
**Varovalna obleka za zaščito pred tekočimi kemikalijami – Preskusna metoda:
Ugotavljanje odpornosti materialov proti penetraciji z razprševanjem (Spray Test)**

Protective clothing - Protection against liquid chemicals - Test method: Determination of resistance to penetration by spray (Spray Test)

Schutzkleidung - Schutz gegen flüssige Chemikalien - Prüfverfahren: Bestimmung der Beständigkeit gegen das Durchdringen von Spray (Spray-Test)

Vêtements de protection - Protection contre les produits chimiques liquides - Méthode d'essai: Détermination de la résistance à la pénétration par un brouillard (essai au brouillard)

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Ta slovenski standard je istoveten z: EN 468:1994

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13.340.10 Varovalna obleka Protective clothing

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EUROPEAN STANDARD

EN 468

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Descriptors: Personal protective equipment, protective clothing, dungarees, protection, chemical compounds, liquids, permeability, artificial fog tests

English version

**Protective clothing for use against liquid chemicals
- Test method: Determination of resistance to
penetration by spray (Spray Test)**

Vêtements de protection contre les produits chimiques liquides - Méthode d'essai: Détermination de la résistance à la pénétration par un brouillard (essai au brouillard)

Schutzkleidung zur Anwendung gegen flüssige Chemikalien - Prüfverfahren: Bestimmung der Beständigkeit gegen das Durchdringen von Spray (Spray-Test)

This European Standard was approved by CEN on 1994-06-20. 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 Central Secretariat or to any CEN member.

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CEN

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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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 December 1994, and conflicting national standards shall be withdrawn at the latest by December 1994.

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

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1 Scope

This European Standard specifies a method for determining the resistance of chemical protective clothing to penetration by sprays of liquid chemicals.

This European Standard is applicable to clothing which may comprise one or more items and which is intended to be worn when there is risk of exposure to slight splashes of a liquid chemical or to spray particles that coalesce and run off the surface of the garment.

This European Standard is applicable to clothing which is intended to be resistant to penetration under conditions which require total body surface cover, but do not demand the wearing of gas-tight clothing.

This European Standard is not applicable to the permeation of liquid chemicals through the materials from which the clothing is made.

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 340	Protective clothing - General requirements
EN 149:1991	Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking

3 Definitions

For the purposes of this standard the following definitions apply:

3.1 Garment: An individual component (of chemical protective clothing), the wearing of which provides protection against contact with chemicals to the part of the body that it covers.

3.2 Penetration: The process by which chemical flows through holes or essential openings in the material. The holes may be the result of mechanical damage.

3.3 Chemical protective clothing: The combined assembly of garments worn to provide protection against exposure to or contact with chemical (see prEN 463).

3.4 Chemical protective suit: Clothing worn to protect against chemicals that covers the whole, or greater part of the body. A chemical protective suit may comprise of garments combined together to provide protection to the body. A suit may also have various types of additional protection such as hood or helmet, boots and gloves joined with it.

3.5 Calibrated stain: A fluorescent or visible stain, with a defined minimum area, generated by dropping a specified quantity of test liquid onto an absorbent coverall. The calibrated stain is used to measure liquid penetration during spray and jet testing of chemical protective clothing.

4 Principle

An aqueous spray, containing a fluorescent or visible dye tracer, is directed under controlled conditions at the chemical protective clothing worn by a human test subject. Inspection of the inside surface of the clothing and the outside surface of absorbent clothing worn underneath allows any points of inward leakage to be identified.

NOTE: As this test requires the use of water containing a dye or tracer care may be necessary to avoid contamination of the surface water drainage system.

5 Liquid for application in the form of a spray

Unless specified in the performance specification the following standard test liquid shall be used:

Prepare the test liquid by dissolving a wetting agent and water soluble fluorescent or visible dye in water at ambient temperature to form a solution with the following characteristics:

The surface tension shall be $(30 \times 10^{-3} \pm 5 \times 10^{-3})$ N/m.

NOTE: Any method may be used to determine the surface tension of the test liquid provided it can measure to the tolerance given above, e. g. a Wright surface tension and interfacial tension torsion balance using a standard 12 mm diameter platinum ring would be acceptable.

6 Apparatus and test subject

6.1 Absorbent coverall, comprising a one piece garment (with hood) of water absorbent fabric (thickness less than 5 mm) which shall produce a calibrated stain in accordance with 6.2.

6.2 Stain detection, a droplet (0,1 ml) of the test liquid placed on the outside surface of the absorbent clothing worn underneath shall be clearly visible and shall give a stain diameter of > 2 cm. Where necessary, for certain dyes ultraviolet lighting shall be used.

This spot shall be clearly identified and shall be used to judge Pass/Fail Criteria.

6.3 Turn-table, which is waterproof and rotates at $(1 \pm 0,1)$ min⁻¹, and is capable of supporting a human figure.

6.4 Graduated containers (for liquid).

6.5 Hydraulic pump, of the self-priming, recirculating type, complete with pressure gauge, variable output control filter and hoses.

6.6 Stop watch

6.7 Spray boom, as shown in figure 1, height at least 2,35 m, vertically mounted, fitted with four nozzle attachments 45 cm apart.

6.8 Hydraulic nozzles, of the hollow cone type, with spray angle nozzles 75°, and each nozzle supplying liquid at a rate of 1,14 l/min at 3 bar (300 kPa) pressure.

6.9 Target frame, Four lengths of metal tubing or rod of external diameter (1,29 ± 0,02) cm and length approximately 200 cm (see figures 2 and 3).

6.10 Four graduated beakers or cylinders of diameter approximately 4 cm and height approximately 10 cm (see figure 3). Each container shall be fitted with a cover or lid with a 2 cm diameter circular hole through which the target frame tubes/cylinders can be placed.

6.11 A human test subject of a size ± 10% of the upper width limit of the suit to be tested and ± 5% of the upper height limit of the suit to be tested.

7 Preparation of samples for the spray test

The test subject shall be fitted with the correct size of absorbent coverall of the type described in 6.1, and shall be limited to wearing one layer of undergarments underneath the absorbent coverall. The human test subject shall then be dressed in the correct size of test garment, as described in clause 6 prEN 340, in accordance with the manufacturers instructions.

The test subject shall also be fitted with the following accessories:

- a) gloves resistant to penetration by the test liquid; the sleeves over the cuffs of the test garment shall be fitted over the outside of the gloves;
- b) boots resistant to penetration by the test liquid; the trousers of the test garment shall be fitted over the outside of the boots;
- c) full face visor or face screen, complete with browguard, to cover the eyes and the face; the depth of the visor shall be 18 cm and its width 32 cm;
- d) filtering facepiece respirator (grade FFP3 to EN 149) worn under face screen to prevent inhalation of the test liquid.

NOTE: Any gaps in the final assembly around the head, face and neck through which the spray may pass, which may be attributable to a lack of complete cover provided by items that are not part of the test chemical protective clothing, should be sealed to prevent liquid entering which could run down inside the garment and disguise penetration of the spray through other areas.

8 Preparation of the spray application systems

8.1 Output from nozzles

Start the flow of test liquid to the spray nozzles and regulate the pressure at the pump to achieve a flowrate of (1,14 ± 0,1) l/min from each hollow cone nozzle.

¹⁾ Information on sources of supply of suitable hydraulic nozzles can be obtained by the secretariat of CEN TC 162, DIN-Deutsches Institut für Normung e.V., Burggrafenstr.6, 10787 Berlin.

8.2 Alignment of spray nozzles

The spray emission from the nozzles shall be directed towards the geometric centre of the turntable at a distance of approximately 1,5 m (see figure 2). Check the correct alignment and distance with an artificial target for collection of the spray. The target shall be constructed from four metal rods or tubes (see 6.9) spaced 35 cm apart and parallel to each other (see figure 2). Place the rods equidistant from the geometric centre of the turn-table (see figure 2) with the lower ends resting in the beakers of cylinders (see 6.10). Cover the beakers with plastic lids which have a central hole of diameter 2 cm, through which the rod is passed and maintained in position without touching the side of the hole. The height of each rod exposed above the lid shall be (190 ± 1) cm (see figure 3).

With the equipment set up correctly, the output of spray within the specified limit and the turn-table in operation, release the spray for 3 min and measure the volume of liquid collected in each beaker or cylinder. Wipe the exposed surface of each rod with a weighed piece of absorbent material and weigh again to establish the residual volume of spray on each rod. Add this volume to that in the beaker to calculate the total volume collected by a rod.

The alignment and distance from the nozzle to the target is acceptable for the test when the total volume collected by the frame averages $(12,5 \pm 1,5)$ ml per rod per minute (i.e. (150 ± 18) ml of spray is collected by the four rods in 3 min).

NOTE: Alternative methods may be used to check the alignment and delivery rate of the spray nozzles, providing they are calibrated against the method given in 8.2

9 Procedure

Position the test subject wearing the chemical protective clothing on the geometric centre of the turn-table and mark the position of the feet. Apply the spray for 1 min to the test subject, whilst the turn-table is rotated through 360° . During the spray period the human test subject shall alternately raise each foot approximately 20 cm from the turn-table (30 ± 5) times with the arms straight but swinging backwards and forwards in unison with the leg movements. The feet shall be replaced on the original mark.

Allow the clothing to drain for 2 min.

Remove the clothing and examine the internal surface for any signs of penetration. Similarly, examine the external surface of the absorbent coverall.

Either mark the location and extent of any sign of penetration of the test chemical on the protective clothing and the coverall or photograph the absorbent coverall.

10 Test report

The test report shall include the following information:

- a) the establishment of the test in accordance with this standard;
- b) the manufacturer/supplier and any identification mark;
- c) the composition and surface tension of the liquid used in the tests;

- d) for each spray test, the location and approximate areas of contamination of the internal surfaces of the test clothing and the external surface of the absorbant coverall. Contaminated areas should preferably be indicated by shading on diagrams of a human figure (front and back separately) or by reference to photographs. Penetration of isolated spots of liquid (stain diameters < 2 cm) should be marked by a single cross;
- e) report the total number of penetration spots;
- f) the size range of the garment tested as defined in EN 340;
- g) the type of spray nozzle and the test liquid supply pressure;
- h) any further qualifying remarks and observations.

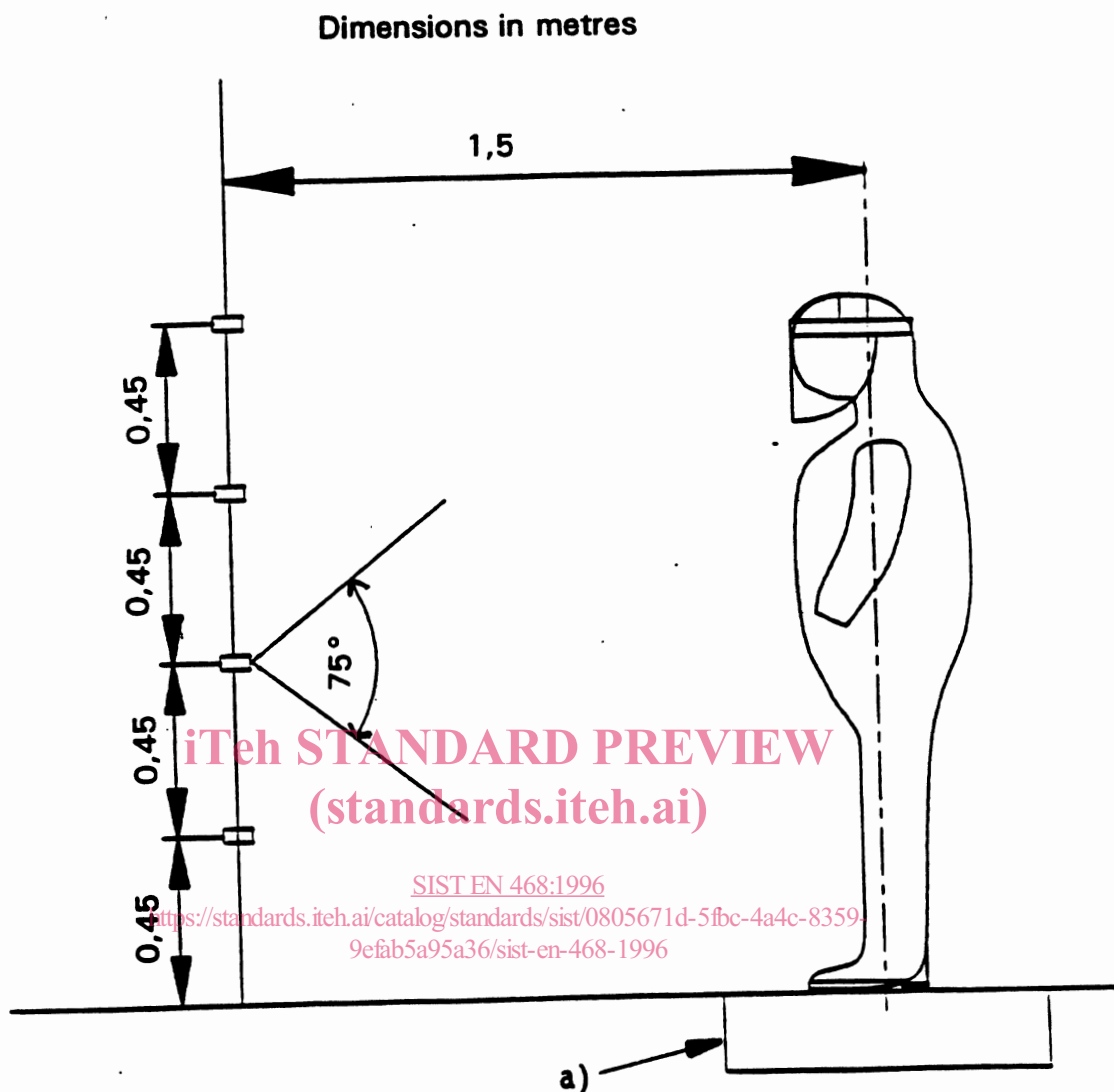


Figure 1: Apparatus for determining the resistance to spray