

Protective clothing — Protection against rain

The European Standard EN 343:2003 has the status of a
British Standard

ICS 13.340.10

National foreword

This British Standard is the official English language version of EN 343:2003. It supersedes DD ENV 343:1998 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PH/3, Protective clothing, to Subcommittee PH/3/1, Clothing for protection against general hazards, which has the responsibility to:

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Foreword

This document (EN 343:2003) 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of an identical text or by endorsement, at the latest by February 2004, and conflicting national standards shall be withdrawn at the latest by February 2004.

This document supersedes ENV 343:1998.

This European Standard 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 standard.

The annexes A, B and C are informative.

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Introduction

In this European Standard 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 to be 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 new and pretreated fabric samples and on parts with seams.

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 European Standard specifies requirements and test methods applicable to materials and seams of protective clothing against the influence of precipitation (e. g. rain, snowflakes), fog and ground humidity.

The testing of rain proofness of ready made garments is excluded in this standard at this time because a separate test method for such a property is currently being prepared.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 340, *Protective clothing — General requirements.*

EN 388, *Protective gloves against mechanical risks*

EN 530:1994, *Abrasion resistance of protective clothing material — Test methods.*

EN 20811, *Textiles - Determination of resistance to water penetration - Hydrostatic pressure test*

EN 31092, *Textiles - Determination of physiological properties - Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded - hotplate test) (ISO 11092 : 1993).*

EN ISO 1421, *Rubber- or plastics-coated fabrics - Determination of tensile strength and elongation at break (ISO 1421:1998)*

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

EN ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1:1999).*

EN ISO 13935-2, *Textiles — Tensile properties of fabrics - Part 2: Determination of maximum force using the grab method (ISO 13934-2:1999)*

ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 4674:1977, *Fabrics coated with rubber or plastics — Determination of tear resistance.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1

water vapour resistance R_{et} [$\frac{m^2 \cdot Pa}{W}$]

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. The evaporative heat flux may consist of both diffusive and convective components

Water vapour resistance R_{et} , expressed in square metres pascal per watt, 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.

3.2

water penetration resistance Wp [Pa]

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

3.3

outer shell material

outermost material of which the protective clothing is made

3.4

liner

insert with a watertight property

3.5

thermal liner

layer with a watertight property providing additional thermal insulation

3.6

lining

innermost material without watertight property.

4 Performance requirements

4.1 General

The ergonomic requirements of EN 340 shall be applied. The components of the garment (see also annex C) are tested in accordance with the following requirements. 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)	4.1	X (in combination if applicable)	X	
Water vapour resistance	4.2	X	X	X
		(in combination if applicable)		
Tensile strength	4.3	X		
Tear resistance	4.4	X		
Dimensional change	4.5	X	X	X
		(in combination if applicable)		
Seam strength	4.6	X		

4.2 Resistance to water penetration

When tested in accordance with 5.1, resistance to water penetration of the outer shell material together with any applied watertight layer shall be in accordance with Table 2.

If a specimen gets different classes of classification in the different tests for marking in accordance with clause 6, the lowest class shall be indicated.

Table 2 — Classification of resistance to water penetration

Water penetration resistance W_p	Class		
	1	2	3
Specimen to be tested			
– material before pretreatment	$W_p \geq 8\,000\text{ Pa}$	no test required ^a	no test required ^a
– material after each pretreatment (see 5.1.3.2 to 5.1.3.5)	no test required	$W_p \geq 8\,000\text{ Pa}$	$W_p \geq 13\,000\text{ Pa}$
– seams before pretreatment	$W_p \geq 8\,000\text{ Pa}$	$W_p \geq 8\,000\text{ Pa}$	$W_p \geq 13\,000\text{ Pa}$
^a no test required because the worst case situation for class 2 and class 3 is after pretreatment			
NOTE: For each class several requirements shall be met.			

4.3 Water vapour resistance

When tested in accordance with 5.2, water vapour resistance of all layers of the garment shall be in accordance with Table 3.

Table 3 — Classification of water vapour resistance

Water vapour resistance R_{et}	Class		
	1 ^a	2	3
$\frac{m^2 \cdot Pa}{W}$	$R_{et} \text{ above } 40$	$20 < R_{et} \leq 40$	$R_{et} \leq 20$
^a WARNING: class 1 has a restricted wearing time, see annex A.			

4.4 Tensile strength of the outer shell material

When tested in accordance with 5.3, 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 outer shell material

When tested in accordance with 5.4 the outer shell material shall withstand a minimum tearing force of 25 N in both orthogonal directions of the material.

4.6 Dimensional change of the protective clothing

When tested in accordance with 5.5 and as specified in Table 1, the dimensional change of relevant materials in both orthogonal directions shall not exceed $\pm 3\%$ after five washing or dry cleaning cycles.

4.7 Seam strength of the outer shell material

When tested in accordance with 5.6, the seam strength of the outer shell material shall be at least 225 N. For materials with an elongation of more than 50 % this requirement is not applicable.

5 Testing requirements

5.1 Testing of resistance to water penetration

5.1.1 General

Testing of resistance to water penetration, in accordance with EN 20811, with an increase of hydrostatic pressure of (980 ± 50) Pa/min.

5.1.2 Number and size of specimens

Number of specimens:

- 5 specimens for the testing of material before pretreatment;
- 5 specimens for the testing of the seams before pretreatment;
- 5 specimens for the testing of material after pretreatment by dry-cleaning and/or washing;
- 4 specimens for the testing after pretreatment by abrasion;
- 4 specimens for the testing after pretreatment by repeated flexing, i.e. 2 specimens in production direction and 2 specimens across the production direction;
- 4 specimens for the testing after pretreatment by fuel and oil, i.e. 2 specimens for testing with fuel and 2 specimens for testing with oil.

Specimens are to be cut off from the layers as specified in Table 1 (see also annex C) and shall have a size of at least 130 mm diameter.

5.1.3 Pretreatments of outer shell material and liner or thermal liner in combination

5.1.3.1 General

Separate samples will be used for each of the following pretreatments prior to testing the resistance to water penetration:

5.1.3.2 Dry-cleaning and/or washing

Number of cycles: five. As far as the care label fixed to the protective clothing does not forbid washing, the specimens are subject to a washing procedure in accordance with EN 340 and in accordance with the symbols given on the care label. If in accordance with the care label only dry cleaning is admitted, the specimens are subject to the procedure in accordance with EN 340.

5.1.3.3 Abrasion

Abrasion 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 water tight layer.

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Pretreatment is carried out in accordance with EN 530:1994, 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: 1000;

NOTE Debris should be removed after 500 cycles.

- abradant replacement after each pretreatment.

5.1.3.4 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 in cross direction;
- number of cycles: 9000.

5.1.3.5 Influence of fuel and oil

The specimens of the outer shell material and liner or watertight liner in combination 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

- Liquid A: Isooctane (2,2,4-trimethylpentane), percentage by volume 100 %; in accordance with ISO 1817
- 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 ± 5) ml
 - Test temperature: (20 ± 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 impermeability to water shall be carried out directly after the removal of any test agent, and be initiated within 10 min.

5.1.4 Evaluation

The lowest single value in Pa on penetration of the first water drop shall be noted.

5.2 Testing of water vapour resistance, R_{et}

Testing in accordance with EN 31092;

5.3 Testing of tensile strength

Testing (e.g. of coated fabrics) in accordance with ISO 1421. 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. Testing with conditioned specimens. Speed of the moving jaw (100 ± 10) mm/min.

5.4 Testing of tear resistance

Testing in accordance with method A1 as given in ISO 4674:1977. Testing with conditioned specimens, speed of the moving jaw (100 ± 10) mm/min.

5.5 Testing of dimensional change

Testing in accordance with EN 340.

5.6 Testing of seam strength

Testing in accordance with the principles of EN ISO 13935-2.

6 Sizes

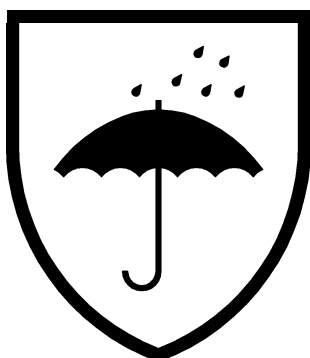
The size designations shall be in accordance with EN 340.

7 Marking and care labelling

Marking and care labelling shall be in accordance with EN 340.

— The following pictogram (see Figure 1) shall be marked on the garment, followed by the number of this standard and the relevant classes as follows:

for the garment



EN 343

X (resistance to water penetration)

X (water vapour resistance)

Figure 1 –Pictogram for resistance to water penetration and water vapour resistance

If the water vapour resistance class is equal to 1, behind this numeral the warning shall be added: "Restricted wearing time" (see Table A.1).

8 Information supplied by the manufacturer

The information supplied with the protective clothing shall be in accordance with EN 340 and shall provide the following additional information:

- Product designation;
- How to put on and take off, if relevant;

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- Necessary warnings of misuse; in case of a water vapour resistance class 1, Table A.1 shall be reproduced in the information sheet;
- Provide basic information on possible uses and where detailed information is available, state the source.

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 for a complete suit consisting of jacket and trousers without thermal lining

Temperature of working environment °C	Class		
	1 R_{et} above 40 min	2 $20 < R_{et} \leq 40$ min	3 $R_{et} \leq 20$ min
25	60	105	205
20	75	250	–
15	100	–	–
10	240	–	–
5	–	–	–

"–" means: no limit for wearing time.

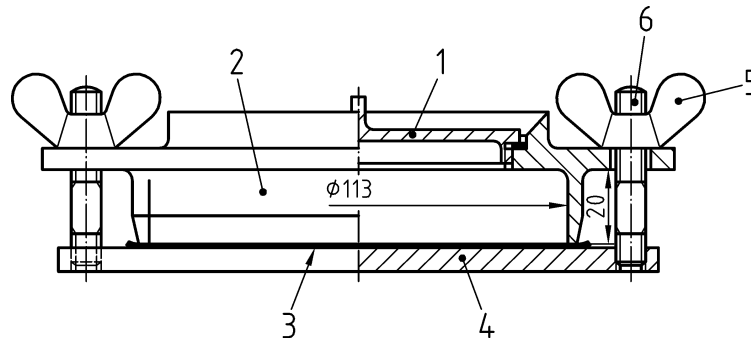
Table valid for medium physiological strain $M = 150 \text{ W/m}^2$, standard-man, at 50 % relative humidity, and wind speed $v_a = 0,5 \text{ m/s}$.

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



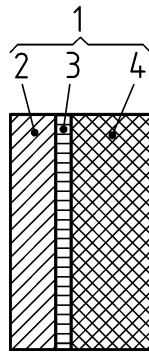
Key

- 1 Screwed sealing plug
- 2 Cylinder with internal diameter of 113 mm for test agent
- 3 Specimen
- 4 Base plate (Bodenplatte)
- 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)

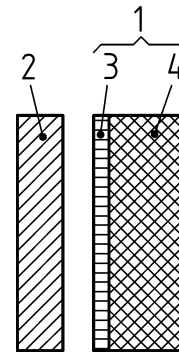
Some examples of textile laminates or thermal liners



Key

- 1 Outer shell material
- 2 Lining
- 3 Membrane (Foile, Coating)
- 4 Outer material

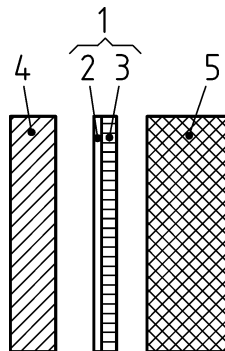
Figure C.1 - 3-layer laminate as outer shell



Key

- 1 Outer shell material
- 2 Lining (loose)
- 3 Membrane (Foile, Coating)
- 4 Outer material

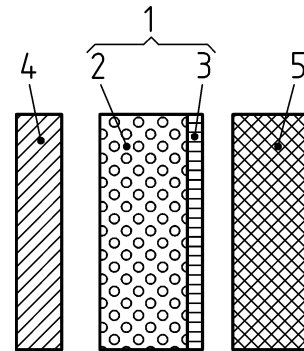
Figure C.2 - 2-layer laminate plus lining



Key

- 1 Liner
- 2 Knitted
- 3 Membrane
- 4 Lining (loose)
- 5 Outer material (loose)

Figure C.3 - Combination of lining, liner and outer material



Key

- 1 Thermal liner
- 2 Non-woven
- 3 Membrane
- 4 Lining (loose)
- 5 Outer material (loose)

Figure C.4 - Combination of lining, thermal liner and outer material

Annex ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives.

This European standard 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 89/686/EEC.

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

The following clauses of this standard are likely to support requirements of Directive 89/686/EEC.

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

Clauses of this standard	EC Directive 89/686/EEC, Annex II	
	1	General requirements applicable to PPE
4.2; 4.3	1.1	Design principles
	1.1.2	Levels and classes of protection
	1.1.2.2	Classes of protection appropriate to different levels of risks
4.6- 5.5 4.2- 5.1; 4.4- 5.3; 4.5- 5.4; 4.7- 5.6	1.3	Comfort and efficiency
	1.3.1	Adaptation to users morphology
	1.3.2	Lightness and design strength
6;8	1.4	Information supplied by the manufacturer
4.3- 5.2	2.2	PPE enclosing the parts of the body to be protected
7	2.1.2	PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety

Compliance with the clauses of this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Bibliography

ISO 5085-1, *Textiles — Determination of thermal resistance — Part 1: Low thermal resistance.*

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