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Foreword

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ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 13, *Protective clothing*, in collaboration with the European Committee for Standardization, (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 17491-4:2008), which has been technically revised. It also incorporates the Amendment ISO 17491-4:2008/Amd.1:2016.

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The main changes are as follows:

- specifications for test liquid have been revised/added;
- ~~Clause 6~~ Clause 6 has been revised to provide more specificity. Specification have been changed and/or revised for absorbent overall, calibrated stain, turntable, spray booth, spray boom, hydraulic nozzles in ~~Clause 6~~ Clause 6 and other applicable clauses;
- details for the selection of the right overall size have been added in ~~6.106.10~~ 6.106.10 as well as in ~~Annex B~~ Annex B;
- ~~9.38.3~~ 9.38.3 has been revised and heading changed to "Distribution of the spray liquid and alignment of spray nozzles.";
- figure and additional information have been added in ~~9.19.1~~ 9.19.1 to provide more specificity;

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- inclusion of **Annex A** on absorbent fabric for the detector suit and non-absorbent fabric for the calibration pattern;
- inclusion of **Annex B** on test subject size measurement and right overall size fitting;
- inclusion of **Annex C** on right donning and doffing, as well as stain area measurement;
- inclusion of **Annex D** with the ILT results.

A list of all parts in the ISO 17491 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document 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^[1].

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^[2].

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Protective clothing — Test methods for clothing providing protection against chemicals

Part 4 Determination of resistance to penetration by a spray of liquid (Sprayspray test)

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

1 Scope

This document specifies the test method for determining the resistance of chemical protective clothing to penetration by sprays of liquid chemicals at two different levels of intensity:

- a) ~~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) ~~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 liquid chemical.

This document does not apply to chemical permeation resistance of the materials from which the chemical protective clothing is made.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

~~<std>ISO 11610, Protective clothing — Vocabulary</std>~~

ISO 11610, Protective clothing — Vocabulary

3 Terms and definitions

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

ISO and IEC maintain ~~terminological~~terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp
- IEC Electropedia: available at ~~https://www.electropedia.org~~https://www.electropedia.org/

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3.1 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

3.2 calibrated stain

visible stain, with a defined minimum area, generated by dropping a specified quantity of test liquid on to an absorbent overall (3.1)(3.1)

Note 1 to entry: The calibrated stain is used to measure liquid penetration during spray and jet testing of chemical protective clothing.

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4 Principle of test method

An aqueous spray, containing a 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.

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An interlab was performed and the results and conclusion can be found in Annex D-Annex D.

5 Test liquid

To prepare the test chemical add methyl blue dye and dye stabilizer prior to adding the surfactant to water. The temperature of the test liquid shall be between 20 °C and 30 °C.

For methods A and B, the concentration of the methyl blue dye (CAS number 28983-56-4) shall be (0,2 ± 0,02) g/l. The dye stabilizer shall be analytical grade citric acid (CAS number 77-92-9) with a concentration of (2,45 ± 0,05) g/l.

The surfactant is then added to achieve the required surface tension. Mixtures such as dish washing detergent that include other ingredients are not considered surfactants and shall not be used.

a) a) For method A: a surface tension of (52,0 ± 7,5) × 10⁻³ N/m;

b) b) For method B: a surface tension of (30,0 ± 5,0) × 10⁻³ N/m.

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NOTE 1 Surfactants: Genapol LRO liquid (sodium lauryl ether sulfate (CAS number [009004-82-4])) that can be used to achieve the required surface tension at the concentration of 0,03 ml/l for method A and 0,5 ml/l for method B. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the products named. Equivalent products can be used if they can be shown to lead to the same results.

NOTE 2 To measure the surface tension within the stated tolerance, any suitable method can be used, e.g., a wright torsion balance using a standard 12 mm diameter platinum ring.

It shall be ensured that the surface tension and temperature of the test liquid are 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 day of test and shall meet all the above requirement in this clause according to either Method A or Method B.

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1 Genapol LRO liquid is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

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