INTERNATIONAL STANDARD

ISO 374-4

First edition
2019-10

Protective gloves against dangerous chemicals and micro-organisms —

Part 4: Determination of resistance to degradation by chemicals

Gants de protection contre les produits chimiques dangereux et les micro-organismes —
Partie 4: Détermination de la résistance à la dégradation par des produits chimiques

Reference number
ISO 374-4:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 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 the following URL: www.iso.org/iso/foreword.html.

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

This document has been transferred from EN 374-4 without technical changes.

A list of all parts in the ISO 374 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.

Protective gloves against dangerous chemicals and micro-organisms —

Part 4:
Determination of resistance to degradation by chemicals

1 Scope

This document specifies the test method for the determination of the resistance of protective glove materials to degradation by dangerous chemicals with continuous contact.

NOTE Annex A gives information on interlaboratory test results on this method.

It is preferable that other tests used in addition to the evaluation of chemical resistance such as permeation resistance and penetration, as the chemical test do not provide sufficient information on the physical property changes affecting a glove during exposure to a chemical. It is necessary that the outside surface of the glove be exposed to the chemical.

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.

ISO 374-1, *Protective gloves against dangerous chemicals and micro-organisms — Part 1: Terminology and performance requirements for chemical risks*

ISO 21420, *Protective gloves — General requirements and test methods*

ISO 23388:2018, *Protective gloves against mechanical risks*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 374-1 and ISO 21420 apply.

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

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Test principles

The resistance of a protective glove material to degradation by a liquid chemical is determined by measuring the change in puncture resistance of the glove material after continuous contact of the external surface with the challenge test chemical. The test is applicable to gloves made of natural or synthetic polymer. Lined gloves can produce unusable measurement results.

5 Test methods, puncture resistance test

5.1 Sampling

Select three gloves for testing. Condition the gloves at (23 ± 2) °C, (50 ± 5) % relative humidity for at least 24 h.

In the case of irregular and/or multiple construction, one sample shall be tested from each area. Using the appropriate circular die of 20 mm, cut 6 specimens of each glove for a total of 18 test specimens. For each glove, 3 specimens will be exposed to the challenge chemical and 3 specimens will be unexposed.

Select specimens so that they are homogeneous and representative of the glove's primary construction. Avoid embossed patterned areas or other areas of varying thickness or composition when cutting these specimens.

If a glove is constituted of several unbounded layers, only the layer giving the chemical protection shall be tested.

The sample shall be tested according to the method described in 5.3. An additional non-mandatory informative test method is given as an example in Annex B.

For lined gloves, if it is not possible to separate the liner from the glove (and if the liner is too thick), the test could not be feasible, because it would not be possible to seal the vial and the sample would slide during the test. For some samples, if there is a thick liner, it could not be necessary to use the septa to have a correct vial sealing. In this case, the liner will ensure the leakproofness.

5.2 Apparatus

The following equipment shall be used:

a) (20 ± 1) mm diameter cutting die;

b) (12 ± 1) mm diameter cutting die (for cutting a hole in the centre of each septum);

c) 20 ml crimp top vials (opening (12,5 ± 0,5) mm of diameter);

d) 20 mm diameter septa (e.g. made from chlorobutyl rubber without polytetrafluoroethylene (PTFE) layer);

e) 20 mm open centre aluminium crimp seals;

f) hand crimper;

g) hand decapper;

h) punched-out sample holder with 18 holes of 20 mm diameter;

i) 150 ml beaker;

j) transfer pipette, 2 ml;

k) dynamometer with a puncture stylus according to ISO 23388:2018, 6.5 and a cell to measure compression forces with a precision of ±1 %;

l) sample vial support.

5.3 Procedure

5.3.1 Test conditions

The test shall be conducted at (23 ± 2) °C (preparation, chemical, exposure to chemical, and puncture test).

5.3.2 Pre-testing measurements

Place the challenge chemical into the 150 ml beaker. Using the transfer pipette, place about 2 ml of challenge chemical into one of the crimp top vials.

Seat a septum in an open centre aluminium crimp seal cap. Using the (12 ± 1) mm cutting die, make a centred hole in the septum.

Place a glove specimen on top of the septum with its normal external surface facing towards the interior of the vial. Place the aluminium cap with the specimen on top of the vial. Seal the vial using the hand crimper and invert it so that the challenge chemical is in contact with the specimen (see Figure 1). Record the time. Place the vial in the punched-out sample holder.

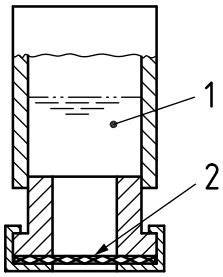
NOTE The punched-out sample holder has a twofold purpose:

a) It allows air to circulate under the sample film, and

b) if the pressure from the challenge chemical forces the sample into a convex shape, the flask will still stand.

Repeat the procedure in the above paragraph for each of the remaining eight specimens that are to be exposed. Time these actions so that the exposures on succeeding specimens begin at three-minute intervals. At the end of the one-hour exposure period (±5 min), examine each test vial to confirm coverage of the specimen with the challenge chemical. If the chemical is not covering the specimen, discard the specimen and repeat the test using a larger quantity of challenge chemical.

Mount the nine unexposed specimens in the remaining vials in the same manner, except that no chemical is placed in the vial.

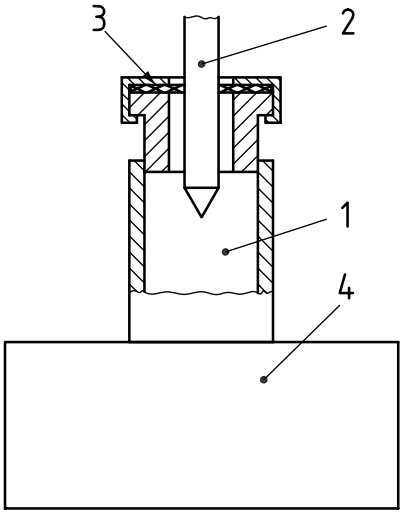


Key

1 challenge chemical

2 outer surface of the glove specimen which is in contact with the challenge chemical, it is a circular area of (12,5 ± 0,5) mm diameter

Figure 1 — Position of the vial during contact time between the specimen and the challenge chemical



Key

1 20 ml crimp vial
2 puncture stylus
3 specimen
4 sample vial support (to be maintained by the dynamometer jaw)

Figure 2 — Position of the vial during puncture test

5.3.3 Puncture testing

Install the puncture stylus on the dynamometer load cell. Set the carriage speed to 100 mm/min and screw the vial support onto the table.

Place a vial into the support. Puncture the specimen and record the peak force required (see Figure 2).

Repeat for each of the specimens; test each of the exposed specimens one hour after the exposure on that specimen was started.

Test specimens shall be examined for any changes to their physical properties during and after the test (after drying). Any changes such as swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding, delaminating shall be noted and described on the test report for information.

5.3.4 Expression of results

Determine the degradation for each of the three glove samples against each specific chemical or chemical mixture using the formula:

$$DRx = \frac{(OPx - RPx)}{OPx} \times 100 \quad (1)$$

where

DRx is the degradation of the *x* glove sample against challenge chemical tested, in %;

OPx is the average puncture force on the three unexposed test specimens from the *x* glove sample; units shall be same as *RPx*;

RPx is the average puncture force on the three exposed test specimens from the x glove sample; units shall be same as *OPx*.

Determine the degradation of the glove material against the challenge chemical using the following Formula (2):

$$DR = \frac{(DR1 + DR2 + DR3)}{3} \quad (2)$$

where

DR is the degradation of the glove material against challenge chemical tested, in %;

*DR*1 is the degradation of the first glove sample against challenge chemical tested, in %;

*DR*2 is the degradation of the second glove sample against challenge chemical tested, in %;

*DR*3 is the degradation of the third glove sample against challenge chemical tested, in %.

Determine the standard deviation (SD) of the degradation for the three glove samples.

6 Test report

For each protective glove material tested, a report shall include the following information:

a) Report the manufacturer's reference for the glove tested including the material, style, and lot number.

b) Report the name of the test chemical, its purity, and if it is in a mixture, its concentration and other components.

c) Make reference to this document.

d) Report the date of the test.

e) Report *DR*1, *DR*2, *DR*3, *DR* (see 5.3.4), the percent change in the puncture for the glove material. The SD shall also be reported.

f) Report whether the liner, if present, has been separated from the test specimen.

g) Report any observations of changes in the physical appearance of the material specimens following chemical exposure. Examples of reported observations are swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding and delaminating.

h) Any deviation to this document shall be reported.