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Protective clothing — Protection against liquid chemicals — Determination of resistance of materials to penetration by liquids

iTeh STANDARD PREVIEW

*Vêtements de protection — Protection contre les produits chimiques
liquides — Détermination de la résistance des matériaux à la pénétration
des liquides*

ISO 6530:1990

<https://standards.itih.ai/catalog/standards/sist/a1746d91-176b-4478-85d4-f5b8c6d3a428/iso-6530-1990>



Reference number
ISO 6530:1990(E)

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.

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.

International Standard ISO 6530 was prepared by Technical Committee ISO/TC 94, *Personal safety – Protective clothing and equipment*.

This second edition cancels and replaces the first edition (ISO 6530:1980), of which it constitutes a minor revision.

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Introduction

This International Standard is concerned with the application of the described method of test in the process of screening materials for the construction of garments intended chiefly to be worn in operations, usually with chemicals of low volatility, diluted in water or other non-hazardous liquid. Such clothing is not for use as the sole means of protection where resistance to permeation by chemicals at the molecular level (see ISO 6529) is essential, and where a complete barrier to liquid (or gaseous chemicals) is required, (e.g. risk of exposure to massive and forceful discharges of concentrated liquid chemicals).

Clothing which has been developed from materials selected by this method of test should only be used, therefore, in well-defined circumstances when an evaluation of the finished item has indicated an acceptable level of performance (e.g. on laboratory and field testing of a garment, consideration of exposure levels to specified chemicals, etc).

Two levels of the potential performance of materials are assessed by the method of test to meet the possible requirements for protection against [ISO 6530:1990](https://standards.iteh.ai/catalog/standards/sist/a1746d91-176b-4478-4ddc-401766c977e8)

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- a) deposition on the surface of a material, at minimal pressure, of spray droplets up to coalescence or occasional small drips;
- b) contamination by a single copious splash or low pressure jet, allowing sufficient time to divest the clothing or take other action as necessary to eliminate any hazard to the wearer from chemicals retained by the protective garment, or, in circumstances where pressure is applied to liquid contaminants on the surface of the clothing material as a result of natural movements of the wearer (flexing of contaminated areas of clothing — arms, knees, shoulders), and contact with contaminated surfaces (e.g. walking through sprayed foliage).

Materials described in a) above would probably meet the performance requirements for the construction of general-purpose clothing mainly for use in laboratories, and in operations where the chemical hazards and operational risks are well-defined and of a low order, through the introduction of specified engineering or other control measures.

Materials described in b) above would probably meet the general performance requirements for the construction of clothing mainly where a high initial standard of resistance to penetration, approaching that of a permeation-resistant material, may be demanded yet where an acceptable compromise may be reached between considerations of safety and comfort.

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Protective clothing — Protection against liquid chemicals — Determination of resistance of materials to penetration by liquids

1 Scope

International Standard ISO 6530 specifies the test method for the measurement of the penetration of a liquid chemical through protective clothing material.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications*.

ISO 3205:1976, *Preferred test temperatures*.

ISO 6529:—¹⁾, *Protective clothing — Protection against liquid chemicals — Determination of resistance of air-impermeable materials to permeation by liquids*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 penetration: The passage of a chemical through pores or apertures in a material and finished items of clothing.

3.2 permeation: A process of molecular diffusion through a solid material (see ISO 6529).

3.3 repellency: The ability of a material to shed liquid that is applied to its surface.

4 Principle

A measured volume of a test liquid is applied firstly, with minimal force, and secondly at higher force if appropriate (e.g. satisfactory initial test result), in the form of a fine stream or jet on to the surface of a clothing material resting in an inclined gutter. Measurement of the respective proportions of the applied liquid which penetrate a test piece and are repelled by its surface indicates the potential of the material for use in the described field of application (see Introduction).

5 Method

5.1 Apparatus

The apparatus, as assembled (see figure 1), shall comprise the following:

1) To be published.

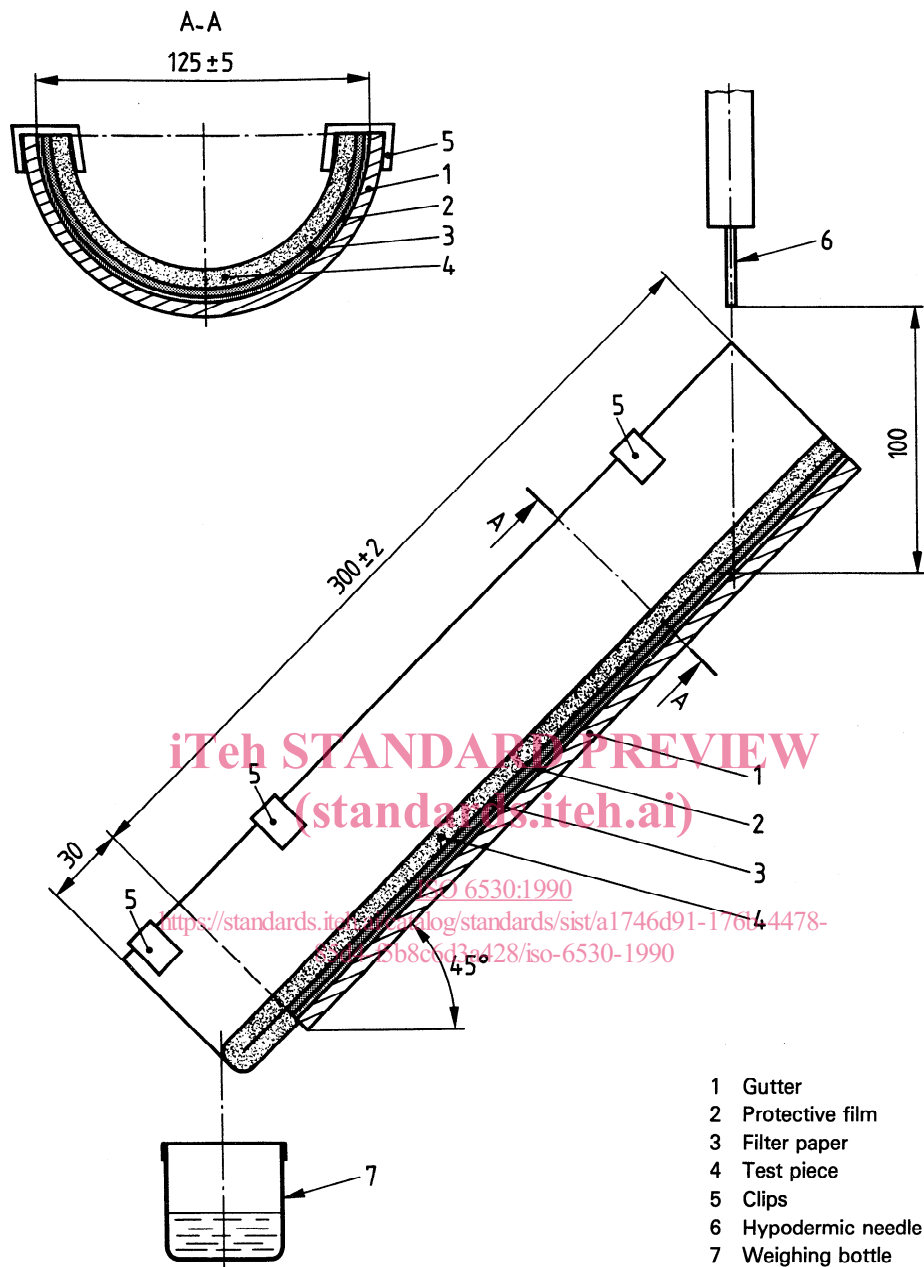


Figure 1 — Test apparatus

5.1.1 Rigid transparent gutter, of semi-cylindrical shape, with internal diameter $125 \text{ mm} \pm 5 \text{ mm}$, length $300 \text{ mm} \pm 2 \text{ mm}$, and inclination 45° .

5.1.2 Rigid cover, semi-cylindrical shape, length 270 mm, external diameter $105 \text{ mm} \pm 5 \text{ mm}$, weight $140 \text{ g} \pm 7 \text{ g}$ (evenly distributed). This cover is not shown in figure 1.

5.1.3 Hypodermic needle, bore $0,8 \text{ mm} \pm 0,02 \text{ mm}$; length is not critical but the pointed tip should be removed and the end should be ground flat.

5.1.4 Syringe, or other leak-free attachment to the needle capable of delivering $10 \text{ ml} (\pm 0,5 \text{ ml})$ of test liquid.

5.1.5 Motorized syringe drive unit or, hydraulic pump, or other pressurized system to deliver the correct volume of test liquid ($10 \text{ ml} \pm 0,5 \text{ ml}$) in an unbroken stream or jet via the needle within $10 \text{ s} \pm 1 \text{ s}$ and within $4 \text{ s} \pm 0,2 \text{ s}$.

NOTE 1 Appropriate precautions should be observed in the use of the pressurized systems.

5.1.6 Mounting device, for maintaining the hypodermic needle and attachments in their required positions (see figure 1).

5.1.7 Small beaker.

5.1.8 Balance, accurate to 0,01 g.

5.1.9 Transparent film, resistant to the test liquid.

5.1.10 Absorbent paper (e.g. filter paper), 0,15 mm to 0,2 mm thick.

5.1.11 Stopwatch, accurate to 0,1 s.

5.1.12 Temperature controlled room, or cabinet to enable tests to be carried out at temperatures other than ambient.

NOTES

2 The transparent film shall protect the gutter and obviate the need to rinse it between tests.

3 The filter paper will show any passage of the test liquid through the test piece. The semi-cylindrical cover is used to maintain intimate contact between the contaminated area of the test piece and the filter paper after release of the test liquid.

5.2 Test liquid

5.2.1 Selection. Use that or those liquid(s) against which protection is required.

NOTE 4 If necessary, particularly for safety reasons, substitutes may be used, provided that the test laboratory can demonstrate that their effects on the results are similar to those of the chemicals against which protection is required.

Water adjusted to a surface tension of 30 dyne/cm \pm 3 dyne/cm is a convenient and safe test liquid for general screening purposes.

The results of tests with volatile liquids may not be reproducible unless validated procedures are followed to control losses by evaporation to a constant definable level. The measurements of penetration and repellency may be facilitated conveniently, however, by the solution of an analysable substance (e.g. fluorescent or visible dye tracers) in the volatile liquid, provided it does not influence the performance of the test piece (i.e. its resistance to penetration and repellency).

5.2.2 Temperature of application. Test liquids shall be adjusted to the required test temperature.

5.3 Preparation of test pieces

5.3.1 Test pieces are taken from flat samples of materials used or to be considered for use in construction of protective clothing resistant to penetration (see Introduction).

5.3.2 Where the influence of environmental factors, washing, chemical degradation, etc., on resistance to penetration is to be assessed, representative control test pieces should be retained.

5.3.3 Before the test of penetration is carried out the test pieces (control and treated where appropriate) should be conditioned at the required test temperature and humidity until equilibrium is attained (see ISO 554). Care should be taken to avoid cross-contamination of the control test pieces.

5.4 Procedure

NOTE 5 Appropriate precautions applicable to the use of equipment under pressure and the forceful discharge of liquid chemicals should be taken.

5.4.1 For each test liquid, take six test pieces of 360 mm \pm 2 mm \times 235 mm \pm 5 mm from the clothing or sample of material.

In the case of woven fabrics, three test pieces are taken in the direction of the warp and three in the direction of the weft.

For nonwovens, if the direction of manufacture is recognizable, take three test pieces in that direction and three at right angles to it.

5.4.2 Fold under 30 mm of the length of the test piece and hold the fold in position on both sides by any appropriate means. Avoid any creases in the fabric.

5.4.3 Cut out a rectangle (300 mm \pm 2 mm \times 235 mm \pm 5 mm) of the filter paper and the transparent film and weigh them together to the nearest 0,01 g.

5.4.4 Check that the apparatus, test liquid and test pieces have been conditioned to the required test temperature.

5.4.5 Check that the volume of test liquid delivered via the needle is within the designated limit (see 5.1.5).

5.4.6 Place the weighed transparent film, the absorbent paper, and the test piece (in this order) in the gutter. Ensure that their top edges align with the top edge of the gutter and that the folded edge of the test piece is face down and protruding 30 mm from the lower edge (see figure 1). Eliminate all creases in each layer and ensure that all surfaces are in close contact. Secure with clips.

5.4.7 Weigh the beaker to the nearest 0,01 g. Place it under the folded edge of the test piece for the collection of test liquid running off the surface.

5.4.8 Mount the hypodermic needle vertically through the centre of an imaginary line, which joins the apices of the two uppermost corners of the gutter, so that the ground tip of the needle is 100 mm from the inclined surface of the gutter (see figure 1).

5.4.9 Simultaneously, start the stopwatch and discharge the test liquid (10 ml) within $10 \text{ s} \pm 1 \text{ s}$, via the needle, on to the surface of the test piece. Without delay, rest the semi-cylindrical cover centrally on top of the test piece and ensure that the lower edges of the cover and the gutter are in line.

5.4.10 After 60 s (from the start of the discharge of the test liquid), tap the gutter to dislodge any drops hanging from the folded edge of the test piece. Remove the cover and the test piece carefully to avoid additional run-off either into the beaker or on to the underlying absorbent paper, and reweigh to the nearest 0,01 g:

- the absorbent paper and underlying film;
- the beaker.

5.4.11 Complete these steps (5.4.1 to 5.4.10) for the remainder of the test pieces. Repeat the tests with a similar batch of test pieces at the designated higher rate of flow of test liquid (10 ml in $4 \text{ s} \pm 0,2 \text{ s}$) only when penetration appears to be minimal (e.g. $< 0,5 \text{ ml}$) at the low flow rate (10 ml in $10 \text{ s} \pm 0,5 \text{ s}$).

5.5 Expression of results

For each test piece calculate the indices of penetration and repellency, for each test liquid and flow rate, as follows.

5.5.1 Index of penetration (P) =
$$\frac{M_p \times 100}{M_t}$$

where

M_p is the mass, in grams, of test liquid (or dissolved tracer) deposited on the absorbent paper/film combination;

M_t is the mass, in grams, of test liquid (or tracer) discharged on to the test piece.

5.5.2 Index of repellency (R) =
$$\frac{M_r \times 100}{M_t}$$

where

M_r is the mass, in grams, of test liquid (or tracer) collected in the beaker.

5.5.3 Express the indices (P) and (R) to one significant decimal place.

NOTE 6 Where reliable correction factors for evaporative losses can be applied, the mass lost under the experimental conditions should be added to M_p or M_r before calculation of the respective indices (P) and (R).

6 Test report

The test report shall include the following:

- a) that the test was carried out in accordance with ISO 6530;
- b) the manufacturer's identity for the material tested and, where appropriate, the particular part of a named item from which the test pieces have been taken;
- c) the mass per unit area (in grams per square metre) of the material tested;
- d) description of any pre-treatment and/or pre-conditioning of the material tested;
- e) the test liquid(s) used;
- f) temperature (in degrees Celsius) and range used in the tests;
- g) all individual test results (indices of penetration and repellency for a given liquid and flow rate of application) and other influencing factors;
- h) any comments considered appropriate by the person carrying out the tests.

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