

SINGAPORE STANDARD

**Code of practice for indoor air quality for
air-conditioned buildings**



Published by

Enterprise
Singapore

SS 554 : 2016

(ICS 13.040.20; 91.040.01)

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ISBN 978-981-4726-44-3

This Singapore Standard was approved by the Building and Construction Standards Committee on behalf of the Singapore Standards Council on 11 April 2016.

First published, 2009

First revision, 2016

The Building and Construction Standards Committee, appointed by the Standards Council, consists of the following members:

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Deputy Chairmen	: Er. Chew Keat Chuan Mr Larry Ng Lye Hock	<i>Building and Construction Authority Urban Redevelopment Authority</i>
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The Technical Committee on Building Maintenance and Management, appointed by the Building and Construction Standards Committee and responsible for the preparation of this standard, consists of representatives from the following organisations:

	Name	Capacity
Chairman	: Dr Lim Lan Yuan	<i>Member, Building and Construction Standards Committee</i>
Deputy Chairman	: Er. Tang Pei Luen	<i>Member, Building and Construction Standards Committee</i>
Secretary	: Ms Barbara Bok	<i>SPRING Singapore</i>
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	Mr Bernard Cheng Kwang Meng	<i>SETSCO Services Pte Ltd</i>
	Prof Michael Chew	<i>National University of Singapore</i>
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	Mr Goh Sheng Jie	<i>Housing & Development Board</i>
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	Mr Tan Ann Kiong	<i>Singapore Contractors Association Limited</i>
	Er. Roland Tan Juay Pah	<i>Institution of Engineers Singapore</i>
	Er. Yeow Mei Leng	<i>Association of Consulting Engineers Singapore</i>
Co-opted Members	: Mr Chue Fook Chee	<i>Individual Capacity</i>
	Mr K Ramanathan	<i>Individual Capacity</i>
	Mr Kua Soo Chong	<i>Individual Capacity</i>

The Working Group, appointed by the Technical Committee to assist in the preparation of this standard comprises the following experts who contribute in their *individual capacity*:

	Name
Co-Convenors	: Prof Chandra Sekhar Assoc Prof Ng Lee Ching
Members	: Dr Ang Keng Been Er. Ang Kok Wee Mr Beh Lean Hooi Mr Thomas Chan Assoc Prof Foo Swee Cheng Ms Lynette Goh Er. Callan Lam Mr Lee Jang Young Er. Leong Cheng Wee

Members : Mr Darion Lim
Mr Lim Koon Teck
Mr Lim Sin On
Dr Lu Lu
Dr Ng Kok Wee
Dr Ooi Peng Lim
Mr Michael Seow
Assoc Prof Tan Kia Tang
Dr Ron Tan Sze Tat
Assoc Prof Tham Kwok Wai
Mr Toh Eng Shyan
Ms Jennifer Yap

The organisations in which the experts of the Working Group are involved are:

Air-care Engineering (S) Pte Ltd

ASHRAE (Singapore Chapter)

Association of Consulting Engineers Singapore

Building and Construction Authority

CapitaLand Limited

Cofely South East Asia Pte Ltd

Health Sciences Authority

Indoor Air Quality Society of Singapore

Institution of Engineers Singapore

International Facility Management Association, Singapore Chapter

Keppel Land International Limited

Land Transport Authority

Micro Filtration Technology Pte Ltd

Ministry of Health

Ministry of Manpower

National Environment Agency

National University of Singapore

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Foreword

This Singapore Standard Code of Practice was prepared by the Technical Committee on Building Maintenance and Management under the direction of the Building and Construction Standards Committee.

This Code specifies indoor air quality that will be acceptable to the majority of building occupants, and will minimise the risk of adverse health effects. It also provides information, advice and guidance on measures to improve the quality of air in air-conditioned environments.

This code is a revision of SS 554: 2009. The key changes include:

- a) Aligning acceptable limits of indoor air quality parameters to national and international standards.
- b) Specifying the reference methods and indicative methods where relevant.
- c) Enhancing the recommended filter ratings and providing information on filter use.
- d) Specifying the number of sampling points according to floor sizes and ventilation types, in addition to number of floors.

Minor changes include alignment with ISO 16814 : 2008 and text revision for better clarity.

This Code is intended to complement Singapore Standard 'Code of practice for air-conditioning and mechanical ventilation in buildings (SS 553).

This Code will be useful to building owners, management corporations, building occupants, and those responsible for designing, operating and maintaining the building environment, as well as others involved in servicing the ventilation and air-conditioning systems.

In preparing this Code, reference was made to the following publications:

1. ISO 16814 : 2008 Building environment design – Indoor air quality – Methods of expressing the quality of indoor air for human occupancy
2. NEA Guidelines for good indoor air quality in office premises (1996)

Permission has been sought from the following organisation / authors for the reproduction of:

1. Figures A.2 and A.4 from Dr Olli Seppanen and Dr William Fisk
2. Figure A.3 from Dr Pawel Wargocki
3. Table E.1 from the NAFA Guide to Air Filtration, 4th Edition 2007, Addendum 7.1 'A Brief Description of the ANSI/ASHRAE Standard 52.2 Test Method'
4. Some of the definitions, 5.5.1 and B.3.2 from ISO 16814 : 2008 published by the International Organization for Standardization

Acknowledgement is made for the use of information from the above organisations / authors.

This Code is expected to be used by all stakeholders, including relevant public agencies, consultants, facility owners and managers and employers. Occupiers, employers and building managers functioning in enclosed air-conditioned premises are encouraged to use this Code to help fulfil their general duties as specified in the Workplace Safety and Health Act.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*
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Code of practice for indoor air quality for air-conditioned buildings

1 Scope

The Code applies to all air-conditioned premises where air-conditioning is used intermittently or continuously, with the exception of residential premises, factory production areas, hospitals, polyclinics and laboratories.

It applies to all types of air-conditioning and air-distribution systems.

The recommended minimum ventilation rates in the Code should be used in conjunction with the SS 553, which provides guidance for the design, construction, installation, testing, commissioning, operation and maintenance of air-conditioning and mechanical ventilation (ACMV) system. Neither SS 553 nor this Code prescribes specific ventilation rate requirements for smoking zones. ASHRAE Standard 62.1 may be referred to if smoking zones are present (see also 5.1.6).

In setting indoor air quality (IAQ) standard, this Code considers environmental factors, which include thermal, physical, chemical and biological factors. The purpose of this Code is to specify indoor air quality that will be acceptable to building occupants, and to minimise the potential of adverse health effects.

Due to the diversity of contaminants generated from indoor and outdoor sources, the contaminants covered in this Code are not exhaustive. The Code provides limits for contaminants commonly found in an indoor environment, and limits for parameters that are indicative of the quality of the indoor air.

Meeting the requirements of this Code may not result in an acceptable indoor air quality for everyone in all air-conditioned buildings. The possible reasons are:

- a) Diversity of sources and contaminants in indoor air which may warrant further investigation;
- b) Inadequate cleaning of outdoor air which is unacceptable;
- c) Variation in occupants' perception of and preference for different levels of air temperature, humidity, noise, lighting etc.; or
- d) Variation in susceptibility of individuals.

2 Normative references

This Code 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 thereafter. For dated references, subsequent amendments to or revisions of any these publications apply to this Code only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ASHRAE Standard 52.2	Method of testing general ventilation air-cleaning devices for removal efficiency by particle size
ASHRAE Standard 55	Thermal environmental conditions for human occupancy
ASTM D5075	Standard test method for nicotine and 3-ethenylpyridine in indoor air
EN 779	Particulate air filters for general ventilation – Determination of the filtration performance

EN 12341	Ambient air. Standard gravimetric measurement method for the determination of the PM ₁₀ or PM _{2.5} mass concentration of suspended particulate matter
ISO 7730	Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria
ISO 8672	Air quality – Determination of the number concentration of airborne inorganic fibres by phase contrast optical microscopy – Membrane filter method
ISO 10312	Ambient air – Determination of asbestos fibres – Direct transfer transmission electron microscopy method
ISO 10313	Ambient air – Determination of the mass concentration of ozone – Chemiluminescence method
ISO 12039	Stationary source emissions – Determination of carbon monoxide, carbon dioxide and oxygen – Performance characteristics and calibration of automated measuring systems
ISO 14966	Ambient air – Determination of numerical concentration of inorganic fibrous particles – Scanning electron microscopy method
ISO 16000	Indoor air Part 2: Sampling strategy for formaldehyde Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air – Active sampling method Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID Part 15: Sampling strategy for nitrogen dioxide (NO ₂)
NIOSH 0800	Bioaerosol sampling (indoor air)
NIOSH Method 2551	Nicotine
SS 553	Code of practice for air-conditioning and mechanical ventilation in buildings