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DIN EN 342:2004-09 and
DIN EN 342 Corrigendum
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Protective clothing – Ensembles and garments for protection against cold; English version EN 342:2017, English translation of DIN EN 342:2018-01

Schutzkleidung –
Kleidungssysteme und Kleidungsstücke zum Schutz gegen Kälte;
Englische Fassung EN 342:2017,
Englische Übersetzung von DIN EN 342:2018-01

Vêtements de protection –
Ensembles vestimentaires et articles d'habillement de protection contre le froid;
Version anglaise EN 342:2017,
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A comma is used as the decimal marker.

National foreword

This document (EN 342:2017) has been prepared by Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets” (Secretariat: DIN, Germany).

The responsible German body involved in its preparation was *DIN-Normenausschuss Textil und Textilmaschinen (Textilnorm)* (DIN Standards Committee Textiles and Textile Machinery (Textilnorm)), Working Committee NA 106-01-10 AA “Protective clothing against foul weather; Mirror Committee to CEN/TC 162/WG 4”.

Amendments

This standard differs from DIN EN 342:2004-09 and DIN EN 342 Corrigendum 1:2008-07 as follows:

a) the definition of the water vapour resistance according to EN ISO 11092 has been included;

b) information on ergonomics and innocuousness has been given;

c) in subclause 4.7, a sentence has been included stating that the dimensional change due to cleaning is to meet the requirements in accordance with EN ISO 13688:2013;

d) the test for tear strength has been included;

e) the test for bursting strength has been included;

f) the test for flexibility of coated or laminated material has been included;

g) the test for dimensional change due to cleaning has been included;

h) Clause 5 on pretreatment has been included;

i) the requirement for standard underwear C to be used primarily when measuring the resultant effective thermal insulation has been included;

j) Clause 9 has been extended in accordance with EU law (e.g. PPE Regulation 2016/425);

k) tables in the annexes have been revised and adapted to the state of the art and additional tables have been included;

l) only walking manikin tests are allowed;

m) the serial insulation calculation method has been removed from this standard; only the parallel calculation model is allowed;

n) minimum values of I_{cler} have been adjusted from the serial (0,310 m^2K/W) to the parallel insulation (0,265 m^2K/W) calculation model;

o) in the tables in Annex C, the adjusted reference insulation values related to material thermal resistance have been added;

p) Annex ZA has been revised.

Previous editions

DIN 61536: 1974-02, 1976-06, 1983-02, 1988-02
DIN 61537: 1988-02
DIN V ENV 342: 1998-04
DIN EN 342: 2004-09
DIN EN 342 Corrigendum 1: 2008-07

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 342

November 2017

ICS 13.340.10

Supersedes EN 342:2004

English Version

Protective clothing - Ensembles and garments for protection against cold

Vêtements de protection - Ensembles vestimentaires et articles d'habillement de protection contre le froid

Schutzkleidung - Kleidungssysteme und Kleidungsstücke zum Schutz gegen Kälte

This European Standard was approved by CEN on 4 September 2017.

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.

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

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Contents

Page

European foreword

This document (EN 342:2017) 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 May 2018, and conflicting national standards shall be withdrawn at the latest by May 2018.

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 342:2004.

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 Annexes ZA and ZB, which are an integral part of this document.

Regarding the most significant changes that have been made in this new edition, see Annex A.

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

Introduction

This document is published to achieve a common basis in Europe for requirements and test methods for protective clothing ensembles and garments against cold in the interest of manufacturers, test institutes and end-users. The measured properties and their subsequent classification are intended to ensure an adequate protection level under different user conditions. Thermal insulation of the ensemble or garment and the air permeability are the essential properties to be tested and marked on the label.

Thermal insulation is the most important property and it is measured by using a full-sized thermal manikin with the ensemble or garment and accompanying standard clothing in order to account for the effect of layers, fit, drape, coverage and shape.

In this respect this standard differs from many other standards specifying only material properties. The insulation is tested with complete ensembles and garments after a defined pretreatment ensuring that processing the garment considers mechanical aspects making tests like flexibility or abrasion unnecessary. It should be recognized that ensembles and garments in frequent use can lose significant insulation capacity due to laundering and wear. In general high quality products and well maintained clothing are less affected in this respect.

Wind can considerably increase convective heat losses. Therefore, the air permeability of the outer garment material is an important factor to be taken into account in relation to the protection of the wearer against cold.

In cold conditions as defined by the standard the possible exposure to water is seldom and considered to be limited, therefore this standard contains only optional requirements to water penetration. In case the exposure to water is not limited, EN 343 applies.

The resultant effective thermal insulation value I_{cler} can be used to assess temperature ranges according to Tables C.1 and C.2. This guidance information for the selection of the appropriate cold protective garment(s) is one of the benefits, if the resultant effective thermal insulation value I_{cler} of the garment(s) has been measured on a thermal manikin.

Sweating should be avoided in continuous cold exposure, since moisture absorption will progressively reduce insulation. This is best controlled by selecting optimal rather than maximal insulation and flexible, adjustable garments rather than fixed and closed ensembles. It is more efficient to get rid of heat and moisture by ventilation of clothing through adjustable openings and button-up, than by passive diffusion through layers of garments. In some conditions with intermittent exposures (e.g. cold store work) or in conditions close to and above 0 °C the water vapour resistance value of fabrics become increasingly important and fabrics with a low value can contribute to improved heat balance and thermal comfort.

1 Scope

This European Standard specifies requirements and test methods for the performance of clothing ensembles (i.e. g two piece suits or coveralls) for protection against the effects of cold environments equal to or below −5°C (see Annex C). These effects comprise not only low air temperatures but also humidity and air velocity.

Requirements and test methods of garments for protection against cool environments are specified in EN 14058.

The protective effects and requirements of footwear, gloves and separate head wear are excluded from the scope of this standard.

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

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 9237:1995, *Textiles — Determination of permeability of fabrics to air (ISO 9237:1995)*

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

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)*

EN ISO 15831:2004, *Clothing — Physiological effects — Measurement of thermal insulation by means of a thermal manikin (ISO 15831:2004)*

ISO 4675:2017, *Rubber- or plastics-coated fabrics — Low-temperature bend test*

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.

3.1
cold environment
environment characterized by the combination of humidity and wind (wind-chill effect) at air temperature equal to or less than −5 °C

3.2
garment
individual component of a clothing ensemble covering a part of the body, except separate garment for head, hands and feet and providing protection against hypothermia

3.3
ensemble
clothing consisting of a two-piece suit or one-piece suit (coverall) or a number of garments covering the body, except separate garment for head, hands and feet and providing protection against hypothermia

3.4
thermal lining
non-watertight layer providing thermal insulation

3.5
thermal resistance
insulation
R_{ct}
temperature difference between the two faces of a material divided by the resultant 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 dry heat flux across a given area in response to a steady applied temperature gradient. The dry heat flux can consist of one or more conductive, convective and radiant components.

Note 2 to entry: The thermal resistance is expressed in square metres kelvin per watt.

[SOURCE: EN ISO 11092:2014, 2.1]

3.6
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]

3.7
water-vapour permeability index
i_{mt}
ratio of thermal and water-vapour resistances in accordance with Formula (1):

$$i_{mt} = S \times \frac{R_{ct}}{R_{et}} \quad (1)$$

where

S = 60 Pa/K

Note 1 to entry: The water-vapour permeability index is dimensionless and has values between 0 and 1. A value of 0 implies that the material is water-vapour impermeable; that is, it has infinite water-vapour resistance, and a material with a value of 1 has both the thermal resistance and water-vapour resistance of an air layer of the same thickness.

[SOURCE: EN ISO 11092:2014, 2.3]

3.8
resultant effective thermal insulation
I_{cler}
thermal insulation from skin to outer clothing surface under defined conditions measured with or calculated for a moving manikin determined in relation to the naked body surface area

Note 1 to entry: I_{cler} is expressed in square metres Kelvin per watt.

3.9
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.

3.10
air permeability
AP
velocity of an air flow passing perpendicularly through a test specimen under specified conditions of test area, pressure drop and time

Note 1 to entry: AP is expressed in millimetre per second.

[SOURCE: EN ISO 9237:1995, 3.1]

3.11
outer shell material
outermost material of which the protective clothing is made

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 following requirements shall be met:

— the garment shall not have rough, sharp or hard surfaces that irritate or injure the user;

— the jacket/coat or coverall shall be closable up to the collar or neckband;

— the jacket/coat or coverall shall be long enough to cover the tops of the trousers;

— external pockets intended to be used in wet conditions (see 4.4) shall be closable;

— closures, such as slide fasteners, fasteners, buttons etc. shall not open inadvertently;

— slide fasteners shall lock when completely closed.

In situations where the comfort can be reduced by the weight of the garment, preliminary wearing tests are recommended.

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 Resultant effective thermal insulation I_{cler}

The resultant effective thermal insulation shall be calculated by Formula (2) and shall have a minimum value of 0,265 m²K/W when measured in accordance with 6.3:

$$I_{cler} = I_{tr} - I_{ar} \quad (2)$$

where

I_{tr} is the total thermal insulation from skin to ambient atmosphere, including clothing and boundary air layer, under defined conditions measured with a manikin moving its legs and arms under the conditions defined in EN ISO 15831:2004 in m²K/W;

I_{ar} is the result total thermal insulation of the boundary air layer with a manikin moving under the conditions defined in EN ISO 15831:2004 in m²K/W.

NOTE For temperature ranges of utility of the garment ensemble considering wearing time and wind speed, see Annex C.

4.3 Air permeability, AP

When tested in accordance with 6.4, the air permeability AP shall be in accordance with Table 1.

Table 1 — Classification of air permeability AP

AP mm/s	Class
AP > 100	1
5 < AP ≤ 100	2
AP ≤ 5	3

NOTE 1 Class 1 material layers of a garment will be considered as appropriate for low air velocities of less than 1 m/s as e.g. in cold indoor environments.

NOTE 2 Class 2 material layers will be considered as appropriate for air velocities of less than 5 m/s.

NOTE 3 Class 3 material layers are appropriate for high air velocities ≥ 5 m/s as e.g. common in outdoor activities.

4.4 Resistance to water penetration, WP

If the manufacturer claims in his information leaflet resistance to water penetration, the material shall have a minimum value of 8 000 Pa when tested according to 6.5.

4.5 Water vapour resistance, Ret and thermal resistance R_{ct}

If the manufacturer claims protection against water penetration as in 4.4, the water vapour resistance R_{et} shall be measured in accordance with 6.6. The water vapour resistance R_{et} of the combination of all layers of the garment together shall be less than 55 m^2 Pa/W. If any individual water vapour resistance value exceeds 55 m^2 Pa/W, the thermal resistance (R_{ct}) according to EN ISO 11092:2014 shall be measured and the water-vapour permeability index i_{mt} shall be determined in accordance with EN ISO 11092:2014 and shall be ≥ 0,15.

4.6 Mechanical and physical properties

4.6.1 Tear resistance of outer shell material

When tested in accordance with 6.7.1, the tear resistance of the outer shell material (excluding knitted materials) shall be at minimum 20 N in both orthogonal directions of the material for each specimen. For materials with an elongation of more than 50 %, this requirement is not applicable.

4.6.2 Burst strength of knitted outer shell

When tested in accordance with 6.7.2 using a 50 cm^2 test area, the burst strength of knitted outer material shall have a minimum of 100 kPa or, using a 7,3 cm^2 test area, shall have a minimum of 200 kPa.

4.6.3 Flexibility of coated or laminated material

If clothing is intended to be used in air temperatures below −50 °C flexibility testing shall be done according to 6.7.3. No cracks shall appear at the fold.

4.7 Dimensional change due to cleaning

The dimensional change due to cleaning shall be assessed in accordance with 6.8. The dimensional change due to cleaning shall meet the requirements in accordance with EN ISO 13688:2013, 5.3.

5 Pretreatment

The specimens used for the tests specified in 6.2 to 6.5 shall be pretreated by cleaning, which 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 3175, EN ISO 15797 and a qualification label according to EN ISO 30023 or equivalent as standardized processes for cleaning.

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 Resultant effective thermal insulation I_{cler}

The resultant effective thermal insulation shall be measured with a moving manikin calibrated according to Annex D. The test procedure shall be in accordance with EN ISO 15831:2004, and calculations shall be carried out according to the parallel method as given in EN ISO 15831:2004. Tests may be carried out on one clothing ensemble.

The resultant effective thermal insulation of the protective clothing ensemble shall be measured with standard underwear C as specified by the manufacturer. If the manufacturer doesn`t specify any underwear, standard underwear B (see Table B.1) shall be used.

Garments shall be tested with standard ensemble R as specified in Table B.1.

During the test with underwear B or a garment the manikin shall not be dressed with any hood not attached to the garment, gloves or boots other than the standard items.

6.4 Air permeability, AP

Air permeability shall be measured from outside to inside in accordance with EN ISO 9237:1995 as the arithmetic mean value out of 10 specimens. The mean value shall be used for classification of the garment. Measurements shall be carried out at a pressure differential of 100 Pa and a test area of 20 cm^2.

In case that the composite material cannot be tested in one piece because of e.g. thick multilayer samples, it is necessary to separate the individual components and measure the component with the lowest value.

6.5 Resistance to water penetration, WP

5 specimens of the watertight layer of the garment shall be tested in accordance with EN 20811:1992, with an increase of water pressure of (980 ± 50) Pa/min.

The result of the test is the lowest individual value, in Pa, of penetration of the first water drop on material.

6.6 Water vapour resistance, R_{et} and thermal resistance R_{ct}

3 specimens shall be tested in accordance with EN ISO 11092:2014.

6.7 Mechanical and physical properties

6.7.1 Tear resistance of outer shell material

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

6.7.2 Burst strength of knitted outer shell material

5 specimens shall be tested in accordance with EN ISO 13938-1:1999 or EN ISO 13938-2:1999. The lowest value shall be noted.

6.7.3 Flexibility of coated and laminated material

Four specimens shall be tested at – 50 °C (± 2°C) in accordance with ISO 4675:2017.

6.8 Dimensional change due to cleaning

Testing shall be in accordance with EN ISO 13688:2013, 5.3.

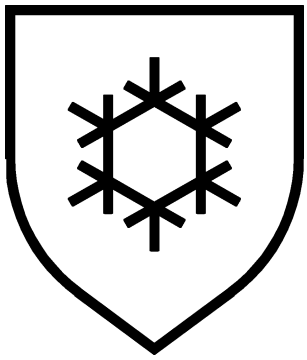
7 Size designation

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 cold is offered shall be as follows with the appropriate performance levels added:



EN 342:2017	
Y(B)/Y(C)/Y(R)	I_{cler} in m²·K/W of the ensemble (with underwear B or with underwear C of the manufacturer) or of the single garment (with standard clothing R)
AP	air permeability class
WP	Water penetration, optional

Figure 1 — Protection against cold (ISO 7000-2412)

NOTE X indicates that the garment has not been submitted to testing. If the water penetration WP has not been tested, because it is irrelevant for the intended use of the garment, on the label WP will be replaced by X.

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:

— the intended field of uses, i.e. the temperature values given in Tables C.1 and C.2 as related to the garment's I_{cler},

— information that the protection can only be guaranteed if the complete ensemble is worn;

— information if the garment is intended to protect against water penetration;

— additional information related to risks at work if the garment is intended to be used in temperatures below – 50 ° C (e.g. concerning respiratory protection, skin protection, necessary warnings);

— explanation of the marking (i.e. the pictogram and performance levels in Clause 8) and the recommended specific underwear (type B, or the standard ensemble R, (see Annex B) or type C as specified by the manufacturer);

— if the insulation in the garment is given related to underwear type C, this underwear shall be clearly specified (e.g. product identification code);

— explanation how to use the information given in the marking;

— the length of the useable life time of the garment which might be affected by the types of material used in its construction, the maintenance process and the environments in which the garment is used;

— reference to appropriate additional PPE items for those parts of the body not protected by the ensemble or garment.

Annex A
(informative)

Significant changes between this document and the previous edition

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

a) definition on water-vapour resistance according to EN ISO 11092 included;

b) information on ergonomics and innocuousness given;

c) sentence in 4.7 added, that the dimensional change due to cleaning shall meet the requirements in accordance with EN ISO 13688;

d) test for tear strength included;

e) test for bursting strength added;

f) test for flexibility of coated or laminated material added;

g) test for dimensional change due to cleaning added;

h) new Clause 5 on pretreatment added;

i) standard underwear C to be used primarily when measuring the resultant effective thermal insulation;

j) Clause 9 in accordance with EU law (e.g. PPE regulation 2016/425) extended;

k) tables in the Annexes revised and adapted to the state of the art and additional tables added;

l) only walking manikin tests are allowed;

m) serial insulation calculation method has been removed from this standard, only parallel calculation model allowed;

n) minimum values on I_{cler} have been adjusted from serial (0,310 m^2K/W) to parallel insulation (0,265 m^2K/W) calculation model;

o) tables in Annex C have been extended with the adjusted reference insulation values related to material thermal resistance;

p) Annex ZA revised.

Annex B
(normative)

Standard clothing for the testing of protective clothing against cold

Table B.1 — Underwear B for use with ensembles and standard ensemble R for use with garments[1)]

Garment	Item No.	Thermal resistance R_{ct} $\frac{m^2 \cdot K}{W}$ ± 10 %	Mass per unit area g/m²	Description	Standard underwear B for ensembles	Standard-ensemble R for garments
Undershirt with long sleeves	01	0,060		Tempex code no. 83046–0000 (in order to get the right value, two shirts shall be worn one over the other, first one e.g. in size 004 (46–48), second one in size 005 (50–52)	X	X
Long underpants	02	0,060		Tempex code no. 83047–0000 (also two pants to be worn one over the other, first one e.g. in size 004, second one in size 005)	X	X
Socks (up to the knee)	03	0,053		Woolpower art. no. 8484	X	X
Bootee	04	0,189		Helly Hansen no. 72464	X	X

1) Such reference can be obtained by:

— for items 01, 02, 08, 09, 10 and 11- by company Tempex, Germany, Tel: +49 2639 8309 0, Fax: +49 2639 8309 99, email: tempex@hb-online.de;

— (Protective Wear GmbH & Co KG is the legal successor of Tempex GmbH, but brand name TEMPEX is still existing);

— for item 03 - by company Woolpower, Sweden, Tel: +46 63 14 85 20, Fax: +46 63 10 34 79;

— for item 04 - bootee Helly Hansen AS, NorwayTel: +47 69249000 Fax: +47 69 24 90 99;

— for items 05, 06 and 07 - by company Fristads Kansas Sverige AB, Sweden, Tel: +46 33 20 22 00, Fax: +46 33 20 02 70.

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.

Garment	Item No.	Thermal resistance R_{ct} $\frac{m^2 \cdot K}{W}$ ± 10 %	Mass per unit area g/m²	Description	Standard underwear B for ensembles	Standard-ensemble R for garments
Jacket (one layer)	05	0,013	375	Fristads Kansas AB 100304		X
Trousers (one layer)	06	0,013	375	Fristads Kansas AB 104986		X
Shirt	07	0,013	140	Fristads Kansas AB 100115		X
Thermojacket	08	0,100		Tempex code no. 30063–5055	X	
Thermopants	09	0,100		Tempex code no. 30065–5055	X	
Knitted gloves	10	0,082		Tempex code no. 83025–0000, the gloves are originally with Thinsulate lining. For the test the Thinsulate lining shall be removed, because the R_{CT} 0,082 is reached without lining.	X	X
Balaclava	11	0,060		Tempex code no. 83004–0000, to wear in the same way as undershirt and underpants, two pieces one over the other.	X	X
NOTE 1 I_{cler} of the standard underwear B is 0,197 m² · K/W ± 3 %. NOTE 2 I_{cler} of the standard ensemble R is 0,174 m² · K/W ± 3 %.						

Test procedures to be followed for testing garments:

a) Jacket: replace the standard jacket 05 in the standard ensemble R by the test jacket;

b) Trousers: replace the standard trouser 06 in the standard ensemble R by the test trousers;

c) Waist coats: replace the standard jacket 05 in the standard ensemble R by the waist coats;

d) Coat: replace the standard jacket 05 in the standard ensemble R by the coat;

e) Separable thermal lining: tested together with the reference jacket 05.

Annex C
(informative)

Temperature ranges of utility

Manufacturers can use the values given in Table C.1 and Table C.2 for information of the user.

The protective value of resultant effective thermal insulation of a garment assembly is converted into combinations of ambient air temperature and activity level (metabolic heat production) (see Tables C.1 and C.2).

The levels in Table C.1 correspond to a standing wearer and in Table C.2 to a wearer moving and performing light or moderate activity. For each level a minimum temperature is calculated at which the body can be maintained at thermo neutral conditions indefinitely (8 h), and a minimum temperature at which a one hour exposure can be sustained with an acceptable rate of body cooling. Values are based on the conditions that air temperature is equal to mean radiant temperature, relative humidity is about 50 %, air velocity is 0,4 m/s respectively 3 m/s, air permeability is 50 mm/s and body movement is 1 m/s. Higher wind speeds will increase the temperatures in Tables C.1 and C.2 because of wind-cooling effects (see EN ISO 11079).

NOTE 1 It is possible that an adequate level of whole body insulation is not sufficient to prevent the cooling of susceptible parts of the body (e.g. hands, feet, face) and the concomitant risk of cold injury. The protection of hands against cold is dealt with in EN 511.

Table C.1 — Resultant effective thermal insulation of clothing I_{cler} and ambient temperature conditions for heat balance at different durations of exposure

Insulation	**Wearer standing, 75 W/m²**			
I_{cler}	**Air velocity**			
m²·K/W	**0,4 m/s**		**3 m/s**	
	8 h	**1 h**	**8 h**	**1 h**
0,265	13	0	19	7
0,310	10	−4	17	3
0,390	5	−12	13	−3
0,470	0	−20	7	−9
0,540	−5	−26	4	−14
0,620	−10	−32	0	−20

Table C.2 — Resultant effective thermal insulation of clothing I_{cler} and ambient temperature conditions for heat balance at different activity levels and durations of exposure

Insulation I_{cler} m²·K/W	Wearer moving activity							
	light 115 W/m²				medium 170 W/m²			
	Air velocity							
	0,4 m/s		3 m/s		0,4 m/s		3 m/s	
	8 h	1 h	8 h	1 h	8 h	1 h	8 h	1 h
0,265	3	−12	9	−3	−12	−28	−2	−16
0,310	−2	−18	6	−8	−18	−36	−7	−22
0,390	−9	−28	0	−16	−29	−49	−16	−33
0,470	−17	−38	−6	−24	−40	−60	−24	−43
0,540	−24	−45	−11	−30	−49	−71	−32	−52
0,620	−31	−55	−17	−38	−60	−84	−40	−61

NOTE 2 Performance of a clothing ensemble or garment in terms of preserving heat balance at normal body temperature depends on internal body heat production. Therefore the protection level of a clothing ensemble or garment is evaluated by comparing its measured insulation value and the calculated required insulation value.

NOTE 3 Requirements for thermal insulation of the human body in a specific cold environment are assessed on the basis of EN ISO 11079.

These temperature values are only valid with even distribution of the insulation on the body and with adequate hand-, foot- and headwear.

Annex D
(normative)

Calibration and measurements for resultant effective thermal insulation

The measurement with the thermal manikin and related operating conditions is based on the reference set of 3 cold protective clothing ensembles. The test procedure performed with the moving manikin shall give an I_{cler} value for ensemble A of 0,18 m^2·K/W ± 5 %, for ensemble B of 0,32 m^2 · K/W ± 5 % and for ensemble C of 0,46 m^2 · K/W ± 5 %. The description of these ensembles is given in Annex E.

The test house shall use the parallel model for the manikin test (see EN ISO 15831:2004) and a correction factor obtained from a linear relationship (if necessary) to achieve the above reference values of all 3 garment systems.

Annex E
(normative)

Calibration garments A, B and C

Table E.1 — Calibration garments A, B and C

Calibration could be done at regular intervals with the garments A, B, C in new state (unwashed).

Item No.	Garments	Description	References	New reference (if changed)	Ensembles
01	Underwear 1	poloshirt + pants	HellyHansen[a] no. 75007 poloshirt and no. 75401 pants w/fly (alt. no. 75406 women's pants)	poloshirt: 75017, pants: 75415	A,B
02	Underwear 2	jacket + pants	Ullfrotté[b] 400 g/m² no. 962 men's jacket (alt. no. 961 women's jacket) and no. 965 men's pants (alt. no. 965 women's pants)	Woolpower: full zip jacket: 7234, long john with fly: 6344 long john: 7344	C
03	Intermediate	jacket + pants	HellyHansen[a] no. 06266 jacket and no. 06501 trousers with fly	Jacket: 72261, trousers w/fly: 72501	B,C
04	Outer garment 1	jacket + trousers	Leijona[c] no. 336320–076–74 jacket and no. 339001–0076–74 trousers	Winter jacket: 236745–00–0074–21 Winter trousers: 239745–00–0074–21	A,B
05	Outer garment 2	jacket + trousers	Tempex[d] no. 390 2201 jacket and no. 392 0201 trousers (Order Picker's Suit)	Jacket: 30001–1026 Trousers: 30006–1026	C
06	Footwear 1	sneakers	Arbesko[e] no.3099 sport shoes (not available)	(leather sports shoe, own selection)	A
07	Footwear 2	safety boots	Tempex[d] no. 730 8880 safety boots	83035–0000	B,C
08	Socks 1		Woolpower[b] no. 976 (400 g/m²)	Woolpower: Socks logo: 8424	A,B,C
09	Socks 2	Bootees	HellyHansen[a] no. 06464	72464	C
10	Handwear 1	gloves	Hestra[f] no. 3128 gloves	31300	A

11	Handwear 2	Mittens	Tempex[d] no. 413 1290 (Low temperature mittens)	83031–0000	B,C
12	Headgear 1		Taiga[g] no. 25928 Rohn	20525 Rohn cap	A,B
13	Headgear 2		Tempex[d] no. 310 1030 Alaskan Hood	83001–0000	C

a Such reference can be obtained by company Helly Hansen AS
Munkedamsveien 35, 6fl, N-0250 Oslo
NORWAY
Phone: +47 69249000
Fax: +47 69249099
E-mail: workwear@hellyhanssen.no
Website: http://www.hhworkwear.com

b Such reference can be obtained by company Woolpower
Chaufförvägen 29
SE-831 48 Östersund
SWEDEN
Phone: +46 63–14 85 20
Fax: +46 63–10 34 79
E-mail: info@woolpower.se
Website: http://www.woolpower.se

c Such reference can be obtained by company Leijona Group Oy
Satelliittikatu 5
Box29
FI-57210 Savonlinna
FINLAND
Phone. +358 15 475 0500
Fax +358 15 475 0520
E-mail: asiakaspalvelu@leijonagroup.com
Website: www.leijonagroup.com

d Such reference can be obtained by company Protective Wear GmbH & Co KG
Märkerstr. 21
56307 Dernbach
GERMANY
Tel: +49 2639 83090
Fax: +49 2639 8309-99
E-Mail: info@hb-online.de
Website: http://www.hb-online.com/

e Such reference can be obtained by company Arbesko AB
Propellervägen 5
SE-702 26 ÖREBRO
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Phone: + 46 19 30 66 00
Fax: + 46 19 30 66 50
E-mail: info@arbesko.se

	Website: http://www.arbesko.com
f	Such reference can be obtained by company Martin Magnusson and Co AB Box 116 SE-330 27 Hestra SWEDEN Phone: +46 370 33 97 10 Fax: +46 370 33 97 05 E-mail: info@hestragloves.se Website: http://www.hestragloves.com
g	Such reference can be obtained by company TAIGA AB Box 20 SE-432 21 VARBERG SWEDEN Phone: +46 340–66 69 00 Fax: +46 340–66 69 22 E-mail: info@taiga.se Website: http://www.taiga.se

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of EU Directive 89/686/EEC aimed to be covered

This European Standard has been prepared under a Commission's standardization request (M/031) to provide one voluntary means of conforming to essential requirements of the New Approach Directive 89/686/EEC Personal Protective Equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive, 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 Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex II of Directive 89/686/EEC Personal Protective Equipment

Essential Requirements of EU Directive 89/686/EEC, Annex II	Clause(s)/subclause(s) of this EN	Remarks/Notes
1.2.1 Absence of risks and other 'inherent'nuisance factors	4.1.1; 4.3; 4.5; 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 design strength	4.6.1; 4.6.2	
1.4 Information supplied by the manufacturer	Clause 5, Clause 9	
2.4 PPE subject to ageing	Clause 9	
2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	Clause 8	
3.7 Protection against cold 3.7.1 PPE constituent materials and other components	4.2; 4.6.3	
3.7.2 Complete PPE ready for use	4.2; 4.4	

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.

Annex ZB
(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 of the European Parliament and of the Council of 9 March 2016 on personal protective equipment.

Once this standard is cited in the Official Journal of the European Union under that Regulation (EU) 2016/425, compliance with the normative clauses of this standard given in Table ZB.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 ZB.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; 4.3; 4.5; 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	4.6.1; 4.6.2	
1.4 Manufacturer's instructions and information	Clause 5, Clause 9	
2.4 PPE subject to ageing	Clause 9	
2.12 PPE bearing one or more identification markings or indicators directly or indirectly relating to health and safety	Clause 8	
3.7 Protection against cold 3.7.1 PPE constituent materials and other components	4.2; 4.6.3	
3.7.2 Complete PPE ready for use	4.2; 4.4	

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] EN 343, *Protective clothing — Protection against rain*

[2] EN 511, *Protective gloves against cold*

[3] EN 14058, *Protective clothing — Garments for protection against cool environments*

[4] EN ISO 3175 (all parts), *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments (ISO 3175, all parts)*

[5] EN ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing (ISO 6330)*

[6] EN ISO 11079, *Ergonomics of the thermal environment — Determination and interpretation of cold stress when using required clothing insulation (IREQ) and local cooling effects (ISO 11079)*

[7] EN ISO 15797, *Textiles — Industrial washing and finishing procedures for testing of workwear (ISO 15797)*

[8] EN ISO 30023, *Textiles — Qualification symbols for labelling workwear to be industrially laundered (ISO 30023)*