INTERNATIONAL STANDARD

ISO 16000-37

First edition
2019-02

Indoor air —

Part 37: Measurement of $PM_{2,5}$ mass concentration

Air intérieur —

Partie 37: Mesure de la concentration massique en $PM_{2,5}$

Reference number
ISO 16000-37:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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 ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Abbreviated terms ... **3**

5 Measurement strategy for determing $PM_{2,5}$ indoors ... **3**
5.1 Location and number of sampling points ... 3
5.2 Measurement strategy for source attribution ... 4
5.3 Indoor air condition ... 4

6 Principle of measurement ... **4**
6.1 General considerations ... 4
6.2 Description of the standard measuring principle ... 4

7 Equipment and facilities ... **5**
7.1 Sampling system components ... 5
7.2 Weighing facilities and procedure ... 5

8 Supplementary high time resolution method ... **5**
8.1 General ... 5
8.2 Selection of the supplementary instrument ... 6
8.3 Supplementary procedure ... 6

9 Evaluation and reporting the results ... **6**

10 Quality assurance and uncertainty evaluation ... **7**
10.1 Reference method ... 7
10.1.1 General ... 7
10.1.2 Flow control system ... 7
10.1.3 Weighing system ... 7
10.1.4 Checking the equipment's parameters ... 7
10.2 Supplementary methods ... 8

Annex A (informative) **Examples of particle concentrations encountered during room user activities** ... **9**

Bibliography ... **11**

© ISO 2019 – All rights reserved

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 146, *Air quality*, Subcommittee SC 6, *Indoor air.*

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.

A list of all parts in the ISO 16000 series can be found on the ISO website.

© ISO 2019 – All rights reserved

Introduction

Airborne particulate matter (colloquially known as “fine dust”) plays a role not only outdoors, but is also significant in terms of hygiene, especially indoors. People in industrialized countries spend most of the day indoors. Either particles are transported into indoor air from outdoor environments or the particles directly result from indoor sources, such as smoking, residential wood burning and cooking.

$PM_{2,5}$ concentration and composition in indoor environments strongly depend on parameters such as the room size, relative humidity, air exchange rate, airflow conditions and sink effects on surfaces (e.g. walls, ceilings, floor coverings, furnishings). In addition, particles already sedimented are temporarily resuspended to the air through various activities and can be inhaled. All this can result in highly variable levels of indoor $PM_{2,5}$ pollution that are not easily ascertained or assessed in terms of their impacts on health.

This document describes the general strategies for the measurement of indoor $PM_{2,5}$ concentration.

This document was prepared in response to the need for improved comparability of methods for particle measurement.

© ISO 2019 – All rights reserved

Indoor air —

Part 37: Measurement of $PM_{2,5}$ mass concentration

1 Scope

This document specifies the measurement methods and strategies for determining the $PM_{2,5}$ mass concentrations of suspended particulate matter (PM) in indoor air. It can also be used for determining PM_{10} mass concentration.

The reference method principle consists of collecting $PM_{2,5}$ on a filter after separation of the particles by an impaction head and weighing them by means of a balance.

Measurement procedure and main requirements are similar to the conditions specified in EN 12341.

This document also specifies procedures for operating appropriate supplementary high time resolution instruments, which can be used to highlight peak emission, room investigation and as part of the quality control of the reference method.

Quality assurance, determination of the measurement uncertainty and minimal reporting information are also part of this document.

The lower range of application of this document is 2 $\mu g/m^3$ of $PM_{2,5}$ (i.e. the limit of detection of the standard measurement method expressed as its uncertainty).

This document does not cover the determination of bioaerosols or the chemical characterization of particles. For the measurement and assessment of dust composition, see the relevant technical rules in the International Standards in the ISO 16000 series.

This document does not cover passenger compartments of vehicles and public transport systems.

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.

EN 12341, *Ambient air — Standard gravimetric measurement method for the determination of the PM_{10} or $PM_{2,5}$ mass concentration of suspensed particulate matter*

3 Terms and definitions

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

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

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

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

© ISO 2019 – All rights reserved

3.1
aerodynamic diameter
diameter of a sphere of density 1 g cm^{-3} and the same setting velocity in still air as the particle of interest under prevailing conditions of temperature, pressure and relative humidity

Note 1 to entry: The aerodynamic diameter is calculated using the formula:

$$D_a = D_p \sqrt{\frac{1}{\chi}} \sqrt{\frac{\rho_p}{\rho_0}}$$

where

D_a is the aerodynamic diameter;
D_p is the particle diameter;
ρ_p is the density of the particle;
ρ_0 is the standard density;
χ is the form factor.

Note 2 to entry: The form factor describes by how much the resisting force of an irregular shaped particle is greater than that of a sphere with the same volume[10].

Note 3 to entry: The aerodynamic diameter determines the sedimentation and the separation properties of particles in impactors. It is also of particular importance for penetrative behaviour and the retention of particles in the human body.

Note 4 to entry: Various definitions are used for the particle diameter, depending on the measurement method. These different diameters are only indirectly comparable since different particle properties are being measured, e.g. geometric diameter, diameter according to dielectric mobility, diameter according to light scattering properties.

[SOURCE: ISO 7708:1995, 2.2, modified — "particle" has been removed from the term, the definition has been reworded, and the original Note 1 to entry has been replaced by Notes 1 to 4 to entry.]

3.3
mass concentration
c
ratio of the mass *m* of the measured component and the gas volume *V*, as shown by:

$$c = \frac{m}{V}$$

[SOURCE: EN 15259:2007, 3.26]

3.4
particle
small discrete mass or solid or liquid matter

[SOURCE: ISO 29464:2017, 3.2.111]

3.5
PM_x
particulate matter suspended in air which is small enough to pass through a size-selective inlet with a 50 % efficiency cut-off at x µm aerodynamic diameter

[SOURCE: EN 12341:2014, 3.1.14]

© ISO 2019 – All rights reserved

3.6
cut-off diameter
aerodynamic diameter at which the impactor stage has a separation efficiency of 50 %

[SOURCE: ISO 23210:2009, 3.1.2, modified — The definition has been changed from "where the separation efficiency of the impactor stage is 50 %".]

3.7
calibration
operation which, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

[SOURCE: JCGM 200:2012, 2.39, modified — The notes have been removed.]

3.8
uncertainty
<of measurement>parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand

[SOURCE: JCGM 100:2008, 2.2.3, modified — The notes have been removed.]

3.13
parallel measurement
measurement from a measuring system that takes samples from the same air over the same time period

3.14
reference method
RM
measurement method(ology) which, by convention, gives the accepted reference value of the measurement

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

JCGM Joint Committee for Guides in Metrology

PM particulate matter

QA quality assurance

QC quality control

5 Measurement strategy for determing $PM_{2,5}$ indoors

5.1 Location and number of sampling points

The measurement usually takes place in the centre of the room at approximately 1,5 m height (see ISO 16000-1 and ISO 16000-34).

As a minimum, one measurement per investigated room should be performed. If stable conditions cannot be guaranteed for all points in the same room, additional locations should be investigated.

The sampling volume extracted per hour shall not exceed 10 % of the hourly volume of room air exchanged. If this is unknown, the sampling volume extracted per hour shall not exceed 10 % of the room's volume.

© ISO 2019 – All rights reserved