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EUROPEAN STANDARD

EN 465

NORME EUROPÉENNE

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Descriptors: Personal protective equipment, protective clothing, dungarees, drip proof protection, chemical compounds, liquids, leaktightness, specifications, mechanical strength, marking instructions

English version

Protective clothing - Protection against liquid chemicals - Performance requirements for chemical protective clothing with spray-tight connections between different parts of the clothing (Type 4 Equipment)

Vêtements de protection - Protection contre les produits chimiques liquides - Exigences de performance des vêtements de protection chimique avec liaisons étanches aux brouillards entre les différentes parties du vêtement (Équipement de type 4)

Schutzkleidung - Schutz gegen flüssige Chemikalien - Leistungsanforderungen an Chemikalienschutzkleidung mit spray dichten Verbindungen zwischen den verschiedenen Teilen der Kleidung (Ausrüstung Typ 4)

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by the 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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by September 1995, and conflicting national standards shall be withdrawn at the latest by September 1995.

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For the specified "Martindale Abrasion Test" in accordance with EN 530, required in "4.4 Abrasion resistance" the method and the pressure between the test piece holder and top plate are needed.

Method 2 with a downward pressure of 9 kPa shall be chosen in the opinion of CEN/TC 162/WG 3.

1 Scope

This standard specifies the minimum requirements for spray-tight chemical protective clothing with spray-tight connections between different parts of the clothing, and to gloves and boots to protect the wearer against liquid chemicals.

It specifies the performance requirements both for the materials of construction of the protective clothing and for the garment as a whole. The performance requirements of the garment as a whole including component parts, such as gloves, etc., that are integral to the garment are given in clauses 5 and 6.

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.

EN 146:1991	Respiratory protective devices - Powered particle filtering devices incorporating helmets or hoods - Requirements, testing, marking
EN 340	Protective clothing - General requirements
EN 369	Protective clothing - Protection 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 468	Protective clothing - Protection against liquid chemicals - Test method: Determination of resistance to penetration by spray (spray test)
EN 530	Abrasion resistance of protective clothing material - Test method
prEN 863	Protective clothing - Mechanical properties - Test method: Puncture resistance
ISO 2411:1991	Fabrics coated with rubber or plastics - Determination of coating adhesion
ISO 4674:1977	Fabrics coated with rubber or plastics - Determination of tear resistance
ISO 5082:1982	Textiles - Woven fabrics - Determination of breaking strength - Grab Method
ISO 5978	Fabrics coated with rubber or plastics - Determination of blocking resistance
ISO 7854:1984	Rubber or plastics coated fabrics - Determination of resistance to damage by flexing (dynamic method)
BS 871:1981	Specification for abrasive papers and cloths

3 Definitions

For the purposes of this standard the following definitions apply:

- 3.1 assemblage:** A permanent joining obtained, e.g. by sewing, welding, vulcanizing, gluing.
- 3.2 coating adhesion strength:** The force necessary to effect a separation of the coating from its substrate under defined conditions.
- 3.3 garment:** An individual component (of protective clothing), the wearing of which affords protection to the body against contact with chemicals.
- 3.4 join:** The connection or joining, which is not permanent, between two different pieces of clothing.
- 3.5 spray-tight:** Resistant to penetration by liquids in the form of a spray.
- 3.6 penetration:** The process by which a chemical flows through holes or essential openings in the material. The holes may be the result of mechanical damage.
- 3.7 permeation:** The process by which a chemical moves through a protective clothing material on a molecular level.

Permeation involves:

- a) sorption of the molecules of the chemical into the contacted (outside) surface of a material;
- b) diffusion of the sorbed molecules in the material, and
- c) desorption of the molecules from the opposite (inner) surface of the material.

- 3.8 chemical protective clothing:** The combined assembly of those garments, the wearing of which is intended to afford protection to the skin against exposure to or contact with chemicals.
- 3.9 chemical protective clothing material:** Any material or combination of materials used in an item of protective clothing for the purpose of isolating parts of the body from direct contact with a chemical.
- 3.10 chemical protective suit:** Suit protecting against chemicals which can be injurious to health. A suit may have various types of additional protection such as hood/helmet, boots and gloves.
- 3.11 connection:** An assemblage or join.

4 Materials of Construction

4.1 General

Chemical protective suits with spray tight connections shall fulfil all the test requirements given in 4.4 to 4.10, when tested in accordance with the test method specified.

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

NOTE: 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.

4.2 Pre-conditioning

Before testing the samples shall undergo 5 cycles of cleaning according to the manufacturer's instructions.

4.3 Conditioning

All samples shall be conditioned by storage at $(20 \pm 2)^\circ\text{C}$ and $(65 \pm 5)\%$ r.h. for at least 24 h. Start each of the following tests within 5 min of removing the sample from the conditioning atmosphere.

4.4 Abrasion resistance

When tested in accordance with EN 530 (Martindale Abrasion Test) using 00 abrasive paper (according to British Standard BS 871:1981) the chemical protective clothing material shall be classified according to the levels of performance given in table 1.

Table 1: Classification of abrasion resistance

Class	Number of Cycles
6	> 2 000
5	> 1 500
4	> 1 000
3	> 500
2	> 100
1	> 10

4.5 Stability to Heat (Resistance to Blocking)

When tested in accordance with ISO 5978, the chemical protective clothing material shall be classified according to the levels of performance given in table 2.

Table 2 : Classification of stability to heat

Class	Level of performance
2	No blocking
1	Slight blocking

4.6 Flex Cracking Resistance

When tested in accordance with method B of ISO 7854 until damage is apparent, the chemical protective clothing material shall be classified according to the levels of performance given in table 3

Table 3 : Classification of flex cracking resistance

Class	Number of cycles
5	> 300 000
4	> 250 000
3	> 150 000
2	> 50 000
1	> 25 000

NOTE: Methods A and D of ISO 7854 may also be suitable for testing chemical protective clothing materials but no supporting data has been available for correlation with Method B of ISO 7854.

4.7 Puncture Resistance

When tested in accordance with prEN 863 the chemical protective clothing material shall be classified according to the levels of performance given in table 4.

Table 4: Classification of puncture resistance

Class	Puncture resistance
5	> 150
4	> 100
3	> 50
2	> 10
1	> 5

4.8 Tear Resistance

When tested in accordance with A1 of ISO 4674 the chemical protective clothing material shall be classified according to the levels of performance given in table 5, for test samples cut at 90° to each other:

Table 5: Classification of tear resistance

Class	Tear resistance N
5	> 150
4	> 80
3	> 40
2	> 20
1	> 10

4.9 Coating adhesion strength

When tested in accordance with ISO 2411 the chemical protective clothing material shall be classified according to the levels of performance given in table 6

Table 6: Classification of coating adhesion strength

Class	Adhesion strength N/m
5	> 1 250
4	> 750
3	> 500
2	> 250
1	> 50

Chemical protective clothing material which is not coated shall not be tested in accordance with this clause and the test report shall be marked NOT APPLICABLE against coating adhesion strength.

4.10 Resistance to permeation by liquids

When tested in accordance with EN 369 or EN 374-3, the material of construction of the chemical protective clothing shall be classified according to the levels of performance given in table 7 for each chemical tested, and the results shall be reported in the manufacturer's instructions (see item e) of clause 8).

Table 7: Classification of permeation resistance

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Class	Breakthrough time min
6	> 480
5	> 240
4	> 120
3	> 60
2	> 30
1	> 10

NOTE: Chemical protective clothing material may be susceptible to attack by chemicals over a period (or repeated periods) of exposure, leading to degradation and eventual failure of the protective layer e.g. by brittle cracking. No suitable test method has been found to test resistance to chemical degradation, but one is being sought.

5 Seams and Assemblages

NOTE: 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 and assemblages attaching these accessories are included within the scope of this standard.