



## SLOVENSKI STANDARD SIST EN 13274-1:2001

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Respiratory protective devices - Methods of test - Part 1: Determination of inward leakage and total inward leakage

Atenschutzgeräte - Prüfverfahren - Teil 1: Bestimmung der nach innen gerichteten Leckage und der gesamten nach innen gerichteten Leckage

Appareils de protection respiratoire - Méthodes d'essai - Partie 1: Détermination de la fuite vers l'intérieur et de la fuite totale vers l'intérieur

Ta slovenski standard je istoveten z: EN 13274-1:2001

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ICS 13.340.30

English version

## Respiratory protective devices - Methods of test - Part 1: Determination of inward leakage and total inward leakage

Appareils de protection respiratoire - Méthodes d'essai -  
Partie 1: Détermination de la fuite vers l'intérieur et de la  
fuite totale vers l'intérieur

Atemschutzgeräte - Prüfverfahren - Teil 1: Bestimmung der  
nach innen gerichteten Leckage und der gesamten nach  
innen gerichteten Leckage

This European Standard was approved by CEN on 1 January 2001.

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 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 Management Centre has the same status as the official versions.

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 79 "Respiratory protective devices", 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of an identical text or by endorsement, at the latest by July 2001, and conflicting national standards shall be withdrawn at the latest by July 2001.

This European Standard 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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

It is one of several parts, which are as follows:

- Part 1: Determination of inward leakage and total inward leakage
- Part 2: Practical performance tests
- Part 3: Determination of breathing resistance
- Part 4: Flame tests
- Part 5: Climatic conditions
- Part 6: Determination of carbon dioxide content of inhalation air
- Part 7: Determination of particle filter penetration
- Part 8: Determination of dolomite dust clogging

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## Introduction

This European Standard is intended as a supplement to the specific device standards for respiratory protective devices. Test methods are specified for complete or parts of devices. If deviations from the test method given in this standard are necessary, these deviations will be specified in the relevant device standard.

## 1 Scope

This European Standard specifies the general procedure for determining:

- a) the inward leakage of facepieces or
- b) inward leakage of respiratory protective devices (RPD), which is the total inward leakage excluding any filter penetration or
- c) total inward leakage of respiratory protective devices.

Device preparation, selection of test subjects, test procedure and the method of calculation of leakage are included. Two methods are described, one using an aerosol (sodium chloride aerosol) and one using a gas (sulfur hexafluoride).

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 132	Respiratory protective devices - Definitions of terms and pictograms
EN 136	Respiratory protective devices - Full face masks - Requirements, testing, marking
EN 140	Respiratory protective devices - Half masks and quarter masks - Requirements, testing, marking
EN 148-1	Respiratory protective devices - Threads for facepieces - Part 1 : Standard thread connection.

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## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 132 apply.

## 4 Prerequisites

In order to implement this standard, at least the following parameters shall be specified in the relevant device standard:

- the number of samples;

- device preparation;
- the selection and number of test subjects;
- any prior conditioning or testing;
- test method (1, 2A, 2B);
- any deviations from the method;
- use of supplementary fans (if applicable);
- characteristics to be assessed subjectively;
- pass/fail criteria.

## 5 General test requirements

Unless otherwise specified, the values stated in this European Standard are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of  $\pm 5\%$ . Unless otherwise specified, the ambient temperature for testing shall be between 16 °C and 32 °C and the temperature limits shall be subject to an accuracy of  $\pm 1$  °C.

## 6 Principle

A test subject wearing the device on test, walks on a horizontal treadmill surrounded by an atmosphere containing a known concentration of a test substance. Two types of challenge atmosphere are specified, one using sodium chloride and the other using sulfur hexafluoride and the general principle of the test is the same for either substance. The substance used depends on the type of equipment under test and is chosen according to the guidance given in the following clauses.

Dilution of the test atmosphere by clean air emanating from the device under test does not affect the accuracy of the measurement of leakage because of the large volume and continuous replacement of the atmosphere.

## 7 Material permeability test

### 7.1 Principle

This test serves the purpose of determining, particularly in case of doubt, which method shall be used for the determination of inward leakage of the facepiece. A specified air pressure is applied to the material of the facepiece and/or its seal to the wearer which is wetted by a liquid and has a film of the same liquid applied to its upper surface. If bubbles escape continuously from the upper surface the material is rated as permeable and the sulfur hexafluoride method is to be used. If no bubbles escape continuously, the sulfur hexafluoride and sodium chloride methods are equally acceptable options.

If a facepiece or its seal to the wearer is made of impermeable materials or is obviously open to the atmosphere, inward leakage may be tested with either sodium chloride or sulfur hexafluoride.

### 7.2 Apparatus

NOTE See Figure 1.

7.2.1 Testing head. A cylindrical vessel over which the test specimen is clamped by a clamping ring and screw. The head is fitted with a gasket to make a seal against the test specimen.

7.2.2 Test liquid. Water in which a wetting agent (softener or washing-up liquid) is dissolved to form a solution by adding a few drops to 1 l of water.

7.2.3 Pressure measuring device

7.2.4 Air supply and control valves

### 7.3 Preparation of test specimens

Take the test specimens from different places in the device in order that an assessment can be made of all materials and seams.

### 7.4 Procedure

Soak the conditioned test specimen under approximately 15 mm of test liquid for a period of not less than 3 min. Remove the test specimen from the test liquid and clamp it in the testing head. Pour sufficient test liquid on to the surface of the test specimen to form a continuous film.

Apply air pressure to the undersurface of the test specimen until bubbles escape, or up to a maximum of 100 mbar, whichever occurs first. Note whether any bubbles escape from the upper surface of the test specimen indicating that the material is permeable. Repeat the test with the other test specimens.

## 8 Device preparation

### 8.1 General

Prior to the inward leakage test examine the device to see that it is in good working condition and can be used without hazard.

Prepare the devices to be tested in accordance with their design and with whether the inward leakage of a facepiece or the inward leakage of a device or the total inward leakage of a device is to be determined.

The sodium chloride and sulfur hexafluoride methods are equally acceptable for determinations of inward leakage and total inward leakage, subject to the requirements of Table 1.



**Table 1 - Selection of test agent**

TYPE OF DEVICE		TEST AGENT		RESULT
		Permeable device	Non-permeable device	
Facepiece (EN 136 or EN 140)		-	NaCl or SF <sub>6</sub>	I.L.
Filtering devices	Particles	NaCl	NaCl	T.I.L.
	Gas	SF <sub>6</sub>	NaCl or SF <sub>6</sub>	I.L.
	Combined	NaCl and SF <sub>6</sub>	-	I.L. and T.I.L.
		-	NaCl	T.I.L.
Breathing apparatus		SF <sub>6</sub>	NaCl or SF <sub>6</sub>	I.L.
I.L. = Inward leakage T.I.L. = Total inward leakage				

## 8.2 Sample tubes and probe

In order to sample and analyse the air inside the facepiece, punch a hole in the facepiece and insert a probe through which the sample is drawn by a suitable sample pump.

A multiple hole sampling probe is strongly recommended. Figures 2 to 6 show designs that have been found suitable. Drying air at a flow of about 1 l/min is employed when sodium chloride is used. This is to minimize condensation and hence loss of sodium chloride particles in the sampling tube. The sample flow rate from the facepiece is equal to the total flow through the sample pump minus the amount of drying air used. Allowance has to be made for the diluting effect of this clean air when leakage calculations are performed. Drying air is not used if sulfur hexafluoride is the test agent.

Fit the probe securely in an airtight manner to the facepiece as near as possible to the mouth of the wearer. For flexible or soft facepieces it may be necessary to fit a head harness to the test subject to prevent distortion of facepiece or inability to create a seal due to failure of the harness to support the probe assembly weight. This harness can then carry the sampling probe and associated connections and pressure probe for pulsed sampling.

A second sampling probe is provided to measure the ambient concentration of test agent in the test enclosure. This shall be placed away from the effect of any exhalate from the device under test.

The sampling probes are connected to the analysing equipment by means of flexible thin-walled tubing of about 3 mm bore, the length of which is kept as short as possible.

### 8.3 Device preparation - total inward leakage

For the determination of the total inward leakage, use the complete device. The preparation of the facepiece is as described in 8.2.

In the case of a filtering device with a gas filter, the total inward leakage is assumed to equal the inward leakage (see 8.4), provided that the gas filter in its holder meets the requirements for the gas breakthrough time required in the appropriate filter standard and the facepiece does not incorporate gas permeable material.

### 8.4 Device preparation - inward leakage

The inward leakage of facepieces in accordance with either EN 136 or EN 140 and which incorporate a threaded connection in accordance with EN 148-1 is determined with the appropriate filter simulator fitted to the facepiece. Clean air is supplied to the facepiece via a lightweight hose. The conditions set out in the following paragraphs referring to breathing resistance, fitting and support of the hose apply here.

The inward leakage of facepieces in accordance with EN 136 or EN 140 and not incorporating a threaded connection in accordance with EN 148-1, and of all filtering devices, is the total inward leakage excluding any filter penetration. For the determination of inward leakage, clean air shall be supplied to the device under test. The breathing resistance of the modified device shall be similar to that of the complete device.

It is important that the attachment of the clean air hose to the device does not affect the fit of the device on the test subject nor should its fitting replace any seals incorporated in the device. If necessary the hose should be supported.

An alternative method of measuring inward leakage of filtering devices is to replace gas filters or combined filters by surrogate high efficiency particle filters of the same mass and resistance. The results of a total inward leakage test using sodium chloride aerosol may then be equated to the inward leakage of the device. It is important that the attachment of the surrogate filters does not affect the fit of the device, nor shall its fitting replace any seals incorporated in the device.

For breathing apparatus the following situations apply regarding inward leakage tests:

a) For breathing apparatus employing facepieces other than facepieces in accordance with EN 136 or EN 140, inward leakage tests are carried out on complete equipment and the result of the test gives a pass/fail criterion related to the device standard for the complete equipment tested.

b) For breathing apparatus employing facepieces in accordance with EN 136 or EN 140 and having threaded connections to EN 148-1, no inward leakage tests are carried out on the complete equipment, but the facepiece is tested as described in the first paragraph of this clause.

c) For breathing apparatus employing facepiece in accordance with EN 136 or EN 140 and not having threaded connections to EN 148-1, inward leakage tests are carried out on complete equipment and the result of the test gives a pass/fail criterion related to the device standard for the complete equipment tested and also (separately) for the facepiece in accordance with EN 136 or EN 140 as appropriate.

## 9 Test

### 9.1 Test subjects

Before performing tests involving human subjects, account should be taken of any national regulations concerning the medical history, examination or supervision of the test subjects.

For the inward leakage test, select persons who are familiar with using such or similar equipment, covering the spectrum of facial characteristics of typical users (excluding significant abnormalities). Exceptionally some persons cannot be satisfactorily fitted with the device under test. Such exceptional subjects shall not be used for the test. Where a manufacturer specifies a head or face size range for the device, only subjects who fall within the specified range shall be used for the test.

In the test report, describe the faces of the test persons (for information only) by the four facial dimensions (in millimetres) illustrated in Figure 7.

If more than one size of facepiece is manufactured, the test subjects shall select the most appropriate size in accordance with the information supplied by the manufacturer.

### 9.2 Test equipment

#### 9.2.1 Enclosure

An enclosure is positioned over a treadmill and is capable of being flowed through continuously by the test atmosphere, which enters the top of the enclosure via a duct and flow distributor and is directed downwards over the head of the test subject. The concentration of the test agent inside the effective working volume is to be checked to ensure it is sufficiently homogeneous and stable in time. The enclosure shall be large enough to permit walking on the treadmill without interference. For devices which are requested to be additionally tested under cross wind conditions, provision shall be made for the positioning supplementary fans in the front, at the side and in the rear of the test subject, not less than 350 mm in diameter, inside the enclosure such that an air velocity of 2 m/s across the enclosure can be produced in the vicinity of the subject's head.

The air velocity through the enclosure measured close to the test subject's head with the test subject standing centrally on the treadmill and without the supplementary fans in operation, shall be 0,12 m/s to 0,2 m/s.

The design of the enclosure shall be such that the device worn by the subject can be supplied if necessary with clean air (free of the test agent).

#### 9.2.2 Treadmill

A level treadmill capable of working at 6 km/h.

#### 9.2.3 Test agent generator

Equipment for generating the test agent in the required concentration and, in case of sodium chloride, particle size distribution.

#### 9.2.4 Sample pump

A sample pump capable of sampling at a rate between 0,3 l/min and 3 l/min.

#### 9.2.5 Detection system

The detection system including sampling probes and connections shall have a response time of less than 20 s for a response of 10 % to 90 % of the full scale deflection of the range used.

If only one photometer is used, place all the sample probes initially in close proximity to one another within the enclosure and adjust the resistance of the sample tubes e. g. by means of a screw clip, so that with the test atmosphere on, identical readings for the test agent concentration are obtained from each sample tube.

### 9.3 Test method - General

9.3.1 Ask the test subjects to read the manufacturer's fitting instructions and if necessary show them how to fit the device correctly in accordance with the fitting instructions. Ask the test subject to fit the device, selecting the correct size if appropriate.

9.3.2 Ask each test subject "Does the device fit?" If the answer is "Yes", continue the test. If the answer is "No", take the test subject off the panel and report the fact.

9.3.3 Before starting the test check visually whether the device has been fitted correctly.

9.3.4 Inform the test subjects that if they wish to adjust the device during the test they may do so. However, if this is done the relevant section of the test will be repeated having allowed the system to re-settle.

9.3.5 Ensure that the test subjects have no indication of the result as the test proceeds.

9.3.6 Ensure that the test atmosphere is OFF.

9.3.7 Have the subject stand on the treadmill in the enclosure. Connect up the sampling probe and, if applicable, the clean air supply. Operate the device as required in the relevant standard. Start the treadmill and have the test subject walk at 6 km/h for 2 min. Measure the test agent concentration inside the facepiece to establish the background level.

9.3.8 Wait for a stable reading to be obtained.

9.3.9 Turn the test atmosphere ON.

9.3.10 Instruct the test subject to continue to walk for a further 2 min or until the test atmosphere has stabilized.

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9.3.11 Whilst still walking have the test subjects perform the following exercises

- a) walking without head movements or talking for 2 min;
- b) turning head from side to side (approximately 15 times), as if inspecting the walls of a tunnel for 2 min;
- c) moving head up and down (approximately 15 times), as if inspecting the ceiling and floor for 2 min;