resistance WP	Class			
	1	2	3	4
Specimen to be tested				
— material before pre-treatment;	WP ≥ 8 000 Pa	—	—	—
— material after each pre-treatment (see 5.2 to 5.5)	—	WP ≥ 8 000 Pa	WP ≥ 13 000 Pa	WP ≥ 20 000 Pa
— seams before pre-treatment	WP ≥ 8 000 Pa	WP ≥ 8 000 Pa	WP ≥ 13 000 Pa	—
— seams after pretreatment by cleaning (see 5.2)	—	—	—	WP ≥ 20 000 Pa
NOTE 1 000 Pa approximately 102 [mmH <sub>2</sub> O]				

4.3 Water vapour resistance,  $R_{et}$

When tested in accordance with 6.4, water vapour resistance  $R_{et}$  of all layers of the garment in combination shall be in accordance with Table 3.

Table 3 — Classification of water vapour resistance

Water vapour resistance $R_{et}$	Class			
	1	2	3	4
$\frac{m^2 \cdot Pa}{W}$	$R_{et} > 40$	$25 < R_{et} \leq 40$	$15 < R_{et} \leq 25$	$R_{et} \leq 15$
WARNING — All classes can result in a restricted wearing time, see Annex A.				

4.4 Tensile strength of the woven outer shell material

When tested in accordance with 6.5, the outer shell material shall withstand a minimum tensile force of 450 N in both orthogonal directions of the material. For materials with an elongation of more than 50 % this requirement is not applicable.

4.5 Tear resistance of the woven outer shell material

When tested in accordance with 6.6 the outer shell material shall withstand a minimum tearing force of 20 N in both orthogonal directions of the material.

4.6 Bursting strength of the knitted outer shell material

When tested in accordance with 6.7 the knitted outer shell material shall withstand a minimum bursting strength of 100 kPa for the 50 cm<sup>2</sup> test area or 200 kPa for the 7,3 cm<sup>2</sup> test area.

4.7 Dimensional change of the protective clothing

When tested in accordance with 6.8 and as specified in Table 1, the dimensional change in both orthogonal directions shall not exceed + 3 % for woven materials and shall not exceed + 5 % for knitted materials after five washing or dry cleaning cycles according to 5.2.

4.8 Seam strength of the outer shell material

When tested in accordance with 6.9, the seam strength of the outer shell material shall be at least 200 N. For materials with an elongation of more than 50 % this requirement is not applicable.

4.9 Waterproofness of a readymade garment (optional)

When tested according to 6.10 the following requirements for the garments shall be met:

Table 4 — Requirements for readymade garment test in rain tower

Wicking length <sup>a</sup> on sleeves and lower hems	max. 5 cm
Wicking length <sup>a</sup> on trouser hems	max. 10 cm
Wicking length <sup>a</sup> on hood hems	max. 4 cm
Wet tricot area <sup>a</sup> on manikin	0 cm <sup>2</sup>
<sup>a</sup> Measurement of wicking length starts at the last stitching.	

5 Pretreatment

5.1 General

The specimens used for testing resistance to water penetration shall be pretreated according to 5.2 to 5.5 except for materials intended for class 1.

5.2 Pretreatment by cleaning

Cleaning shall be in line with the manufacturer’s instructions on the basis of standardized processes.

If the number of cleaning cycles is not specified, the tests shall be carried out – in case of laundering after 5 laundering cycles (one laundering cycle consisting of one washing and one drying), or – in case of dry cleaning after 5 cycles of dry cleaning. This shall be reflected in the information supplied by the manufacturer.

If the manufacturer’s instructions indicate that both cleaning methods are allowed, the test specimen shall undergo the laundering procedure only.

NOTE Manufacturer’s instructions typically indicate one or several of the various methods and processes of EN ISO 6330, EN ISO 15797, ISO 3715 and a qualification label according to EN ISO 30023 or equivalent as standardized processes for cleaning.

5.3 Pretreatment by abrasion

4 specimens shall be submitted to pretreatment by abrasion. The pretreatment shall be carried out on the outer face of the outer shell material but with all materials of the clothing assembly combined with any applied waterproof layer.



Pretreatment is carried out except for outside coated shell material in accordance with EN 530:2010, Method 2, with the following specifications:

- abradant and glass cloth with abrasive grain in accordance with EN 388;
- pressure to the specimen:  $(9 \pm 0,2)$  kPa;
- number of cycles: 1 000; remove debris after 500 cycles;
- abradant replacement after each pretreatment.

For outside coated shell material pretreatment shall be carried out in accordance with EN ISO 12947-1 and -2, with the following specifications and modifications:

- abradant: standard woollen cloth in accordance with EN ISO 12947-1;
- the abradant is mounted in the upper sample holder; the specimen to be tested is mounted in the lower (larger) sample holder;
- pressure to the specimen:  $(9 \pm 0,2)$  kPa;
- number of cycles: 25 000; remove debris after 10 000 cycles;
- abradant shall be replaced after each pretreatment.

#### 5.4 Pretreatment by repeated flexing

Pretreatment is carried out on the lines of EN ISO 7854:1997, method C, and with the following deviations:

- 2 specimens shall be tested in longitudinal direction;
- 2 specimens shall be tested in cross direction;
- number of cycles shall be 9 000.

#### 5.5 Pretreatment with fuel and oil

2 specimens shall be submitted to pretreatment with fuel and 2 specimens shall be submitted to pretreatment with oil in accordance with ISO 1817. The specimens consisting of the outer shell material combined with any applied waterproof layer shall be arranged in the test device (see Figure B.1) in such a way that the surface to be tested faces upwards and is in direct contact with the test agent.

The test vessels shall be made of materials that are resistant to the test agent.

They shall be tight enough, when closed, to prevent diffusion to ambient atmosphere.

Test agents:

- 1) Liquid A: Isooctane (2,2,4-trimethylpentane), percentage by volume 100 %; in accordance with ISO 1817;
- 2) Liquid F: Test oil: straight-chain paraffins ( $C_{12}$  to  $C_{18}$ ), 80 % by volume and 1-methylnaphthalene, 20 % by volume in accordance with ISO 1817;
  - quantity of test agents:  $(50 \pm 5)$  ml;
  - test temperature:  $(20 \pm 2)$  °C;



— duration of exposure: 60 min.

After removal of the specimens from the test device, any test agent remaining on them shall be carefully removed with absorbent filter paper.

The test for resistance to water penetration shall be carried out directly after the removal of any test agent, and be initiated within 10 min.

## **6 Test methods**

### **6.1 Sampling**

Specimens shall be taken from the garment or, if this is not possible, from the material or materials used in the finished garment. Size and shape shall be as required for each test procedure.

### **6.2 General requirements and innocuousness**

#### **6.2.1 General requirements**

The general requirements shall be assessed by visual inspection and by hand.

#### **6.2.2 Innocuousness**

The innocuousness of the protective clothing shall be tested according to EN ISO 13688:2013, 4.2.

### **6.3 Water penetration, WP**

4 specimens of the waterproof material and 4 specimen with seams constructions in the middle of the specimen shall be tested in accordance with EN 20811:1992, Clause 7, but with an increase of water pressure of  $(980 \pm 50)$  Pa/min. The lowest single value in Pa on penetration of the first water drop on the specimen shall be noted.

If due to the nature of the tested material the first drop is not visible, use an absorbent filter paper wipe gently test surface to indicate water being absorbed to the filter paper.

### **6.4 Water vapour resistance, $R_{et}$**

3 specimens shall be tested in accordance with EN ISO 11092.

### **6.5 Tensile strength**

Testing (e.g. of coated fabrics) shall be in accordance with EN ISO 1421:2005, Method 1. If there are difficulties such as separation of edge threads testing shall be carried out in accordance with the method as given in EN ISO 13934-1.

### **6.6 Tear resistance**

Testing shall be in accordance with EN ISO 4674-1:2016, Method A. The testing speed of the moving jaw is  $(100 \pm 10)$  mm/min.

### **6.7 Bursting strength**

Testing shall be in accordance with EN ISO 13938-1:1999, or EN ISO 13938-2:1999. The result as specified in the test standard shall be noted.

### **6.8 Dimensional change after cleaning**

The requirements and testing procedures for dimensional change on materials shall comply with EN ISO 13688:2013, 5.3.



## **6.9 Testing of seam strength**

4 specimens shall be tested in accordance with the principles of EN ISO 13935-2. The result as specified in the test standard shall be noted.

## **6.10 Testing the waterproofness of a readymade garment (optional)**

The readymade garment shall be tested according to EN 14360:2004. The test specimen shall be pretreated as described in 6.11.2.

If only single garments like trousers or jackets are tested, or if a jacket has no hood, the manikin shall be covered in the remaining parts by means of waterproof materials.

Wicking effects occur when water is absorbed and transported along the lower hems to the inside of the garment due to capillary effects.

Wicking effects do not necessarily cause wet areas on the tricot in the standard test procedure but will cause wet sensation for the wearer in use.

NOTE The wicking length as required in Table 4 can be obtained by applying a dry absorbent paper to the hem area.

## **6.11 Ageing**

### **6.11.1 General**

When the manufacturer's instructions give a maximum number of cleaning cycles, the requirements in Table 2 shall be met for materials after the maximum number of cleaning cycles indicated by the manufacturer. If the number of cleaning cycles is not specified, the tests shall be carried out after 5 cleaning cycles as specified in 5.2. This shall be reflected in the information supplied by the manufacturer.

### **6.11.2 Cleaning of readymade garments**

When the readymade garment is tested in the raintower according to EN 14360:2004, the requirements given in 4.9 shall be met after the maximum number of cleaning cycles indicated by the manufacturer.

## **7 Size designation**

The size designation shall be in accordance with EN ISO 13688:2013, Clause 6.

## **8 Marking and care labelling**

Marking and care labelling shall be in accordance with EN ISO 13688:2013, Clause 7.

The pictogram indicating that protection against rain is offered shall be as in Figure 1 with the appropriate performance levels added:



EN 343  
Y resistance to water penetration class  
Y water vapour resistance class  
R readymade garment rain tower test, optional

**Figure 1 — Pictogram for resistance to water penetration, water vapour resistance and optional readymade garment (ISO 7000-2413, Protection against foul weather)**

NOTE R will be replaced with X if the garment has not been tested.

**9 Information supplied by the manufacturer**

The information supplied with the protective clothing shall be in accordance with EN ISO 13688:2013, Clause 8, and shall provide the following additional information:

- product designation;
- how to put on and take off, if relevant;
- usage and storage of hoods, if applicable;
- whether the requirements according to 4.9 for readymade garment have been met, if applicable;
- basic information on possible uses and where detailed information is available, state the source;
- a warning that the lifetime of the garment is not only affected by cleaning but will also depend on usage, care, storage, etc;
- if water vapour resistance class is equal to 1 the following warning shall be given as follows:

**WARNING — Restricted wearing time according to the following table:**

Temperature of working environment	25 °C	20 °C	15 °C	10 °C	5 °C
Wearing time (min)	60	75	100	240	—

NOTE The  $R_{et}$  of class 1 garments can be much higher than 40 which means that especially those garment materials are almost not breathable. Therefore a warning is considered necessary.

This Table is valid for medium physiological strain  $M = 150 \text{ W/m}^2$ , standard man, at 50 % relative humidity and wind speed  $v_a = 0,5 \text{ m/s}$ .



Annex A  
(informative)

Recommendations for wearing time

The following Table A.1 is a guide to illustrate the effect of water vapour permeability on the recommended continuous wearing time of a garment in different ambient temperatures.

Table A.1 — Recommended maximum continuous wearing time (min) for a complete suit consisting of jacket and trousers without additional lining for thermal insulation

	Class			
	1	2	3	4
Temperature of working environment °C	$R_{et} > 40$ m <sup>2</sup> Pa/W	$25 < R_{et} \leq 40$ m <sup>2</sup> Pa /W	$15 < R_{et} \leq 25$ m <sup>2</sup> Pa /W	$R_{et} \leq 15$ m <sup>2</sup> Pa /W
25	60	105	180	— <sup>a</sup>
20	75	250	—	—
15	100	—	—	—
10	240	—	—	—
5	—	—	—	—
<sup>a</sup> “—” means: no limit for wearing time.				

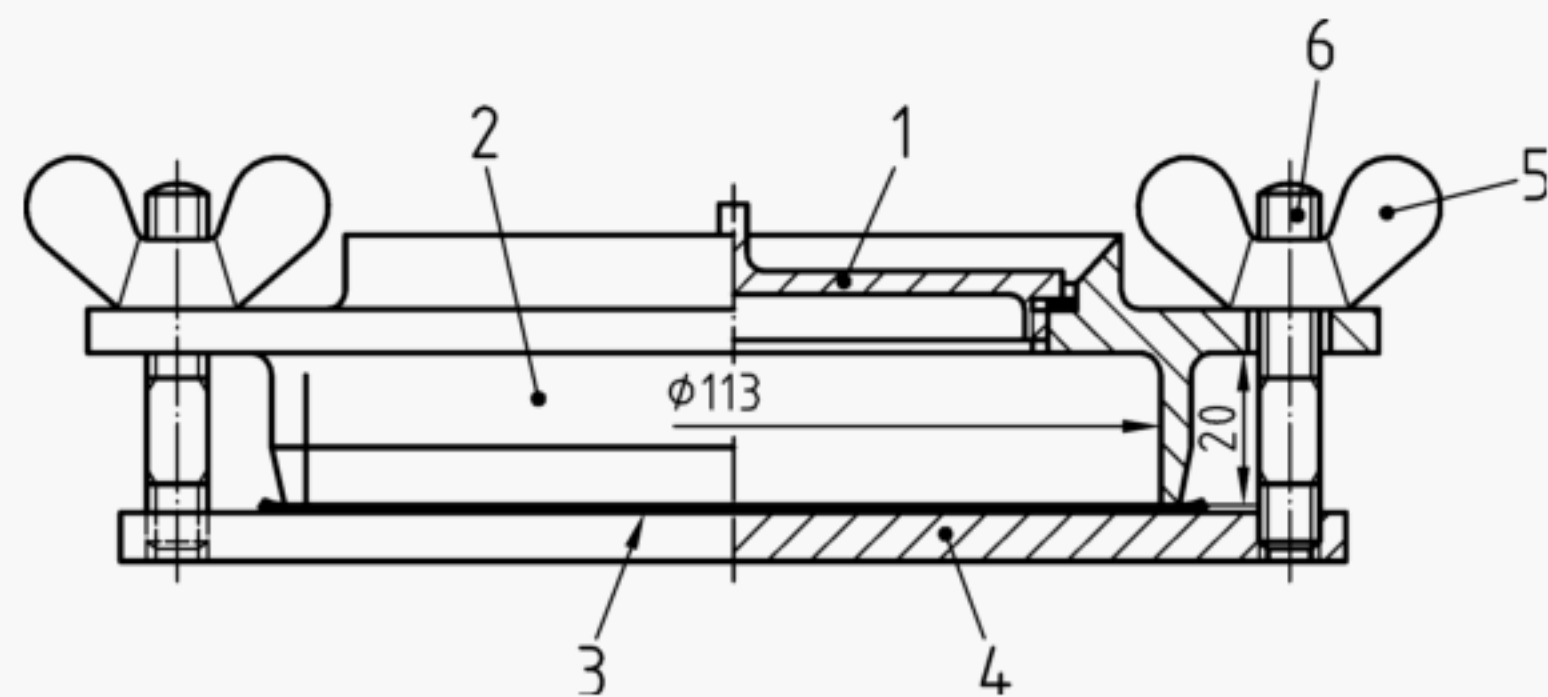
Table A.1 is valid for medium physiological strain  $M = 150 \text{ W/m}^2$ , standard man, at 50 % relative humidity and wind speed  $v_a = 0,5 \text{ m/s}$ .

With effective ventilation openings and/or break periods the time for wearing can be prolonged.

**Annex B**  
(informative)

**Test device for one sided exposure to fuel and oil**

Dimensions in millimetres



**Key**

- 1 screwed sealing plug
- 2 cylinder with internal diameter of 113 mm for test agent
- 3 specimen
- 4 base plate
- 5 wing nut
- 6 bolt

**Figure B.1 — Example for a test device for one-sided exposure (modified apparatus of ISO 1817)**



## **Annex C** (informative)

### **Significant changes between this document and the previous edition**

The significant technical changes between this document and the previous edition are listed below:

- a) normative references updated;
- b) structural changes corresponding to EN 342 and EN 14058;
- c) requirements for innocuousness added;
- d) a new class for resistance to water penetration with  $WP \geq 20000$  Pa added (class 4);
- e) a new class for water vapour resistance with  $R_{et} < 15$  added (class 4) (see Table 3);
- f) threshold value for tear resistance of outer shell material adopted from EN 342 / EN 14058;
- g) requirements and testing for bursting strength of knitted outer shell material added;
- h) optional requirements and testing for readymade garments added;
- i) testing and pretreatment rewritten as separate clauses;
- j) Annex A amended;
- k) Annex C deleted;
- l) Annex ZA updated.

**Annex ZA**  
(informative)

**Relationship between this European Standard and the essential requirements of Regulation (EU) 2016/425 of the European parliament and of the Council of 9 March 2016 on personal protective equipment aimed to be covered**

This European Standard has been prepared under a Commission’s standardization request to provide one voluntary means of conforming to essential requirements of Regulation (EU) 2016/425 on personal protective equipment (PPE).

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative 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 Regulation (EU) 2016/425, and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Regulation (EU) 2016/425**

Essential Requirements of Regulation (EU) 2016/425	Clause(s)/subclause(s) of this EN	Remarks/ Notes
1.2.1 Absence of inherent risks and other nuisance factors	4.1.1, 4.2, 4.3, 4.7	
1.2.1.1 Suitable constituent materials	4.1.2	
1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user	4.1.1	
1.3.2 Lightness and strength	4.4, 4.5, 4.6, 4.8, 5.3, 5.4, 5.5	
1.4 Manufacturer's instructions and information	5.2; 9	
2.4 PPE subject to ageing	6.11	
2.12 PPE bearing one or more identification markings or indicators directly or indirectly relating to health and safety	8	

**WARNING 1** — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2** — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.



## Bibliography

- [1] ISO 5085-1, *Textiles — Determination of thermal resistance — Part 1: Low thermal resistance*
- [2] EN ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing (ISO 6330)*
- [4] EN ISO 15797, *Textiles — Industrial washing and finishing procedures for testing of workwear (ISO 15797)*
- [5] EN ISO 30023, *Textiles — Qualification symbols for labelling workwear to be industrially laundered (ISO 30023)*
- [6] EN 342:2017, *Protective clothing - Ensembles and garments for protection against cold*
- [7] EN 14058:2017, *Protective clothing - Garments for protection against cool environments*





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## BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK