

# SVENSK STANDARD

## SS-EN ISO 17491-4:2008

Fastställt/Approved: 2008-08-25

Publicerad/Published: 2008-09-18

Utgåva/Edition: 1

Språk/Language: engelska/English

ICS: 13.340.10

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**Skyddskläder – Skydd mot kemikalier i vätskeform –  
Provningmetod: Bestämning av motstånd mot penetration av  
stänk (stänkprovning) (ISO 17491-4:2008)**

**Protective clothing – Test methods for clothing providing  
protection against chemicals –  
Part 4: Determination of resistance to penetration by a spray of  
liquid (spray test) (ISO 17491-4:2008)**

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Denna standard ersätter SS-EN 468, utgåva 1.

The European Standard EN ISO 17491-4:2008 has the status of a Swedish Standard. This document contains the official English version of EN ISO 17491-4:2008.

This standard supersedes the Swedish Standard SS-EN 468, edition 1.

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN ISO 17491-4**

August 2008

ICS 13.340.10

Supersedes EN 468:1994

English Version

**Protective clothing - Test methods for clothing providing protection against chemicals - Part 4: Determination of resistance to penetration by a spray of liquid (spray test) (ISO 17491-4:2008)**

Vêtements de protection - Méthodes d'essai pour les vêtements fournissant une protection contre les produits chimiques - Partie 4: Détermination de la résistance à la pénétration par vaporisation de liquide (essai au brouillard) (ISO 17491-4:2008)

Schutzkleidung - Prüfverfahren für Chemikalienschutzkleidung - Teil 4: Bestimmung der Beständigkeit gegen das Durchdringen von Flüssigkeitsspray (Spray-Test) (ISO 17491-4:2008)

This European Standard was approved by CEN on 14 August 2008.

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## SS-EN ISO 17491-4:2008 (E)

### Foreword

This document (EN ISO 17491-4:2008) 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, in collaboration with Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment".

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of an identical text or by endorsement, at the latest by February 2009, and conflicting national standards shall be withdrawn at the latest by February 2009.

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

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## **Introduction**

This part of ISO 17491 describes a test method for determining the spray penetration resistance of chemical protective clothing Type 4 (with spray-tight connections between different parts of the clothing and, if applicable, between the clothing and other items of personal protective equipment) and Type 6 (limited performance protective clothing).

Such clothing comprises one or more items covering the full surface of the body and is intended to be worn under conditions where there is a risk of exposure to a spray of a liquid chemical. Other requirements with regard to this type of clothing and its constituent materials can be found in the respective product standards (see Bibliography [4]).

Interlaboratory testing has shown that this test method is a repeatable pass/fail method.

A document on the selection, use and maintenance of chemical protective clothing is available (see Bibliography [5]).

**CAUTION — Some of the procedures specified in this part of ISO 17491 involve the use of processes which could lead to hazardous situations and hence appropriate precautions should be taken.**





# Protective clothing — Test methods for clothing providing protection against chemicals —

## Part 4:

# Determination of resistance to penetration by a spray of liquid (spray test)

## 1 Scope

This part of ISO 17491 specifies methods for determining the resistance of chemical protective clothing to penetration by sprays of liquid chemicals at two different levels of intensity:

- a) Method A: low-level spray test. This is applicable to clothing that covers the full body surface and is intended to be worn when there is a potential risk of exposure to small quantities of spray or accidental low-volume splashes of a liquid chemical.
- b) Method B: high-level spray test. This is applicable to clothing with spray-tight connections between different parts of the clothing and, if applicable, between the clothing and other items of personal protective equipment, which covers the full body surface and which is intended to be worn when there is a risk of exposure to sprayed particles of liquid.

This part of ISO 17491 does not address chemical permeation resistance of the materials from which the chemical protective clothing is made.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TR 11610, *Protective clothing — Vocabulary*

## 3 Terms and definitions

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

### 3.1

#### **connection**

assemblage or join

### 3.2

#### **calibrated stain**

fluorescent or visible stain, with a defined minimum area, generated by dropping a specified quantity of test liquid on to an absorbent overall

**NOTE** The calibrated stain is used to measure liquid penetration during spray and jet testing of chemical protective clothing.

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**3.3 absorbent overall**  
overall made from an absorbent material, worn under the test suit and intended for collecting liquid penetration during spray and jet testing of chemical protective clothing

### 4 Principle of test method

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 the absorbent overall worn under the test garment allows any points of inward leakage to be identified.

### 5 Liquid for application in the form of a spray

A test liquid containing the following substances shall be used:

- water at  $(20 \pm 2)$  °C;
- a water-soluble fluorescent or visible dye, e.g. methyl blue (CAS number [28983-56-4]);
- a surfactant, e.g. Genapol LRO liquid (sodium lauryl ether sulphate, CAS number [009004-82-4]);
- a stabilizer for the dye (if needed), e.g. citric acid (CAS number [77-92-9], analytical grade).

Prepare the test liquid by dissolving the dye in water. Add the surfactant and the dye stabilizer (if needed) in the appropriate proportions to obtain a solution with following characteristics:

- a) for method A: a surface tension of  $(52 \pm 7,5) \times 10^{-3}$  N/m;
- b) for method B: a surface tension of  $(30 \pm 5) \times 10^{-3}$  N/m.

**NOTE** A typical concentrated solution for a high-level spray test can be made by dissolving 4 g methyl blue, 25 ml Genapol LRO liquid and 125 g citric acid in 1 l of tap water. The mixture is stirred for 15 min to 20 min with a magnetic stirrer and eventually 200 ml of the mixture is diluted in 10 l of water.

To measure the surface tension within the stated tolerance, any suitable method may be used, e.g. a Wright torsion balance using a standard 12 mm diameter platinum ring. Agents other than surfactants may be mixed with water if the same surface tension can be obtained.

It shall be ensured that the surface tension is stable throughout the test, i.e. the surface tension of the liquid leaving the nozzle as well as the tension of the liquid in the tank shall meet the requirements. This shall be verified before and after each test.

Avoid dyes that adhere too strongly to the fibres of the absorbent material resulting in a wet spot larger than the coloured spot.

The necessary measures shall be taken to protect the test subject and to avoid contamination of the surface water drainage system.

## 6 Apparatus and test subjects

### 6.1 Absorbent overall

The absorbent overall shall be a one-piece garment with a hood. It shall be made from a water-absorbent material, that is sufficiently homogeneous to produce absorption spots which vary less than 10 % in surface from the mean value for a given volume of liquid, when sampled at any place on the garment.<sup>1)</sup>

NOTE In order to protect the test subject from the test liquid, water-repellent undergarments should be worn under the absorbent overall.

### 6.2 Calibrated stain

Calibrated stains shall be used as a reference for the pass/fail evaluation of the tested suit. Pass/fail criteria shall be defined in the relevant product standard (see Bibliography [4]).

A calibration stain shall be produced before starting a series of tests and immediately after a test where a leakage has been detected.

Select an area of the absorbent overall that is not likely to be contaminated. Put under it a piece of undergarment and ensure that both layers are in contact. Put the assembly under a dispenser, with the lower tip of the dispenser at a vertical distance of  $(5 \pm 0,5)$  cm above the assembly. Dispense a volume of  $(25 \pm 5)$   $\mu$ l of the test liquid to produce a clearly visible stain on the surface of the overall. Define the outline of the stain before it is measured. Several methods can be used to measure the calibration stain, such as a planimeter. The minimum area of the stain shall be 1 cm<sup>2</sup>.

### 6.3 Turntable

A waterproof platform capable of supporting a test subject and rotating at  $(1 \pm 0,1)$  full circle per minute.

### 6.4 Test liquid container

The test liquid shall be prepared and stored in a container.

### 6.5 Hydraulic pump

A self-priming, recirculating-type pump shall be used. The pump shall be equipped with a pressure gauge and adjustment, a variable output control filter and hoses to convey the test liquid from the test liquid container to the spray boom. A four-way distribution tube shall be connected to the pump outlet, with each of the four outlets connected directly to a nozzle.

The pump shall be capable of supplying a minimum pressure of 400 kPa. Provisions shall be taken to avoid the test starting before the pressure is completely built up.

### 6.6 Stopwatch

A stopwatch accurate to 1 s shall be used.

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1) Sontara PES/Woodpulp 45/55 and Poligard Adsorbant garments are suitable for this purpose. This information is given for the convenience of users of this part of ISO 17491 and does not constitute an endorsement by ISO of the products named. Equivalent products may be used if they can be shown to lead to the same results.