
**Protective clothing — Protection
against chemicals — Determination
of resistance of protective clothing
materials to permeation by liquids
and gases**

*Vêtements de protection — Protection contre les produits
chimiques — Détermination de la résistance des matériaux utilisés
pour la confection des vêtements de protection à la perméation par
des liquides et des gaz*



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 6529 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

This third edition cancels and replaces the second edition (ISO 6529:2001), which has been technically and editorially revised in order to:

- a) clarify explicitly that the testing of gloves and, when fitted to chemical protective clothing, boots, is included;
- b) include a normative annex defining specific default procedures for testing, calculating and reporting permeation resistance;
- c) permit the testing of fabrics, regardless of whether they are, to some degree, air-permeable or totally air-impermeable;
- d) introduce a pre-test which is used in order to determine the number of replicate tests to be carried out;
- e) include more explanatory notes;
- f) introduce an informative annex giving technical advice on the testing of seams and closures;
- g) include worked examples of the calculation of results;
- h) specify the minimum frequency of sampling the collection medium during a test;
- i) clarify the reporting of sets of replicate results in cases in which the inter-sample variation is large.

Introduction

People involved in the production, use, transportation and emergency response with liquid and gaseous chemicals can be exposed to numerous compounds capable of causing harm upon contact with the human body. The deleterious effects of these chemicals can range from acute trauma such as skin irritation and burn to chronic degenerative disease, such as cancer. Since engineering controls may not eliminate all possible exposures, attention is often placed on reducing the potential for direct skin contact through the use of protective clothing that resists permeation, penetration and degradation.

The test methods described in this International Standard are intended to be used to evaluate the barrier effectiveness of materials used for protective clothing (see Note) against ingress by liquid or gaseous chemicals. Options are provided for conducting this testing under both conditions of continuous or intermittent contact with the chemicals.

These test methods provide options for reporting test results in terms of breakthrough time, permeation rate and cumulative permeation. These parameters are key measures of the effectiveness of a clothing material to act as a barrier to the test chemical. Long breakthrough times, low permeation rates and low cumulative permeation mass are characteristic of high level barrier materials.

Resistance to penetration by liquid chemicals should be determined by using ISO 6530 while resistance to penetration by liquid chemicals under pressure should be determined by using ISO 13994. These International Standards are listed in the Bibliography.

It has been assumed in the drafting of this International Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people with a sound understanding of analytical chemistry. Appropriate precautions should be taken when carrying out this type of testing in order to avoid injury to health and contamination of the environment.

NOTE Finished items of protective clothing include gloves, arm shields, aprons, suits, hoods, boots, etc. The phrase “specimens from finished items” encompasses seamed and other discontinuous regions as well as the usual continuous regions of protective clothing items.

Protective clothing — Protection against chemicals — Determination of resistance of protective clothing materials to permeation by liquids and gases

1 Scope

This International Standard describes laboratory test methods to determine the resistance of materials used in protective clothing, including gloves and including footwear, when the footwear is an integral part of the clothing, to permeation by liquid or gaseous chemicals under the conditions of either continuous or intermittent contact.

Method A is applicable to testing against liquid chemicals, either volatile or soluble in water, expected to be in continuous contact with the protective clothing material.

Method B is applicable to testing against gaseous chemicals expected to be in continuous contact with the protective clothing material.

Method C is applicable to testing against gaseous and liquid chemicals, either volatile or soluble in water, expected to be in intermittent contact with the protective clothing material.

These test methods assess the permeation resistance of the protective clothing material under laboratory conditions in terms of breakthrough time, permeation rate and cumulative permeation. These test methods also enable qualitative observations to be made of the effects of the test chemical on the material under test.

These test methods are only suitable for measuring permeation by liquids and gases. Permeation by solid challenge chemicals is beyond the scope of this International Standard.

NOTE It can be difficult or impossible to normalize the results of permeation tests carried out against solid challenge chemicals. The normalized rate of permeation is dependent on the area of fabric exposed to the challenge chemical. In the case of solids this will, in turn, depend also on factors such as particle size, size distribution, particle shape and packing considerations.

These test methods address only the performance of materials or certain materials' constructions (e.g. seams). These test methods do not address the design, overall construction and components, or interfaces of garments, or interfaces between garments and gloves or garments and footwear, or other factors which may affect the overall chemical protection offered by protective clothing, gloves or footwear or combinations of chemical protective clothing, gloves and footwear.

It is emphasized that these tests do not necessarily simulate conditions to which materials are likely to be exposed in practice. In most cases the conditions of the permeation test will be far more challenging than expected workplace conditions.

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 13994, *Clothing for protection against liquid chemicals — Determination of the resistance of protective clothing materials to penetration by liquids under pressure*