



# SLOVENSKI STANDARD

## SIST EN 1232:1999

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### Zrak na delovnem mestu - Črpalke za osebno vzorčenje kemičnih agensov - Zahteve in preskusne metode

Workplace atmospheres - Pumps for personal sampling of chemical agents -  
Requirements and test methods

Arbeitsplatzatmosphäre - Pumpen für die personenbezogene Probenahme von  
chemischen Stoffen - Anforderungen und Prüfverfahren

Air des lieux de travail - Pompes pour l'échantillonnage individuel des agents chimiques -  
Exigences et méthodes d'essai

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13.040.30      Kakovost zraka na delovnem mestu      Workplace atmospheres

23.080      Črpalke      Pumps

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EUROPEAN STANDARD

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NORME EUROPÉENNE

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Descriptors: air, quality, air pollution, workroom, sampling, concentration, chemical compounds, pumps, characteristics, specifications, tests, testing conditions, information, marking

English version

**Workplace atmospheres - Pumps for personal  
sampling of chemical agents - Requirements and  
test methods**

Air des lieux de travail - Pompes pour l'échantillonnage individuel des agents chimiques - Exigences et méthodes d'essai (standards.iteh.ai) Arbeitsplatzatmosphäre - Pumpen für die personenbezogene Probenahme von chemischen Stoffen - Anforderungen und Prüfverfahren

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**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

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**Foreword**

This European Standard has been prepared by Technical Committee CEN/TC 137 "Assessment of workplace exposure", 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of an identical text or by endorsement, at the latest by August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

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

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## Introduction

Many different methods are used to determine the concentration of chemical agents in the workplace atmosphere. One of these methods involves the use of a pump and sampling head connected by a flexible tube. Air is drawn through the sampling head and chemical agents are trapped for example on a filter, sorption tube, long term detector tube or in a gas washing bottle. The pump and sampling head are attached to the worker so as to collect chemical agents in the breathing zone (personal sampling).

The volume of air drawn by the pump during the sampling period is one of the quantities in the calculation of the concentration of the chemical agents. It is essential that the volume of air sampled is determined accurately. As the volume of air sampled is influenced by the performances of the pump, it is essential that they are adequate to meet this requirement.

EN 482, "Workplace atmosphere - General requirements for the performance of procedures for the measurement of chemical agents", specifies general performance criteria for methods for measuring the concentration of chemical agents in workplace air. These performance criteria include maximum values of overall uncertainty (a combination of precision and bias) that are required to be achieved under prescribed laboratory conditions. In addition, the performance criteria should also be met under a wider variety of environmental influences, representative of workplace conditions.

It is essential that the contribution of the sampling pump towards inaccuracies in measurement is to a minimum so that the overall uncertainty in measurement procedures does not exceed that specified by EN 482. The user of a pump, meeting the requirements of prEN 1232, and used in combination with a pumped sorbent tube, meeting the requirements of prEN 1076, can expect that the requirements of EN 482 are met under laboratory conditions.

This standard should enable manufacturers and users of personal sampling pumps to adopt a consistent approach to, and provide a framework for, the assessment of performance criteria specified in EN 482. It is the manufacturer's primary responsibility to ensure that the pump meets the requirements laid down in this European Standard including environmental influences which may be expected to affect performance.

## 1 Scope

This European Standard specifies performance requirements for battery powered pumps used for personal sampling of chemical agents in the workplace atmosphere. It also specifies the methods of laboratory type testing for determination of the performance characteristics under prescribed laboratory conditions.

This European Standard is applicable to pumps whose nominal volumetric flow rate is within the range 5 ml/min to 5 l/min and which are used together with sampling devices typical for such flow rates for the sampling of gases, vapours, dusts, fumes, mists and fibres.

This European Standard is not applicable to pumps with a flow rate outside this range or for pumps which are used with sampling devices whose flow resistance significantly exceeds the values for back pressure listed in 4.6 and 4.7.

This European Standard is equally applicable to pumps with a constant flow rate and to stroke pumps with a constant stroke volume.

Sampling pumps are classified according to their intended use:

- Type P: pumps for personal sampling of particulate matter;
- Type G: pumps for personal sampling of gases and vapours.

## 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.

- EN 141:1990 Respiratory protective devices - Gas filters and combined filters - Requirements, testing, marking
- EN 50 014 Electrical apparatus for potentially explosive atmospheres - General requirements
- EN 50081-1 Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry

### 3 Definitions

For the purpose of this European Standard the following definitions apply:

- 3.1 personal sampling:** The process of air sampling carried out using a personal sampler.
- 3.2 personal sampler:** A device attached to a person that samples air in his or her immediate vicinity so that his or her exposure to pollutants may be determined.
- 3.3 back pressure:** The difference in pressure between the inlet and the outlet of the pump, for a constant volumetric flow rate setting, when the inlet is connected to a flow resistance.
- 3.4 nominal range of volumetric flow rates:** The range of volumetric flow rate values, adjustable at the pump, at which the manufacturer claims that the pump can operate at a constant flow rate up to the maximum value of the required back pressure range for the operating time.
- 3.5 operating time:** The period during which the pump can be operated at specified flow rate and back pressure without recharging or replacing the battery.
- 3.6 volumetric flow rate under operating conditions:** The volumetric flow rate of the pump at ambient temperature and pressure occurring during operation.
- 3.7 pulsation:** The pulsation  $P$  indicates, at a given flow rate, the degree of variation in volumetric flow rate. By recording the time curve of the flow rate, this is calculated using equation (1):

$$P = \sqrt{\frac{1}{T} \int_0^T [f(t) - \bar{f}(t)]^2 dt} \quad (1)$$

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where

- $f(t)$  is the volumetric flow rate with respect to time  $t$  in litre per minute;
- $\bar{f}(t)$  is the mean volumetric flow rate over time  $T$  in litre per minute;
- $t$  is the time in seconds;
- $T$  is the time period of pulsation in seconds.

### 4 Requirements

NOTE: The corresponding test methods are given in clause 6.

#### 4.1 Features

The pump shall have as a minimum the following features:

- a holder to secure the pump on a person (integrated or available as an accessory);
- either a malfunction indicator which, following completion of sampling, indicates that the air flow has been reduced or interrupted during sampling or an automatic cut-out which stops the pump if the flow rate is reduced or interrupted.
- a fuse or current limiting switch which interrupts or limits the current in the electrical circuit of the pump in the case of short circuit.
- the facility for the adjustment of flow rate shall be such that it can only be actuated with the aid of a tool (e.g. screw driver) or requires special knowledge for operation (e.g. via software) so that inadvertent readjustment of the flow rate is precluded during use.

- type P pumps shall have an automatic control which keeps the volumetric flow rate constant in the case of changing back pressure;
- type G pumps shall have either an automatic control which keeps the volumetric flow rate constant in the case of changing back pressure or a means of determining the sampled volume (e.g. stroke counter);

NOTE: The use of an integral timer, automatically resetable by operating the on/off switch of the pump, is not mandatory so as not to eliminate the use of some pumps. However, this feature is highly desirable and should be incorporated in future designs. The inclusion of a filter prevents particulates from being drawn into the pump's mechanism.

## 4.2 Mass

The mass of the pump, including batteries and integral holders, shall not exceed 1,2 kg.

## 4.3 Mechanical strength

4.3.1 After a shock treatment, the flow rate measured shall not deviate by more than 5 % from the initial value.

4.3.2 The general function of the pump shall not be impaired by the shock treatment. No mechanical or electrical defects shall occur.

## 4.4 Pulsation of flow rate (for type P pumps only)

For type P pumps the pulsation shall not exceed 10 % of the flow rate.

## 4.5 Design safety

The outer case of the pump shall be so designed that there are no sharp corners or other uncomfortable protruding parts.

## 4.6 Flow rate stability under increasing back pressure (for flow controlled pumps only)

The flow rate set within the nominal flow range shall not deviate more than  $\pm 5$  % from the initial value on changing the back pressure within the range specified in table 1. This applies to any measured back pressure-flow plot.

Table 1: Required back pressure range

| Adjusted flow rate<br>ml/min | Required back pressure range<br>kPa |
|------------------------------|-------------------------------------|
| Type P pumps                 |                                     |
| 1000                         | 0,1 to 4,0                          |
| 2000                         | 0,3 to 4,0                          |
| 3000                         | 0,4 to 4,0                          |
| 4000                         | 0,6 to 5,0                          |
| 5000                         | 0,7 to 6,25                         |
| Type G pumps                 |                                     |
| 5                            | 0,01 to 0,1                         |
| 10                           | 0,02 to 0,2                         |
| 50                           | 0,1 to 1,2                          |
| 100                          | 0,2 to 2,6                          |
| 300                          | 1,0 to 10,0                         |

NOTE: The upper and lower figures specified for the required back pressure range for type P pumps are typical for an unloaded and heavily loaded filter. The figures specified for required back pressure for type G pumps are typical for one sorption tube with low flow resistance up to two sorption tubes in line.

## 4.7 Required back pressure (for type G pumps fitted with a stroke counter)

The calibration factor (stroke factor) shall not change more than 5 % when going from the low to the high back pressure obtained from table 2.

Table 2: Required back pressures

| Adjusted flow rate<br>ml/min | Required back pressure<br>kPa |
|------------------------------|-------------------------------|
| 5                            | 0,01 and 0,1                  |
| 10                           | 0,02 and 0,2                  |
| 50                           | 0,1 and 1,2                   |
| 100                          | 0,2 and 2,6                   |
| 300                          | 1,0 and 10,0                  |

#### 4.8 Operating time

The operating time shall be at least 2 h and should preferably be 8 h. This applies to the complete nominal flow range against a specified back pressure at temperatures of

- a) 20 °C to 25 °C;
- b)  $(5 \pm 2)$  °C.

During the operating time, the flow rate shall not deviate by more than 5 % from the initial value.

The manufacturer shall quote in the instructions for use the operating time for the following flow rates, for temperatures of  $(5 \pm 2)$  °C and 20 °C to 25 °C:

- a) for type P pumps:
  - 1) 2 l/min;
  - 2) maximum value of nominal flow rate range;
- b) for type G pumps:
  - 1) 50 ml/min or 300 ml/min;
  - 2) maximum value of nominal flow rate range.

#### 4.9 Start-up and long term performance

During operation of the pump at room temperature and at an ambient temperature of 5 °C, the flow rate shall not deviate by more than 5 % from the value measured at the start of the determination of the long term performance.

#### 4.10 Short term interruption of air flow

When the flow is fully blocked for 2 min, the pump shall cut out or the malfunction indicator activate. The pump shall not restart automatically at the end of the blocking time or the malfunction indicator shall remain activated until reset.

#### 4.11 Temperature dependence

Within the range of ambient temperature from 5 °C to 40 °C, the flow rate measured under operating conditions shall not deviate by more than 5 % from the flow rate at 20 °C.

If a wider temperature range is claimed by the manufacturer, the test (see 6.11) shall be modified accordingly.

#### 4.12 Orientation

When the pump is tilted backwards, forwards, to the right and to the left by 90° from its normal upright position, the flow rate shall not deviate by more than 5 % from the value measured in the upright position.

#### 4.13 Timer accuracy

If the pump is supplied with an internal timer, after 8 h the indicated time shall not deviate more than 5 min from that of the reference timer.



#### 4.14 Instructions for use

The instructions for use supplied with the pump shall be in the language(s) of the countries where the pump is to be marketed. It shall contain at least the following information:

- a) manufacturer's name;
- b) type;
- c) reference to this European Standard;
- d) intended use (types P and/or G);
- e) nominal range of flow rate;
- f) operating time;
- g) temperature range for operating;
- h) type designation of charger to be used for charging the battery;
- i) that only the charger mentioned under (h) shall be used for charging the battery;
- j) notes and recommendations required for operation and calibration of the pump and charge/discharge of the battery;
- k) notes with respect to maintenance and trouble-shooting;
- l) notes with respect to special safety requirements. If the pump can be used in an area subject to explosion hazard, the certificate number provided by the appropriate certification body;
- m) information concerning the adjustment of flow rate; this should also include information pertinent to the use of low resistance pulsation dampers if required;
- n) notes with respect to the calculation of sampled volumes under operating or standard conditions;
- o) information that the integral flow meter (if fitted) is not designed for a precise determination of the flow rate;
- p) information that the calibration factor of a stroke counter pump is not intended for precise determination of the sampled volume unless confirmed by the user.

#### 4.15 Electromagnetic compatibility

The pump shall meet the requirements for electromagnetic compatibility according to EN 50081-1 and EN 50082-1.

#### 4.16 Explosion hazard

If the pump is claimed to be suitable for use in areas subject to explosion hazard, fulfilment of the requirements according to EN 50014 shall be verified.

### 5 General test conditions

The pump shall be operated in accordance with the instructions for use.

#### 5.1 Number of test objects

For pumps whose application range covers both type P and type G, one pump shall be tested according to the test conditions for type P pumps and one shall be tested according to the test conditions for type G pumps.

#### 5.2 Test instruments

The accuracy of the test instruments shall be taken into consideration when the measurement results are compared with the requirements.

Only calibrated meters shall be used for the tests.

NOTE: A list of typical instruments is included in annex A.