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Protective clothing 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) chemical protective suits

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Schutzkleidung gegen flüssige und gasförmige Chemikalien, einschließlich Flüssigkeitsaerosole und feste Partikel - Teil 1: Leistungsanforderungen für belüftete und unbelüftete "gasdichte" (Typ 1) und "nicht-gasdichte" (Typ 2) Chemikalienschutzanzüge

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Vêtements de protection contre les produits chimiques liquides et gazeux, y compris les aérosols liquides et les particules solides - Partie 1 : Exigences de performance des combinaisons de protection chimique ventilées et non ventilées

**Ta slovenski standard je istoveten z: EN 943-1:2002**

**ICS:**

13.340.10      Varovalna obleka      Protective clothing

**SIST EN 943-1:2003**      en

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ICS 13.340.10

English version

Protective clothing 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) chemical  
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Schutzkleidung gegen flüssige und gasförmige  
Chemikalien, einschließlich Flüssigkeitsaerosole und feste  
Partikel - Teil 1: Leistungsanforderungen für belüftete und  
unbelüftete “gasdichte” (Typ 1) und “nicht-gasdichte” (Typ  
2) Chemikalienschutzanzüge

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This European Standard was approved by CEN on 20 June 2002.

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 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 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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## Foreword

This document EN 943-1:2002 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 March 2003, and conflicting national standards shall be withdrawn at the latest by March 2003.

The CEN/TC 162 decided in April 1989 to start with the work and to allocate it to WG3 "Resistance to chemicals of protective clothing".

During the plenary meeting of CEN/TC 162 in February 1992 the proposal was presented to the TC and accepted. The proposal was transmitted to the secretariat of CEN/TC 162 with the request to induce the publishing of the draft European Standard. Following the first Preliminary Enquiry of separate standards for Type 1 and 2 re-usable protective clothing it was agreed to combine these into a single standard and include limited use clothing. This revision was substantial enough to justify a 2nd Preliminary Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the essential requirements of EU Directive 89/686/EEC.

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

Annexes A, B and C are normative.

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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 minimum requirements, test methods, marking and information supplied by the manufacturer for the following ventilated and non-ventilated limited use and re-usable chemical protective suits, including component parts such as gloves and boots which can be specified elsewhere.

### Type 1 - "gas-tight" chemical protective suit

Type 1a - "gas-tight" chemical protective suit with a breathable air supply independent of the ambient atmosphere, e.g. a self-contained open-circuit compressed air breathing apparatus, worn inside the chemical protective suit.

Type 1b - "gas-tight" chemical protective suit with a breathable air supply, e.g. a self-contained open-circuit compressed air breathing apparatus, worn outside the chemical protective suit.

NOTE As chemical protective suits are used with respiratory devices, special attention should be given to the adequate selection of respiratory protective equipment. The limiting factors for the use of respirator filters (e.g. oxygen deficiency) should be taken into consideration.

Type 1c - "gas-tight" chemical protective suit with breathable air providing positive pressure, e.g. air lines.

### Type 2 - "non-gas tight" chemical protective suit

"Non-gas-tight" chemical protective suit with breathable air providing positive pressure.

Specifications for total inward leakage test see annex A.

Specifications for test methods and performance classification for materials, seams, joins and assemblages see annex B.

Specifications for glass paper and glass cloth see annex C.

## 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 136:1998, *Respiratory protective devices — Full face masks — Requirements, testing, marking.*

EN 139:1994, *Respiratory protective devices — Compressed air line breathing apparatus for use with a full face mask, half mask or mouthpiece assembly — Requirements, testing, marking.*

EN 270:1994, *Respiratory protective devices — Compressed air line breathing apparatus incorporating a hood - Requirements, testing, marking.*

EN 340, *Protective clothing — General requirements.*

EN 368, *Protective clothing for use against liquid chemicals — Resistance of materials to penetration by liquids.*

EN 369, *Protective clothing for use against liquid chemicals — Test method: Resistance of materials to permeation by liquids.*

EN 374-3, *Protective gloves against chemicals and micro-organisms — Part 3: Determination of resistance to permeation by chemicals.*

EN 463, *Protective clothing for use against liquid chemicals — Determination of resistance to penetration by a jet of liquid (Jet Test).*

EN 464, *Protective clothing for use against liquid and gaseous chemicals, including liquid aerosols and solid particles — Determination of leak-tightness of gas-tight suits (Internal Pressure Test).*

EN 530, *Abrasion resistance of protective clothing material.*

EN 863, *Protective clothing — Mechanical Properties — Test Method — Puncture resistance.*

EN 12021, *Respiratory protective devices – Compressed air for breathing apparatus.*

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

prCEN ISO TR 11610, *Protective clothing – Glossary of terms and definitions (ISO/DIS 11610:1997).*

EN ISO 7854, *Rubber or plastics coated fabrics — Determination of resistance to damage by flexing .*

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

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 – Seam tensile properties of fabrics and made-up textile articles - Part 2: Determination of maximum force to seam rupture using the grab method (ISO 13935-2:1999).*

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

### 3 Terms and definitions

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

### 4 Performance requirements

#### 4.1 Materials

Chemical protective clothing materials shall fulfil all the test requirements given in Table 1 when tested in accordance with the test method specified in B.2.

Pre-conditioning and conditioning shall be carried out in accordance with B.2.1 and B.2.2 as required

Table 1 — Minimum performance requirements of chemical protective clothing materials

Clause in annex B	Performance requirement	Performance level	
		Limited Use	Re-usable
B.2.3	Abrasion resistance	3	3
B.2.4	Flex cracking resistance	1	4
B.2.5	Flex cracking at –30 °C (optional)	2	2
B.2.6	Trapezoidal tear resistance	3	3
B.2.8	Tensile strength	3	4
B.2.9	Puncture resistance	2	2
B.2.10	Resistance to permeation by liquids	See B.2.10	See B.2.10
B.2.13	Resistance to ignition	See B.2.13	See B.2.13

Chemical protective clothing material for which a test method in the above table does not provide a clear measurement end-point criteria shall be marked NOT APPLICABLE in the test report and in the instructions for use, the reason why the test could not be completed shall be indicated e.g. where the elasticity of the sample prevents an end-point in the puncture resistance test.

Materials of construction shall not be known to cause skin irritation or have any adverse effect to health.

NOTE 1 The material of construction should be as light and as flexible as possible in order to ensure wearer comfort as well as providing effective protection.

NOTE 2 Material properties are only one element for the determination of wearer comfort of protective clothing. Design features of the clothing can have a more important influence on wearer comfort than material properties.

## 4.2 Seams, joins and assemblages

Seams, joins and assemblages shall be tested and classified according to the requirements of B.3. The minimum performance requirement for Seam Strength shall be Level 5

NOTE 1 The requirements of this clause apply to the garment as a whole including component parts, such as gloves or boots, that are integral to the garment. The seams, joins and assemblages attaching these accessories are included within the scope of this standard. The performance criteria for the accessories; gloves, boots or respiratory protective equipment are given in other European Standards.

NOTE 2 The performance can be different to that of the material from which it is made, but has to be adequate for the intended use.

## 4.3 Strength of joins and assemblages

The strength of joins and assemblages between the suit and detachable parts e.g., between gloves and sleeves, and boots and trouser legs, shall not be less than 100 N when tested in accordance with 6.5.



Table 2 — Performance requirements for whole suits

	1a	1b	1c	2
<b>5 Requirements for whole suit</b>				
5.1 General	✓	✓	✓	✓
5.2 Conditioning	✓	✓	✓	✓
5.3 Leak tightness	✓	✓	✓	
5.4 Inward leakage		✓ (1)	✓	✓
<b>5.5 Visors</b>				
5.5.1 General	✓		✓	✓
5.5.2 Distortion of vision	✓		✓	✓
5.5.3 Field of vision	✓		✓	✓
5.5.4 Mechanical strength	✓		✓	✓
5.6 Facemask	✓	✓		
5.7 Pass-thru for use with self-contained breathing apparatus	✓			
5.7.1 Strength of pass-thru	✓			
5.7.2 Performance of pass-thru	✓			
5.7.3 Resistance to kinking	✓			
5.8 Air supply system			✓	✓
5.8.1 Couplings			✓	✓
5.8.2 Connections			✓	✓
5.8.3 Connection strength			✓	✓
5.9 Breathing hose and ventilating hose			✓	✓
5.9.1 External breathing hose			✓	✓
5.9.1.1 Resistance to collapse			✓	✓
5.9.2 Internal breathing hose			✓	✓
5.9.2.1 Resistance to collapse			✓	✓

5.9.3 External ventilating hose		✓ (2)		
5.10 Air flow rate			✓	✓
5.10.1 Continuous flow valve			✓	✓
5.11 Warning and measuring facilities			✓	✓
5.12 Compressed air supply tube			✓	✓
5.13 Exhaust assembly	✓	✓ (3)	✓	✓
5.14 Pressure in suit	✓	✓ (3)	✓	✓
5.15 Breathing resistance			✓	✓
5.16 Carbon dioxide content of inhalation air			✓	✓
5.17 Noise associated with air supply to suit			✓	✓

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NOTE 1 Inward leakage test is required for Type 1b suits where the facemask is not permanently attached.

NOTE 2 Applicable only when the self-contained breathing apparatus is worn outside the suit and air from the cylinder is fed into the suit for ventilation.

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NOTE 3 Applicable for suits where air is vented from the facemask into the chemical protective suit and when the self-contained breathing apparatus is worn outside the suit and air from the cylinder is fed into the suit for ventilation.

## 5 Performance requirements for the whole suit

### 5.1 General

Chemical protective suits shall fulfil the requirements given in Table 2 when tested as a complete suit.

The suit shall be made so that the wearer has freedom of movement and is as comfortable as possible, consistent with the protection afforded by the garment when tested in accordance with 6.2

### 5.2 Conditioning

The complete suit shall be exposed:

- a) for not less than 4 h to an atmosphere of  $(60 \pm 3) ^\circ\text{C}$  at 95 % relative humidity; followed by
- b) for not less than 4 h to a temperature of  $(-30 \pm 3) ^\circ\text{C}$  and allowed to return to ambient conditions.

It shall then be allowed to return to ambient temperature. If these temperatures are incompatible the manufacturer shall state this and state the designed conditions in the instructions.

### 5.3 Leak tightness

The complete suit shall pass when tested according to EN 464. The pressure drop shall not be greater than 300 Pa (3 mbar) in 6 min.

### 5.4 Inward leakage

When tested in accordance with annex A the inward leakage shall not exceed the values given in Table 3.

**Table 3 — Inward leakage performance**

Suit type	Inward leakage
Type 1a	Not required (EN 464 applies)
Type 1b with facemask permanently joined to the suit (an assemblage)	Not required (EN 464 applies)
Type 1b using a facemask which is <u>not</u> permanently joined to the suit	EN 464 <u>plus</u> Inward leakage test (annex A) with inward leakage not greater than 0,05 % when measured in the ocular cavity of the mask
Type 1c	not greater than 0,05 %
Type 2	not greater than 0,05 %

### 5.5 Visor

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#### 5.5.1 General

Where a visor is fitted as part of the suit, as distinct from a respirator facemask joined to the suit, the visor shall comply with 5.5.3 and 5.5.4.

When tested in accordance with 5.5.2 visors shall not distort vision.

Where anti-fogging compounds are used or specified by the manufacturer they shall not have an adverse effect on the health of the wearer, or on the protective garment.

#### 5.5.2 Distortion of vision

During the practical performance test (6.2), the test subject shall be asked to read a sign with four letters 100 mm high and 20 mm high, selected at random, at a distance of 6 m.

#### 5.5.3 Field of vision

During the practical performance test (6.2), the field of vision shall be satisfactory.

#### 5.5.4 Mechanical strength

The visor shall not be visibly damaged in such a way as to be likely to affect the performance of the complete device, when tested in accordance with 6.7.

## 5.6 Full facemask

Only facemasks complying with class 2 or 3 of EN 136:1998 shall be used.

If the suit incorporates a full face mask bonded or fixed in such a way that the connection is integral to the suit the system of joining must not interfere with the face to mask seal or any other function of the facemask, when tested in accordance with 6.2.

If the facemask is attached to the suit in a non-permanent manner the sealing mechanism shall be tested in accordance with EN 463. There shall be no penetration of the facemask to suit join according to the following criteria: join penetration has occurred when the total stain area on the undergarment is greater than three times the calibrated stain area. Three samples of facemask to suit joins shall be tested after conditioning to 5.2.

## 5.7 Pass-thru for use with self-contained breathing apparatus

If fitted, the pass-thru shall satisfy the requirements of 5.7.1, 5.7.2 and 5.7.3

### 5.7.1 Strength of pass-thru

The pass-thru and connections to the suit and body shall be tested in accordance with 6.1 and 6.2.

The complete device and its assembly to the suit and body shall withstand a steady force of 1 000 N when tested in accordance with 7.10 of EN 270:1994.

### 5.7.2 Performance of pass-thru

The unit complete with connections shall deliver a minimum 300 l/min at 550 kPa (5,5 bar).

### 5.7.3 Resistance to kinking

If a flexible air supply hose is fitted externally the hose shall maintain a near circular shape when extended from a loop and shall not decrease airflow by more than 10 % when tested in accordance with 6.11.1 of EN 270:1994.

## 5.8 Air supply system

If a mobile high pressure air supply is to be used it shall comply with 6.10 of EN 270:1994. If a stationary high pressure air supply is to be used it shall comply with the performance criteria specified by the manufacturer of the chemical protective suit. The air delivered by the air supply system shall conform with EN 12021.

### 5.8.1 Couplings

The equipment shall be constructed so that any twisting of the hoses and tubes does not affect the fit or performance of the equipment, or cause the hoses or tubes to be disconnected. The design of the coupling shall be such as to prevent unintentional interruption of the air supply. At least one swivelling coupling shall be fitted to the compressed air supply tube adjacent to the wearer.

Where a hand operated connection is fitted to the outlet of the compressed air tube it shall incorporate a self-sealing coupling to seal the air supply. Test in accordance with 6.1 and 6.2.

### 5.8.2 Connections

Components of the apparatus shall be readily separated for cleaning, examining and testing. All demountable connections shall be readily connected and secured, where possible by hand. Any means of sealing used shall be retained in position when the joints and couplings are disconnected during normal maintenance. Test in accordance with 6.1 and 6.2.