

**Workplace exposure - Assessment of sampler  
performance for measurement of airborne particle  
concentrations - Part 6: Transport and handling tests**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 13205-6:2014 sisaldab Euroopa standardi EN 13205-6:2014 inglisekeelset teksti.	This Estonian standard EVS-EN 13205-6:2014 consists of the English text of the European standard EN 13205-6:2014.
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English Version

**Workplace exposure - Assessment of sampler performance for  
measurement of airborne particle concentrations - Part 6:  
Transport and handling tests**

Exposition sur les lieux de travail - Évaluation des  
performances des dispositifs de prélèvement pour la  
mesure des concentrations de particules en suspension  
dans l'air - Partie 6: Essais de manipulation et de transport

Exposition am Arbeitsplatz - Beurteilung der  
Leistungsfähigkeit von Sammlern für die Messung der  
Konzentration luftgetragener Partikel - Teil 6: Prüfungen  
zum Transport und zur Handhabung

This European Standard was approved by CEN on 7 May 2014.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

<b>Contents</b>	<b>Page</b>
Foreword.....	3
Introduction .....	4
<b>1 Scope .....</b>	<b>5</b>
<b>2 Normative references .....</b>	<b>5</b>
<b>3 Terms and definitions .....</b>	<b>5</b>
<b>4 Symbols and abbreviations .....</b>	<b>5</b>
4.1 Symbols .....	5
4.1.1 Latin .....	5
4.1.2 Greek .....	6
4.2 Enumerating subscripts.....	7
<b>5 Transport test based on weighing samples before and after shipping by mail.....</b>	<b>7</b>
5.1 Principle.....	7
5.2 Test procedure .....	7
5.2.1 General.....	7
5.2.2 Test equipment .....	7
5.2.3 Test aerosol and method of loading collection media .....	8
5.2.4 Test method.....	8
5.3 Calculations.....	9
5.4 Test Report .....	11
5.4.1 General.....	11
5.4.2 Testing laboratory details and sponsoring organisation .....	11
5.4.3 Description of candidate sampler and collection substrate .....	11
5.4.4 Description of test methods and materials .....	11
5.4.5 Results .....	11
5.4.6 Summary.....	12
<b>6 Handling test for loaded samplers or collection substrates using a shaker .....</b>	<b>12</b>
6.1 Principle.....	12
6.2 Test procedure .....	12
6.2.1 General.....	12
6.2.2 Test equipment .....	12
6.2.3 Mounting of the samplers .....	13
6.2.4 Test aerosol and method of loading collection media .....	13
6.2.5 Test method.....	13
6.3 Calculations.....	14
6.4 Test Report .....	16
6.4.1 General.....	16
6.4.2 Testing laboratory details and sponsoring organisation .....	16
6.4.3 Description of candidate sampler and collection substrate .....	16
6.4.4 Description of test methods and materials .....	16
6.4.5 Results .....	16
6.4.6 Summary.....	17
Bibliography .....	18

## Foreword

This document (EN 13205-6:2014) has been prepared by Technical Committee CEN/TC 137 "Assessment of workplace exposure to chemical and biological agents", 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 December 2014 and conflicting national standards shall be withdrawn at the latest by December 2014.

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

This document together with EN 13205-1, EN 13205-2, CEN/TR 13205-3, EN 13205-4 and EN 13205-5 supersedes EN 13205:2001.

EN 13205, *Workplace exposure – Assessment of sampler performance for measurement of airborne particle concentrations*, consists of the following parts:

- *Part 1: General requirements;*
- *Part 2: Laboratory performance test based on determination of sampling efficiency;*
- *Part 3: Analysis of sampling efficiency data* [Technical Report];
- *Part 4: Laboratory performance test based on comparison of concentrations;*
- *Part 5: Aerosol sampler performance test and sampler comparison carried out at workplaces;*
- *Part 6: Transport and handling tests* (the present document).

Significant technical changes from the previous edition, EN 13205:2001:

- This part of EN 13205 is partly based on Annex D of the previous edition, EN 13205:2001.
- The scope has been limited to aerosol samplers, and the current version of the standard is not (directly) applicable to other types of aerosol instruments.
- As this is now a standard in its own right, a clause on the used symbols has been added. Almost all definitions are now given either in EN 1540, *Workplace exposure — Terminology* or in Part 1 of this standard.
- The method of calculating the uncertainty of a sampler or a measuring procedure has been revised in order to comply with ENV 13005. The concept of "accuracy" is no longer used instead the concept of "expanded uncertainty" is used.
- The standard gives two methods to determine the dependence of the mass loss from collection substrates due to transport and/or handling, respectively. It is described how to use the test data to calculate the uncertainty due to transport/handling and how this is related to the requirements given in Part 1 of this European 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, 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

EN 481 defines sampling conventions for the particle size fractions to be collected from workplace atmospheres in order to assess their impact on human health. Conventions are defined for the inhalable, thoracic and respirable aerosol fractions. These conventions represent target specifications for aerosol samplers, giving the ideal sampling efficiency as a function of particle aerodynamic diameter.

In general, the sampling efficiency of real aerosol samplers will deviate from the target specification, and the aerosol mass collected will therefore differ from that which an ideal sampler would collect. In addition, the behaviour of real samplers is influenced by many factors such as external wind speed. In many cases there is an interaction between the influence factors and fraction of the airborne particle size distribution of the environment in which the sampler is used.

This part of EN 13205 describes two test methods for determining the uncertainties due to transport errors. The values calculated can directly be compared to the requirements of EN 13205-1:2014. The first method is based on loading collection substrates with particles from a workplace aerosol and delivery by ordinary mail. The second method is based on loading collection substrates with particles from a specified laboratory test aerosol and subsequent exposure of the collection substrates to vibrations using either a laboratory shaker table or a vertical shaker.

EN 13205 (all parts) enables manufacturers and users of aerosol samplers to adopt a consistent approach to sampler validation, and provide a framework for the assessment of sampler performance with respect to EN 481 and EN 482.

It is the responsibility of the manufacturer of aerosol samplers to inform the user of the sampler performance under the laboratory conditions<sup>1)</sup> specified in this part of EN 13205. It is the responsibility of the user to ensure that the actual conditions of intended use are within what the manufacturers specifies as acceptable conditions according to the performance test.

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1) The inhalable convention is undefined for particle sizes in excess of 100 µm or for wind speeds greater than 4 m/s. The tests required to assess performance are therefore limited to these conditions. Should such large particle sizes or wind speeds actually exist at the time of sampling, it is possible that different samplers meeting this standard give different results.

## 1 Scope

This European Standard specifies a performance test of loaded collection substrates for samplers for the inhalable, thoracic or respirable aerosol fractions and, as alternative, a handling test, both for testing transport losses of aerosol sampler substrates under prescribed conditions in order to calculate the expanded uncertainty of a measuring procedure according to EN 13205-1:2014, Annex A. The transport test involves shipping loaded substrates with ordinary mail, whereas the handling test uses a shaker.

This part of EN 13205 applies to all samplers used for the health-related sampling of particles in workplace air.

## 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.

EN 143, *Respiratory protective devices - Particle filters - Requirements, testing, marking*

EN 1540, *Workplace exposure - Terminology*

EN 13205-1:2014, *Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations — Part 1: General requirements*

EN 13205-2:2014, *Workplace exposure — Assessment of sampler performance for measurement of airborne particle concentrations — Part 2: Laboratory performance test based on determination of sampling efficiency*

ISO 15767, *Workplace atmospheres — Controlling and characterizing uncertainty in weighing collected aerosols*

## 3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 1540, EN 13205-1:2014 and EN 13205-2:2014 apply.

NOTE With regard to EN 1540, in particular, the following terms are used in this document: respirable fraction, sampling efficiency, personal sampler, static sampler, thoracic fraction, inhalable fraction, measuring procedure, non-random uncertainty, random uncertainty, uncertainty (of measurement), precision and analysis.

## 4 Symbols and abbreviations

### 4.1 Symbols

#### 4.1.1 Latin

$C_{\text{OEL}}$	relevant occupational exposure limit (OEL) value, [ $\text{mg}/\text{m}^3$ ]
$m_{0,1}$ , $m_{0,5}$ and $m_2$	nominal masses to be loaded onto collection substrates for selected sampling time $t$ and nominal flow rate $Q^0$ at concentrations corresponding to 10 %, 50 % and 200 % of the occupational exposure limit, [mg]
$m_{\text{Handl}_{bn}}$	mass remaining on collection substrate $n$ of subset $b$ after the handling test, [mg] –