SLOVENSKI STANDARD
SIST EN 16523-1:2015+A1:2018

01-december-2018

Nadomešča:
SIST EN 16523-1:2015

Ugotavljanje odpornosti materiala proti pronicanju kemikalij - 1. del: Pronicanje potencialno nevarnih tekočih kemikalij pri pogojih neprestanega stika

Determination of material resistance to permeation by chemicals - Part 1: Permeation by potentially hazardous liquid chemicals under conditions of continuous contact

Bestimmung des Widerstands von Materialien gegen die Permeation von Chemikalien - Teil 1: Permeation durch potentiell gefährliche flüssige Chemikalien unter Dauerkontakt

Détermination de la résistance des matériaux à la permeation par des produits chimiques - Partie 1: Permeation par des produits chimiques liquides potentiellement dangereux dans des conditions de contact continu

Ta slovenski standard je istoveten z: **EN 16523-1:2015+A1:2018**

ICS:

13.340.01	Varovalna oprema na splošno	Protective equipment in general

SIST EN 16523-1:2015+A1:2018 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16523-1:2015+A1

October 2018

ICS 13.340.01

Supersedes EN 16523-1:2015

English Version

Determination of material resistance to permeation by chemicals - Part 1: Permeation by potentially hazardous liquid chemicals under conditions of continuous contact

Détermination de la résistance des matériaux à la perméation par des produits chimiques - Partie 1: Perméation par des produits chimiques liquides potentiellement dangereux dans des conditions de contact continu

Bestimmung des Widerstands von Materialien gegen die Permeation von Chemikalien - Teil 1: Permeation durch potentiell gefährliche flüssige Chemikalien unter Dauerkontakt

This European Standard was approved by CEN on 5 December 2014 and includes Amendment 1 approved by CEN on 7 May 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

Page

European foreword

This document (EN 16523-1:2015+A1:2018) has been prepared by Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2019 and conflicting national standards shall be withdrawn at the latest by April 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes [A1] EN 16523-1:2015 [A1].

In comparison with [A1] EN 16523-1:2015 [A1], the entire document has been revised.

This document includes Amendment 1 approved by CEN on 7 May 2018.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

[A1] *Deleted text* [A1]

EN 16523, *Determination of material resistance to permeation by chemicals*, is composed with the following parts:

— *Part 1: Permeation by potentially hazardous liquid chemicals under conditions of continuous contact* [the present document];

— *Part 2: Permeation by gaseous chemical under conditions of continuous contact*.

NOTE CEN/TC 162 WG 13 has foreseen to work on other test methods in the future that will spread in several standard parts:

— *Permeation by solid chemical under conditions of continuous contact;*

— *Permeation by chemical under conditions of intermittent contact;*

— *Permeation by chemical of seams, joins, assemblages and closers;*

— *Permeation by chemical in a form of droplets;*

— *Guide on testing and interpretation.*

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1]

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Users involved in the production, use, transportation, and emergency response with liquid chemicals can be exposed to numerous compounds capable of causing harm upon contact with the human body. The harmful 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 personal protective equipment (PPE) that resists permeation, penetration and degradation.

The test method described in this part of EN 16523 is intended to be used to evaluate the barrier effectiveness of materials used for protective clothing, gloves and footwear materials against permeation by liquid chemicals.

This method does not assess the chemical degradation or penetration of the material. Resistance to penetration by liquid chemicals can be determined by using for example ISO 6530 [10] while resistance to penetration by liquid chemicals under pressure can be determined by using for example ISO 13994 [11]. Resistance to chemical degradation can be determined by EN 374-4 [2] for gloves and EN 13832-1:2006, 4.2 [3] for footwear.

This method provides tests results in terms of breakthrough time. This parameter is a key measure of the effectiveness of a material to act as a barrier to the challenge chemical. Such information is used in the comparison of the performances of PPE materials during the process of selecting PPE for protection from hazardous chemicals. Long breakthrough times are characteristic of high permeation resistance. Breakthrough time does not provide a correlation between protection and the toxicity of the chemicals tested, only cumulative permeation can provide this information.

It has been assumed in the drafting of this part of EN 16523 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.

A future part of EN 16523 will explain the use of the series of standards EN 16523.

1 Scope

This European Standard specifies a test method for the determination of the resistance of protective clothing, gloves and footwear materials to permeation by potential hazardous liquid chemicals under the condition of continuous contact.

This test method is applicable to the assessment of protection against liquid chemicals that can be collected only by liquid or gaseous collecting media.

This test method is not ▌A1⟩ applicable to ⟨A1▌ the assessment of chemical mixtures, except for aqueous solutions.

This standard is used with the specifications given in the products standards (for example ▌A1⟩ EN ISO 374-1:2016 ⟨A1▌ for gloves) where the following information is defined:

— any pre-conditioning;

— precise sampling (place, size, number);

— associated levels of performance.

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.

▌A1⟩ EN ISO 374-1:2016, *Protective gloves against dangerous chemicals and micro-organisms — Part 1: Terminology and performance requirements for chemical risks (ISO 374-1:2016)* ⟨A1▌

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
analytical technique
method of identifying and quantifying the amount of permeated chemical in the collection medium

Note 1 to entry: Such methods are often specific to individual chemical and collection-medium combinations.

EXAMPLE Applicable analytical techniques can include ultraviolet (UV) or infrared (IR) spectrophotometry, mass spectrometry, pH measurement, ion chromatography, conductimetry, colourimetry, atmospheric analytical detector tubes and radionuclide tagging/detection counting. Although liquid and/or gas chromatography are separation techniques rather than detection methods they can be used in conjunction with suitable detectors to quantify the amount of permeated chemical in the collection medium (see Annex C).

3.2
liquid challenge chemical
liquid chemical that is used to challenge the protective clothing, gloves and footwear material specimen

3.3
collecting medium
liquid or gas on the inner “clean” side of the test sample in which any permeated chemical is collected

3.4
response time
time between the actual arrival of the challenge chemical on the collecting side of the specimen and the time when the analytical instrumentation responds to it

3.5
limit of quantification
minimum quantity of a substance which can be measured

Note 1 to entry: It is the value where the uncertainty of measurement is equal to 50 % of the determined value.

3.6
loop

3.6.1
closed loop
system in which the collecting medium is re-circulated or stirred through the sampling compartments of the test cell

Note 1 to entry: Closed loop systems are not commonly used with gaseous collection media.

3.6.2
open loop
system where the collecting medium passes through the sampling compartment of the test cell without re-circulation

Note 1 to entry: Open loop systems may be used with either liquid or gaseous collection media.

3.7
minimum detectable permeation rate
MDPR
lowest rate of permeation that is measurable with the complete permeation-test system

Note 1 to entry: This value is not necessarily the intrinsic limit of detection for the analytical instrument.

Note 2 to entry: MDPR is usually based upon 3 times the average background noise.

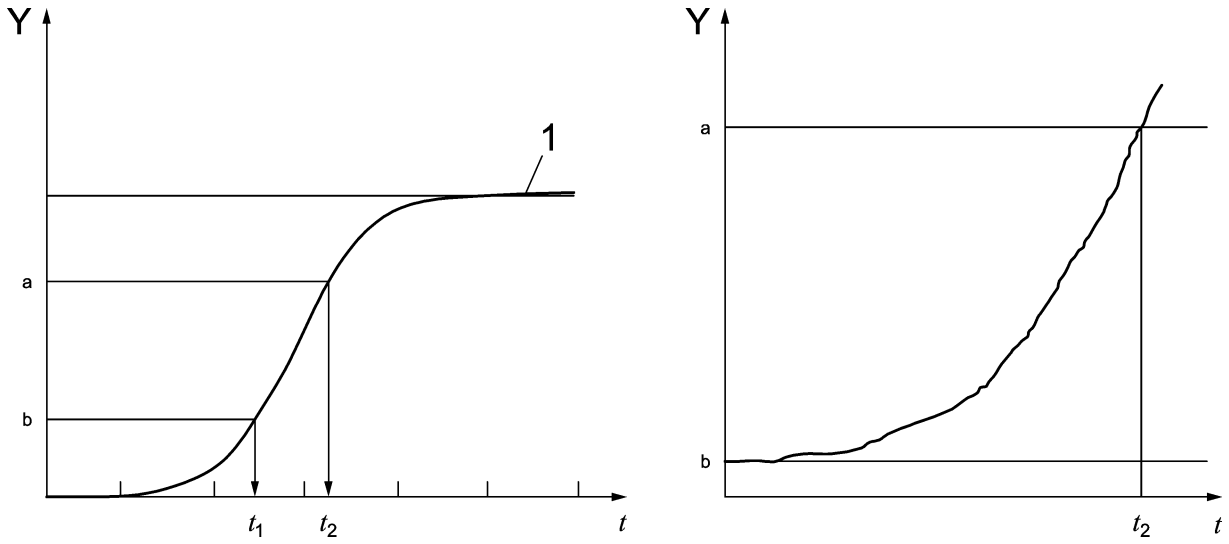
Note 3 to entry: Useful information can be found on the following websites:

— http://www.measurementuncertainty.org/guide/app_f.thml;

— http://www.iupac.org/publications/pac/1997/pdf/6902x0297.pdf.

3.8
normalized breakthrough time
NBT
time at which the permeation rate reaches the normalization permeation rate

Note 1 to entry: See Figure 1:



Key

Y	permeation rate in µg cm^{-2} min^{-1}	a	normalized permeation rate (NPR)
t	time	b	minimum detectable permeation rate (MDPR)
1	steady-state permeation	t_2	normalized breakthrough time (NBT)

Figure 1 — Schematic permeation graph showing actual and normalized breakthrough times

3.9
normalized permeation rate
NPR
arbitrary fixed figure of 1,0 µg cm^{-2} min^{-1}

Note 1 to entry: This optimized figure is a compromise between test method parameters (mixing, flow rate, detection limits, etc.) and the scientific analysis possibilities at the present time, to ensure a better repeatability and reproducibility of the test.

Note 2 to entry: In some standards, the NPR is fixed at a lower concentration (for example 0,1 µg cm^{-2} min^{-1}). However, the parameters of the other standards, flow rate, mixing are often less severe than the present test method. The tests are only designed to evaluate protective clothing, gloves and footwear.

3.10
permeation
process by which a chemical moves through a PPE (protective clothing, gloves and footwear) material, on a molecular level (see Annex A) and which involves the following:

— absorption of molecules of the chemical into the contacted (outside) surface of a material;

— diffusion of the absorbed molecules in the material;

— desorption of the molecules from the opposite (inside) surface of the material

3.11
permeation rate
mass of challenge chemical permeating unit area of the protective clothing, gloves and footwear per unit time

Note 1 to entry: The permeation rate is expressed in µg cm $^{-2}$ min^{-1}.

3.12
steady-state permeation rate
SSPR
constant rate of permeation that occurs after breakthrough when the chemical contact is continuous and all forces affecting permeation have reached equilibrium

Note 1 to entry: See Figure 1.

Note 2 to entry: Steady-state permeation may not be achieved during the period for which permeation testing is conducted.

4 Test principle

The resistance of protective clothing, gloves and footwear material to permeation by a liquid chemical is characterized by measuring through the normalized breakthrough time (NBT).

In the permeation test apparatus, the protective clothing, gloves or footwear material separates the challenge chemical from the collecting medium.

The collecting medium, which can be a gas or a liquid, is analysed quantitatively for its concentration of the chemical as a function of time.

5 Collecting media

5.1 Gaseous collecting medium

A gaseous collecting medium is usually used under continuous flow conditions for the collection of permeating molecules that are capable of vaporizing in sufficient quantities for analysis. The gaseous collection medium shall be a gas or gas mixture which does not interfere with the detection of the challenge chemical and does not itself permeate or degrade the material under test. The quality of the gas supply shall be of sufficient consistency over the duration of the test that changes do not interfere with detection of the challenge chemical.

NOTE Dry air or nitrogen are often used.

5.2 Liquid collecting medium

〚A1〛 A liquid collecting medium is usually used for the collection of permeated challenge chemicals of low volatility that are soluble in the collecting medium under the conditions of the test. The challenge chemical shall be soluble in the collecting medium in sufficient quantities for analysis.

The liquid collecting medium shall not influence the resistance of a material to permeation.

NOTE 1 Water is generally used (Water grade 3 see EN ISO 3696).

In the case of water soluble test specimen (e.g. PVAL-polyvinyl alcohol), an alternative collecting medium shall be used. It shall have no effect on the material.

NOTE 2 Limitation due to collecting media: It can be recognized that there are circumstances under which the above criteria are mutually exclusive. For example, when testing a PVC (polyvinyl chloride) fabric for resistance to permeation by involatile isocyanates, it will be found that the challenge chemical is insoluble in aqueous collection media and that the test fabric is readily permeated or degraded by virtually all non-aqueous liquids. Under such circumstances testing is, unfortunately, not possible. 〚/A1〛

6 Apparatus

6.1 Permeation cells

6.1.1 Standard permeation cell

Components of the permeation test system that can be in contact with the challenge chemical shall not interact with it.

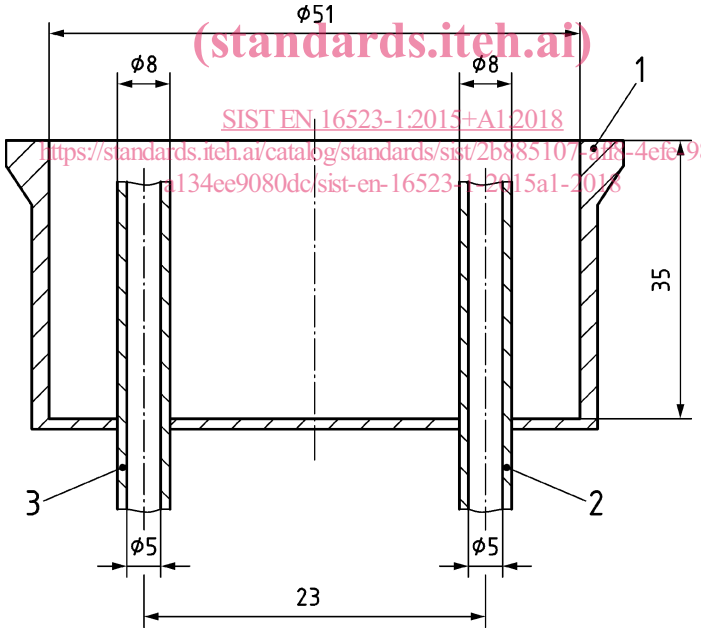
The permeation cell consists of two compartments, separated by the test specimen. The specimen's outer surface is in contact with the challenge chemical, whereas the specimen's inner surface is in contact with a collecting medium.

The permeation cell is constructed of two sections with an internal diameter of 51 mm at their open ends (see Figures 2 and 3). The section containing the challenge chemical, L_c is at least 10 mm long; the section containing the collecting medium is 35 mm long. The limit deviation for each dimension shall not be greater than ± 2 mm (see Figures 2 and 3). The cell assembly shall not leak and seals are used (see Figure 4).

The material(s) used for the cell shall not interact with the challenge chemical (chemical reaction, adsorption, retention, etc.).

NOTE Glass permeation cells are often used.

Dimensions in millimetres



Key

1 ⟨A1⟩ *deleted text* ⟨A1⟩ compartment for collecting medium

2 inlet collecting medium

3 outlet collecting medium

NOTE Dimensional deviations: ± 2 mm.

Figure 2 — Important dimensions for the ⟨A1⟩ *deleted text* ⟨A1⟩ compartment for collecting medium