BRITISH STANDARD

BS EN
1073-2:2002

Protective clothing against radioactive contamination —

Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination

The European Standard EN 1073-2:2002 has the status of a British Standard

ICS 13.280; 13.340.10

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 1073-2:2002.

The UK participation in its preparation was entrusted by Technical Committee PH/3, Protective clothing, to Subcommittee PH/3/10, Protection against radioactive contamination, which has the responsibility to:

— aid enquirers to understand the text;

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

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 12, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

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EUROPEAN STANDARD

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English version

Protective clothing against radioactive contamination - Part 2: Requirements and test methods for non-ventilated protective clothing against particulate radioactive contamination

Vêtements de protection contre la contamination radioactive - Partie 2: Exigences et méthodes d'essai des vêtements de protection non ventilés contre la contamination radiocative sous forme de particules

Schutzkleidung gegen radioaktive Kontamination - Teil 2: Anforderungen und Prüfverfahren für unbelüftete Schutzkleidung gegen radioaktive Kontamination durch feste Partikel

This European Standard was approved by CEN on 24 March 2002.

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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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Contents

Foreword

This document EN 1073-2:2002 has been prepared by Technical Committee CEN/TC 162, "Protective clothing including hand and arm protection and life jackets", 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 January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements and test methods for non-ventilated protective clothing protecting the wearer against particulate radioactive contamination. Such clothing is intended to protect only the body, arms and legs of the wearer, but it may be used with accessories which provide protection to additional areas of the wearer (e.g. boots, gloves, RPE). Protection to these other areas is specified in other European Standards.

This European Standard does not apply for the protection against ionizing radiation and the protection of patients against contamination with radioactive substances by diagnostic and/or therapeutic measures.

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

EN 863, *Protective clothing — Mechanical properties — Test method: Puncture resistance.*

prEN 943-1, *Protective clothing for use against liquid and gaseous chemicals, including liquid aerosols and solid particles — Part 1: Performance requirements for ventilated and non-ventilated "gas-tight" (Type 1) and "non-gas-tight" (Type 2) protective suits.*

EN 1073-1, *Protective clothing against radioactive contamination — Part 1: Requirements and test methods for ventilated protective clothing against particulate radioactive contamination.*

EN 1146, *Respiratory protective devices for self-rescue - Self-contained open-circuit compressed air breathing apparatus incorporating a hood (compressed air escape apparatus with hood) — Requirements, testing, marking.*

EN 25978, *Rubber- or plastics-coated fabrics — Determination of blocking resistance (ISO 5978:1990).*

EN 13274-4, *Respiratory protective devices - Methods of test - Part 4: Flame tests.*

prEN 13982-2, *Protective clothing for use against solid particulate chemicals — Part 2: Test methods for determination of inward leakage of aerosols of fine particles into suits (ISO/DIS 13982-2:1999).*

EN ISO 9073-4, *Textiles — Test methods for nonwovens — Part 4: Determination of tear resistance (ISO 9073-4:1997).*

prCEN ISO/TR 11610, *Protective clothing — Glossary of terms and definitions (ISO/DTR 11610:2002).*

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

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in prCEN ISO/TR 11610 and the following terms and definitions apply.

3.1
protective clothing against radioactive contamination
protective clothing intended to provide protection to the skin and if required to the respiratory tract against radioactive contamination [EN 1073-1]

3.2
non-ventilated protective clothing (against particulate radioactive contamination)
clothing, intended to provide protection to the body only (not the respiratory tract, face, head, hands or feet) from particulate radioactive contamination, and which is not supplied with clean air to ensure internal ventilation and positive pressure

3.3
total inward leakage (TIL)
ratio, given in percentage between the test particle concentrations inside the suit and the test chamber

The challenge concentration corresponds to 100 %.

3.4
nominal protection factor (100 :TIL)
ratio of the concentration of the test particles in the ambient atmosphere to the concentration of the test particles inside the suit

3.5
particulate radioactive contamination
presence of radioactive substances in the form of solid particles in or on a material or in a place where they are undesirable or could be harmful

4 Requirements

The design and the material of non-ventilated protective clothing against particulate radioactive contamination shall fulfil all mandatory requirements of this standard. In case of classification at least class 1 shall be reached.

4.1 Design

4.1.1 The non-ventilated protective clothing against radioactive contamination shall comply with the general requirements specified in EN 340.

4.1.2 The design of the protective clothing shall be such that the protective clothing is straightforward to put on and take off, and shall minimise the risk of contamination and shall minimise physiological stress. Testing according to "practical performance test" (see 5.2).

4.1.3 The clothing can be designed for single use or to be reusable.

4.1.4 The clothing may consist of one or more garments designed to be worn together, and may incorporate permanently attached accessories (e.g. hood, gloves, overboots, respiratory protection), may be intended to be joined to such accessories and/or used with them, or be intended for use without accessories. Where relevant, the performance of the clothing is tested with any accessories also fitted according to the instructions of the manufacturer, and the information supplied by the manufacturer (see clause 7) shall make this clear.

The user, in consultation with the manufacturer, shall assess which parts of the body need protection for their application, and what accessories, if any, are required to provide the necessary level of protection.

4.2 Materials

The materials used for non-ventilated protective clothing against particulate radioactive contamination shall meet the requirements according to Table 1 after the pre-treatment in accordance with 5.1.1 and after the conditioning according to 5.1.2.

NOTE If protection against hazardous chemicals is required then the testing should be carried out according to the relevant standard for chemical protective clothing.

Table 1 - Requirements for the materials

Requirement	Classification	Test according to
Abrasion resistance	6 > 2 000 Cycles 5 > 1 500 Cycles 4 > 1 000 Cycles 3 > 500 Cycles 2 > 100 Cycles 1 > 10 Cycles	EN 530, Method 2, 00 abrasive paper according to prEN 943-1 and 9 kPa downward pressure
Puncture resistance	4 > 100 N 3 > 50 N 2 > 10 N	EN 863
Resistance to blocking[a]	2 no blocking 1 blocking	EN 25978
Tear resistance	6 > 150 N 5 > 80 N 4 > 40 N 3 > 20 N 2 > 10 N 1 > 2 N	EN ISO 9073-4
Resistance to ignition	shall not continue to burn	EN 1146, EN 13274-4 (single burner test)
[a] For uncoated woven material the test is not applicable		

4.3 Nominal protection factor

Non-ventilated protective clothing shall be classified according to Table 2. Testing according to 5.3.

Table 2 - Total inward leakage

Class	Mean value of inward leakage at the three sampling positions inside the suit during exercise of		Nominal protection factor[a]
	one activity (TIL_E) %	all activities (TIL_A) %	
3	0,3	0,2	500
2	3	2	50
1	30	20	5
a Nominal protection factor = 100 :TIL_A			

4.4 Seam, assemblage and join strength

4.4.1 Seam strength

A sample of each type of straight seam construction shall be tested in accordance with A.2 of EN ISO 13934-2:1999 (Constant-rate-of-traverse). Three specimens of each type of seam shall be tested and the mean of each set of three samples calculated. The garment seam performance shall be classified according to the levels of performance given in Table 3 using the lowest result, i.e. the weakest seam type.

NOTE The test method described in EN ISO 13934-2 is only applicable to straight seams joining two pieces of material.

Table 3 - Classification of seam strength

Class	Seam strength N
5	> 300
4	> 125
3	> 75
2	> 50
1	> 30

4.4.2 Joins and assemblages

The joins and assemblages between the suit and detachable parts e.g. between gloves and sleeves, boots and trouser legs, shall be tested in accordance with 5.4 and withstand a pull of:

Table 4 - Classification of joins and assemblages strength

Class	Joins and assemblages strength N
2	> 100
1	> 50

5 Test methods

5.1 Test preparations

5.1.1 Pre-treatment

When the clothing is intended to be reusable the requirements for the materials or the complete clothing shall be proved after five cycles of cleaning and disinfection according to the manufacturer's instructions for use before testing.

5.1.2 Conditioning

All clothing and material samples shall be conditioned by storage at (20 ± 2) °C and (65 ± 5) % relative humidity for at least 24 h. Start each of the tests as specified in 4.2, 4.3 and 4.4, within 5 min after removal from the conditioning atmosphere.

5.1.3 Visual inspection

A visual inspection shall be carried out by the test house prior to the laboratory or the practical performance test. This may entail a certain amount of dismantling of the components of the protective clothing in accordance with the manufacturer's information for maintenance.

5.1.4 Preconditioning for the practical performance test

If the manufacturer does not state the preconditioning atmosphere for the practical performance test, the complete clothing shall be exposed:

a) for 4 h to a temperature of (-30 ± 3) °C and allowed to return to ambient conditions, followed by

b) for 4 h to an atmosphere of (60 ± 3) °C at 95 % relative humidity. It shall then be allowed to return to ambient conditions.

5.2 Practical performance test

5.2.1 General

The tests shall be carried out at (20 ± 5) °C and a relative humidity of less than 60 % by two persons. The test temperature and humidity shall be recorded. Two suits shall be tested, each being tested on one test person.

The test persons shall be selected who are familiar with using such or similar protective clothing. The persons will be drawn from those people certified as fit to do so by the medical officer. Before performing tests involving human subjects, account shall be taken of any national regulations concerning the medical history, examination or supervision of the test subjects.

Prior to the test there shall be an examination that the suit is in working-condition and that it can be used without danger. If more than one size of a clothing is manufactured the subjects are asked to select the appropriate size according to the manufacturer's instructions.

After fitting the suit each test person is asked "Does the suit fit?". If the answer is "Yes", continue the test. If the answer is "No", replace the test person or the suit and record the fact.

5.2.2 Procedure

During the test the following activities shall be carried out within a total working time of 20 minutes in simulation of the practical use of the suit:

a) walking on the level with regular rate of (5 ± 0,5) km/h for 5 min;

b) filling a small basket (see Figure 1, approximate volume 8 l) with 12 mm chippings (e.g. limestone chippings) or other suitable material from a hopper which stands 1,5 m high and has an opening at the bottom to allow the contents to be shovelled out and a further opening at the top where the chippings may be returned. The person stoops or kneels as he wishes and fills the basket with chippings. He then lifts the basket and empties the contents back into the hopper. This shall be repeated 15 times to 20 times in 10 min.

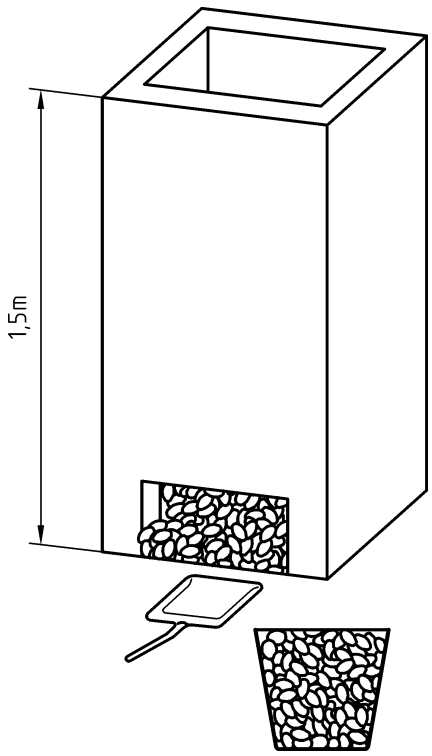

Figure 1 - Hopper and basket

5.2.3 Information to be recorded

During the practical performance test the clothing shall be subjectively assessed by the wearer and the following shall be recorded:

a) security of fastening;

b) ease of movement;

c) comfort regarding the thermo physiological features (heat stress, humidity transfer);

d) any other comments volunteered by the wearer;

e) any visible defects.

5.3 Determination of the nominal protection factor

The nominal protection factor shall be determined by measuring the total inward leakage in accordance with prEN 13982-2 with any accessories specified by the manufacturer fitted in accordance with their instructions.

On three test subjects six new (reusable clothing, see 5.1.1) suits shall be tested, two suits per test subject.

For classification according to Table 2, the average value of each exercise (TIL_E, see prEN 13982-2) and of all measurements (TIL_A , see prEN 13982-2*)* for the six suits shall be taken.

5.4 Join and assemblage pull test

Assemble the means of attachment according to the manufacturers' information. If the assembled item (e.g. glove or boot) is itself not strong enough to apply the required pull substitute an item that is. Securely attach one part to a fixed clamp. Apply the required force longitudinally. Record at which force it parts or state that at the required force it was still complete.

6 Marking

The non-ventilated protective clothing shall be marked according to EN 340 with at least the following information. The marking shall be clearly visible and as durable as adequate for the life of the clothing:

a) the name, trade mark or other means of identification of the manufacturer;

b) the number and date of this European Standard followed by the level of performance of the total inward leakage;

c) the year of manufacture;

d) the type name, identification number or model number of the clothing;

e) the size range as defined in EN 340;

f) the pictogram, see Figure 2;

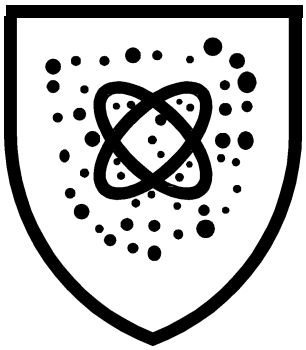

Figure 2 - Pictogram

7 Information supplied by the manufacturer

The information supplied shall be at least in the official language(s) of the country or region of application.

The manufacturers' information shall comply with the specifications of EN 340.

The following information shall be supplied additionally:

— instructions for donning, using, fitting, removing and storing;

— accessories, and their means of attachment necessary to achieve the specified level of body protection;

— application, limitations of use (classification, temperature range, etc.);

— tests to be carried out by the wearer before use (if required);

— maintenance and cleaning and decontamination by e.g. showering (if required).

Warnings (if appropriate) shall be given against problems likely to be encountered, as e.g. heat stress, work load, environmental atmosphere, etc.

NOTE The comfort of the wearer should be considered. The manufacturer should suggest appropriate undergarments.

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.

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, Annex II:

EU Directive 89/686/EEC, Annex II		Clauses of this standard
1.1.1	Ergonomics	4
1.1.2.1	Highest level of protection possible	4
1.1.2.2	Classes of protection appropriate to different levels of risk	4.2, 4.3, 4.4
1.2.1	Absence of risks and other nuisance factors	4
1.3.1	Adoption of PPE to users morphology	4.1.1, 4.1.2
1.3.2	Lightness and strength	4.1.2, 4.4
1.3.3	Compatibility of different classes or types of PPE designed for simultaneous use	4.1.4, 4.1.2
1.4	Information supplied by the manufacturer	7
2.2	PPE enclosing the parts of the body to be protected	4.1.2
2.4	PPE subject to ageing	6, 7
2.12	PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	6
3.9.2.1	Protection against external radioactive contamination	4, 6, 7

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

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