AS 16000.34:2025

Australian STANDARD®

STANDARDS Australia

Indoor air

Part 34: Strategies for the measurement of airborne particles (ISO 16000-34:2018, MOD)



AS 16000.34:2025

This Australian Standard® was prepared by EV-007, Methods for Examination of Air. It was approved on behalf of Standards Australia's Standards Development and Accreditation Committee on 23 October 2025.

This Standard was published on 7 November 2025.

The following are represented on Committee EV-007:

- ACT Health
- Australian Aluminium Council
- Australian Institute of Refrigeration Air Conditioning and Heating
- Clean Air Society of Australia & New Zealand
- Department of Climate Change, Energy, the Environment and Water, NSW
- Department of Environment, Tourism, Science and Innovation, QLD
- Department of Water and Environmental Regulation, WA
- Environment Protection Authority, Vic.
- National Association of Testing Authorities Australia
- RMIT University

Additional Interests:

- Australian Institute of Occupational Hygienists (AIOH)
- CETEC
- International Accreditation New Zealand
- K2 Environmental, New Zealand
- Prezant Environmental
- Reed OHE
- SafeWork NSW
- WorkPlace Environment Consultants

This Standard was issued for comment as DR AS 16000.34:2025

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals and new products by visiting:

www.standards.org.au

ISBN: 978 1 76175 448 7

Australian Standard®

Indoor air

Part 34: Strategies for the measurement of airborne particles (ISO 16000-34:2018, MOD)

First published as AS 16000.34:2025.

© ISO 2025 — All rights reserved
© Standards Australia Limited 2025

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

How to read this Standard

This page explains the meaning of the language and structure of this Standard.

Refer to Standards Australia's Standardisation Guide 006 for more details about drafting rules.

Australian and Australian/New Zealand Standards are voluntary unless they are referenced in legislation or called up in contracts.

Requirements

To conform to a Standard, all requirements in the Standard need to be met.

A requirement is any statement in the Standard which uses the word "shall".

Recommendations, permissions and possibilities

The following words are commonly used in Standards, but statements using them do not have to be followed to conform to the Standard:

(a) "should" means that something is recommended.

(b) "may" means that something is permitted.

(c) "can" means that something is possible.

Structure of Standards

A Standard always has the following parts:

(i) The Preface states who developed the Standard, what the Standard is aiming to do, and how it relates to other documents.

(ii) The Scope states what the Standard is about, what it covers and what it does not cover.

(iii) The Normative references clause lists other documents that are referenced in the Standard as part of requirements.

(iv) The Terms and definitions clause defines important terms to help with understanding the Standard.

A Standard may also include other parts, such as the following:

(1) A normative appendix sets additional requirements that need to be conformed to.

(2) An informative appendix provides additional information or guidance. They usually do not contain requirements. If an informative appendix does contain requirements, the Standard will explain when those requirements apply.

(3) A Bibliography lists documents referenced in the Standard but not as part of requirements.

Many Standards include notes. Notes provide recommendations and/or guidance only. They never contain requirements.

This Standard is a modified adoption of an International Standard. It makes changes to the international text.

The changes to the international text are shown in boxes in the text. These boxes have the heading "National Variations".

To use this Standard in Australia/New Zealand, the changes in the national variation boxes need to be followed.

Preface

This Standard was prepared by the Standards Australia Committee EV-007, Method for Examination of Air. Standards Australia Sub-committee EV-007-02, Indoor Air, contributed to the preparation of this document.

The objective of this document is to specify the general strategies for determining the concentration of airborne particles indoors and covers the size range from approximately 1 nm to 100 μm.

This document is an adoption with national modifications, and has been reproduced from, ISO 16000-34, *Indoor Air — Part 34: Strategies for the measurement of airborne particles*. The modifications are set out in national variations boxes which give instructions where the ISO text is to be modified for use in Australia. Due to ISO copyright policy it is not possible to directly modify the ISO content.

As this document has been reproduced from an international document, the following apply:

(a) In the source text “This part of ISO 16000” should read “this document”.

(b) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is for information and guidance only.

© Standards Australia Limited 2025

Contents

Page

Preface ..... **v**
Foreword ..... **viii**
Introduction ..... **xi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Origin, properties and health implications of airborne particles **4**
4.1 Origin and properties 4
4.2 Health implications 5
5 Sources of indoor particulate matter and particle dynamics indoors **6**
5.1 General 6
5.2 Sources of indoor particulate matter 8
5.2.1 Typical indoor sources 8
5.2.2 Influence of the premises 8
5.2.3 Particle size range generated by typical sources 9
5.3 Particle dynamics indoors 11
5.3.1 Major particle sinks 11
5.3.2 Variations of the particle spectrum 11
5.3.3 Effect of air conditioning 12
5.3.4 Conditions of room use 12
6 Measurement methods for airborne particles indoors **12**
6.1 General 12
6.2 Established method description 13
6.2.1 General 13
6.2.2 Cyclone 16
6.2.3 Impactors (impactor – cascade impactor – LPI – MOI) 16
6.2.4 Differential mobility analyser (DMA) 17
6.2.5 Aerosol mass spectrometer (AMS) 18
6.2.6 Aerosol mass monitor (AMM) 19
6.2.7 Oscillating microbalance (OMB) 20
6.2.8 Beta radiation attenuation (BRA) monitor 20
6.2.9 Microscopy (OM – SEM – TEM) 21
6.2.10 Light scattering aerosol spectrometer (LSAS) 22
6.2.11 Time-of-flight spectrometer (TOF-AS) 22
6.2.12 Condensation particle counter (CPC – UF CPC – CPC with SES – CPC photometric mode) 23
6.2.13 Faraday cup aerosol electrometer (FCAE) 24
6.2.14 Fast response aerosol spectrometer (FRAS) 24
6.2.15 Low pressure impactor with electric detection (LPI+E) 25
7 General sampling recommendations **25**
7.1 Instrumentation and sampling system 25
7.2 Measurement location 26
7.3 Measurement time and duration 26
7.4 Estimated concentration scale (minimum and maximum accuracy) 27
7.5 Background concentration 27
7.6 Impact of outdoor air quality 27
7.7 Impact of room conditions 28
7.8 Impact of the measurement itself 28
8 Measurement strategy for determining airborne particles indoors **29**
8.1 General 29

© Standards Australia Limited 2025

8.2 Preliminary work — Definition of the measurement objective and list of basic information 29
8.2.1 General 29
8.2.2 Statement on the purpose of the measurement 29
8.2.3 List of main expected sources 29
8.2.4 Temporal effects 29
8.2.5 Description of the indoor compartment 30
8.3 Visual room inspection — Definition of the measurement planning and strategy 30
8.4 Preliminary measurements 32
8.5 Measurement procedures 32
8.5.1 General 32
8.5.2 Procedure for the determination of the background 32
8.5.3 Procedure for the estimation of the influence of outdoor (ambient air) concentration 33
8.5.4 Procedure for the identification of main sources present in a room 34
8.5.5 Procedure for the measurement of the average and the time-resolved emission of a specific source 36
8.5.6 Procedure for the estimation of the efficiency of an abatement techniques (i.e. filtration by air conditioning system 37

9 Uncertainty evaluation 38

10 Evaluation and reporting of results 39

11 Documentation 39

12 Quality assurance 39
12.1 Performance specifications 39
12.2 Quality assurance when determining particle number concentrations 40
12.2.1 General 40
12.2.2 Sampling volume flow 40
12.2.3 Checking the equipment's parameters 41
12.3 Quality assurance when determining particle mass concentrations 41
12.3.1 Mass concentration calculation based on measured number concentration 41
12.3.2 Gravimetric mass concentration measurement 41

Annex A (normative) **Protocol for the measurement of indoor airborne particles 43**

Bibliography 48

© Standards Australia Limited 2025

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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 146, *Air quality,* Subcommittee SC 6, *Indoor air*.

NATIONAL VARIATION

Delete the sixth and seventh paragraphs and *replace* with the following:

ISO 16000 series consists of the following parts, under the general title Indoor air:

— Part 1: General aspects of sampling strategy
— Part 2: Sampling strategy for formaldehyde
— Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air — Active sampling method
— Part 4: Determination of formaldehyde — Diffusive sampling method
— Part 5: Sampling strategy for volatile organic compounds (VOCs)
— Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID
— Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations
— Part 8: Determination of local mean ages of air in buildings for characterizing ventilation conditions
— Part 9: Determination of the emission of volatile organic compounds from samples of building products and furnishing - Emission test chamber method
— Part 10: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test cell method
— Part 11: Determination of the emission of volatile organic compounds from samples of building products and furnishing - Sampling, storage of samples and preparation of test specimens
— Part 12: Sampling strategy for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polycyclic aromatic hydrocarbons (PAHs)

© Standards Australia Limited 2025

NATIONAL VARIATION

— Part 13: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) - Collection on sorbent-backed filters

— Part 14: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) - Extraction, clean-up and analysis by high-resolution gas chromatography and mass spectrometry

— Part 15: Sampling strategy for nitrogen dioxide (NO2)

— Part 16: Detection and enumeration of moulds - Sampling by filtration

— Part 17: Detection and enumeration of moulds - Culture-based method

— Part 18: Detection and enumeration of moulds - Sampling by impaction (and its Corrigendum 1:2011)

— Part 19: Sampling strategy for moulds

— Part 20: Detection and enumeration of moulds - Determination of total spore count

— Part 21: Detection and enumeration of moulds - Sampling from materials

— Part 22: Detection and quantification of fungal biomass by fungal β-N-acetylhexosaminidase enzyme activity

— Part 23: Performance test for evaluating the reduction of formaldehyde and other carbonyl compounds concentrations by sorptive building materials

— Part 24: Performance test for evaluating the reduction of volatile organic compound concentrations by sorptive building materials

— Part 25: Determination of the emission of semi-volatile organic compounds by building products - Micro-chamber method

— Part 26: Sampling strategy for carbon dioxide (CO2)

— Part 27: Determination of settled fibrous dust on surfaces by SEM (scanning electron microscopy) (direct method)

— Part 28: Determination of odour emissions from building products using test chambers

— Part 29: Test methods for VOC detectors

— Part 30: Sensory testing of indoor air

— Part 31: Measurement of flame retardants and plasticizers based on organophosphorus compounds - Phosphoric acid ester

— Part 32: Investigation of buildings for the occurrence of pollutants

— Part 33: Determination of phthalates with gas chromatography/mass spectrometry (GC/MS)

— Part 34: Strategies for the measurement of airborne particles

— Part 35: Determination of total cell count in building material [Under development]

— Part 36: Standard method for assessing the reduction rate of culturable airborne bacteria by air purifiers using a test chamber

— Part 37: Measurement of PM2,5 mass concentration

— Part 38: Determination of amines in indoor and test chamber air - Active sampling on samplers containing phosphoric acid impregnated filters

— Part 39: Determination of amines - Analysis of amines by (ultra-) high-performance liquid chromatography coupled to high resolution or tandem mass spectrometry

— Part 40: Indoor air quality management system (and its Amendment 1:2024)

— Part 41: Assessment and classification

— Part 42: Measurement of the particle number concentration by condensation particle counters

— Part 43: Standard method for assessing the reduction rate of culturable airborne fungi by air purifiers using a test chamber

— Part 44: Test method for measuring perceived indoor air quality for use in testing the performance of gas phase air cleaners

NOTE: This is not an exhaustive list of the ISO 16000 series, please refer to the ISO website for newer or revised ISO 16000 series (and all parts).

© Standards Australia Limited 2025

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

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.

© Standards Australia Limited 2025

Introduction

NATIONAL VARIATION

Delete the paragraph below and *replace* with the following:

Airborne particulate matter (also known as “fine dust”) plays a role not only in outdoor exposures but is also significant in relation to indoor exposures. People in industrialized countries spend most of the day indoors. Particles are either transported into the indoor air from outdoor environments or the particles are directly generated from indoor sources, such as smoking, housework and do-it-yourself (DIY) activities, burning candles, residential wood burning, cooking, foot traffic and mobilisation of settled or entrapped dust and using printers. The concentration, composition and size distribution of airborne particulate matter in the indoor environments is strongly dependent on parameters, such as the sources present in the room, room size, relative humidity, air exchange rate, air flow conditions and sink effects on surfaces (e.g. walls, ceilings, floor coverings, soft furnishings). In addition, particles already deposited can be re-entrained into the indoor air through various activities and subsequently inhaled. Depending on the particular case, all this can result in highly variable levels of indoor fine dust concentrations that are not easily ascertained or assessed in terms of their impact on health and equipment.

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. Particles are either transported into indoor air from outdoor environments or the particles directly result from indoor sources, such as smoking, housework and do-it-yourself (DIY), burning candles, residential wood burning, cooking and using printers. The concentration, composition and size distribution of airborne particulate matter in indoor environments strongly depend on parameters such as the sources present in the room, room size, relative humidity, air exchange rate, air flow conditions and sink effects on surfaces (e.g. walls, ceilings, floor coverings, soft furnishings). In addition, particles already deposited can be re-entrained through various activities and subsequently inhaled. Depending on the particular case, all this can result in highly variable levels of indoor fine dust pollution that are not easily ascertained or assessed in terms of their impact on health.

NATIONAL VARIATION

In the paragraph below, *delete* the term “industrial safety” and *replace* with “Occupational Health & Safety (OHS), Work Health & Safety (WHS) and/or public health”.

In the ISO 16000 series, the following rooms are understood to constitute indoor spaces: dwellings with living rooms, bedrooms, work rooms, sport rooms, cellars, kitchens and bathrooms; work spaces or workstations in buildings not subject to controls under industrial safety legislation in terms of airborne pollution (e.g. offices, shops); public buildings (e.g. restaurants, theatres, cinemas, other function rooms); and the passenger compartments of vehicles and all public transport systems (e.g. buses, trains, aircraft).

Epidemiological and toxicological findings suggest that health effects are more strongly related to sub-micron particles[33]. Indeed, ultrafine particles (UFP), due to their small size, can deeply penetrate into the body and contribute to adverse health effects.

This document describes the general strategies for the measurement of airborne particles, including PM_{10}, $PM_{2,5}$, PM_1 and UFP. The different technologies available equipment are presented and compared in a way that allows the user to select the best technique depending on the monitoring objective. Sampling requirements are presented together with key factors that users should take into account.

© Standards Australia Limited 2025

Australian Standard®

Indoor air

Part 34: Strategies for the measurement of airborne particles (ISO 16000-34:2018, MOD)

1 Scope

This document specifies the general strategies for determining the concentration of airborne particles indoors and covers the size range from approximately 1 nm to 100 µm.

In addition, this document describes methods for identifying typical indoor particle sources and gives general recommendations for obtaining a representative sample.

The main sources of indoor particulate matter are described in this document, together with indoor particle dynamics. Various measurement methods are described, along with their advantages, disadvantages and areas of application, as well as some general sampling recommendations. Measurement strategies for determining airborne particles indoors are discussed, including reference case studies with more specific sampling recommendations.

Additional documents in the ISO 16000 series will focus on each fraction of airborne particulate matter and give specific recommendations for these measurements.

The determination of measurement uncertainty and minimum reporting requirements are also part of this document.

This document does not apply to the determination of bioaerosols or the chemical characterization of particles. For the measurement and assessment of dust composition, see the relevant part in the ISO 16000 series.

This document does not apply to the measurement of airborne particles in vehicle passenger compartments 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.

ISO 16000-1:2004, *Indoor air — Part 1: General aspects of sampling strategy*

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 http://www.electropedia.org/

3.1
particle
small discrete mass of solid or liquid matter

[SOURCE: ISO 29464:2017, 3.2.111]

© Standards Australia Limited 2025