
**Protective clothing - Test methods
for clothing providing protection
against chemicals —**

**Part 5:
Determination of resistance to
penetration by a spray of liquid
(manikin spray test)**

*Vêtements de protection - Méthodes d'essai pour les vêtements
fournissant une protection contre les produits chimiques —*

*Partie 5: Détermination de la résistance à la pénétration par
vaporisation de liquide (essai au brouillard à l'aide d'un mannequin)*



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Published in Switzerland

Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Principle.....	1
5 Test agent and test subject.....	2
6 Apparatus.....	2
7 Specimen preparation.....	4
8 Procedure.....	5
9 Test report.....	6
Bibliography.....	7

Foreword

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

ISO 17491 (all parts) cancels and replaces ISO 17491:2002, which has been technically revised.

ISO 17491 consists of the following parts, under the general title *Protective clothing — Test methods for clothing providing protection against chemicals*:

- *Part 1: Determination of resistance to outward leakage of gases (internal pressure test)*
- *Part 2: Determination of resistance to inward leakage of aerosols and gases (inward leakage test)*
- *Part 3: Determination of resistance to penetration by a jet of liquid (jet test)*
- *Part 4: Determination of resistance to penetration by a spray of liquid (spray test)*
- *Part 5: Determination of resistance to penetration by a spray of liquid (manikin spray test)*

Introduction

Chemical protective clothing is worn in conjunction with appropriate respiratory protective devices when required in order to isolate the body of the wearer from the environment. Several tests exist for determining the resistance of chemical protective clothing materials to either the permeation or penetration of gaseous or liquid chemicals.

However, the effectiveness of the overall protective clothing item in preventing exposure from chemical hazards depends on the integrity of the clothing item's design in eliminating or reducing inward leakage of chemicals.

The selection of the appropriate integrity test method will depend on the application of the chemical protective clothing and the exposure hazards present. Usually, the integrity test method will be specified in the overall chemical protective clothing specification.

Evaluations of protective clothing material chemical resistance are carried out by the appropriate test.

ISO 6529 specifies methods for measuring the resistance of the protective clothing materials, seams, and assemblages to permeation by either liquids or gases. ISO 13994 specifies a method for determining the penetration resistance of protective clothing materials under conditions of continuous liquid contact and pressure, and can be applied to microporous materials, seams, and assemblages. ISO 6530 specifies a procedure for measuring the penetration resistance of protective clothing materials from the impact and runoff of liquids. General protective clothing requirements are specified in ISO 13688.

This International Standard specifies different test methods for determining the resistance of complete protective clothing to inward leakage of either gaseous or liquid chemicals (protective clothing integrity). These test methods apply to either liquid or gaseous chemicals, or aerosols, and range in the level of severity.

The integrity test methods specified by this International Standard are as follows:

- Part 1 specifies a method to be performed either at minimum test settings (method 1) or at more rigorous test settings (method 2), for assessing the resistance of a gas-tight suit to outward leakage of air through, for example, essential openings, fastenings, seams, interface areas between items, pores, and any imperfections in the materials of construction.
- Part 2 specifies two different methods for determining the inward leakage of chemical protective clothing in an aerosol environment (method 1) or gaseous environment (method 2). The procedure is applicable to gas-tight suits and non-gas-tight suits according to ISO 16602 and provides an evaluation of chemical protective suit integrity, particularly leakage in the breathing zone, under dynamic conditions through the use of human subjects.
- Part 3 specifies a method for determining the resistance of chemical protective clothing to penetration by jets of liquid chemicals. This procedure is applicable to clothing worn where there is a risk of exposure to a forceful projection of a liquid chemical and intended to be resistant to penetration under conditions which require total body surface cover but not gas-tight clothing.
- Part 4 specifies a method to be performed either at minimum test settings (method A, low-level spray test) or at more rigorous test settings (method B, high-level spray test), for determining the resistance of chemical protective clothing to penetration by sprays of liquid chemicals. This procedure applies to protective clothing intended to be worn when there is a risk of exposure to slight splashes of a liquid chemical or to spray particles that coalesce and run off the surface of the garment and intended to be resistant to penetration under conditions which require total body surface cover but not gas-tight clothing.
- Part 5 specifies an alternative test method for determining the resistance to spray penetration. It uses a static manikin instead of a test subject; it also uses a different spray configuration and duration.

The methods specified in this International Standard are not appropriate for evaluating the permeation or penetration of liquid chemicals through the material from which the clothing is made.

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

Part 5:

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

1 Scope

This part of ISO 17491 specifies an alternative test method to the one described in ISO 17491-4.

The method for determining the resistance to chemical spray penetration differs from the method in ISO 17491-4 in that it uses a static manikin instead of a test subject. It also uses a different spray configuration and duration.

2 Normative references

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

ISO 13688, *Protective clothing — General requirements*

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

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

The chemical protective clothing is placed on a manikin that is already dressed in an absorbent overall covering the portions of the manikin form that are of interest. Water, treated to achieve a surface tension of $(30 \pm 5) \times 10^{-3} \text{ N/m}$, is sprayed at the chemical protective clothing from five nozzles positioned in a specific configuration with respect to the specimen.

The specimen is exposed to the liquid spray for a period of 15 min in each of four specimen orientations; thus 60 min spray in total on one specimen. Liquid penetration resistance is determined by the absence of liquid inside the chemical protective clothing on the inner liquid-absorptive garment. The chemical protective clothing is rated as passing if liquid does not penetrate and as failing if liquid does penetrate.