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SANS 10400-O:2025

Edition 4

SOUTH AFRICAN NATIONAL STANDARD

The application of the National Building Regulations

Part O: Lighting and ventilation

WARNING

This document references other documents normatively.

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was prepared by National Committee SABS/TC 060, *Standards which address the National Building Regulations (NBRS)*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in March 2025.

This document supersedes SANS 10400-O:2011 (edition 3).

This document should be read in conjunction with SANS 10400-A.

Reference is made in 4.3.2.3.3.9 to the “relevant national legislation”. In South Africa this means the **Occupational Health and Safety Act: Regulations: Hazardous Chemical Agents 2021**.

Compliance with the requirements of this document will be deemed to be compliance with the requirements of part O of the National Building Regulations, issued in terms of the National Building Regulations and Building Standard Act, 1977 (Act No. 103 of 1977).

Compliance with this document cannot confer immunity from legal obligations.

SANS 10400 consists of the following parts, under the general title *The application of the National Building Regulations*:

Part A: General principles and requirements.

Part B: Structural design.

Part C: Dimensions.

Part D: Public safety.

Part F: Site operations.

Part G: Excavations.

Part H: Foundations.

Part J: Floors.

Part K: Walls.

Part L: Roofs.

Part M: Stairways.

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Foreword *(concluded)*

Part N: Glazing.

Part O: Lighting and ventilation.

Part P: Drainage.

Part Q: Non-water-borne means of sanitary disposal.

Part R: Stormwater disposal.

Part S: Facilities for persons with disabilities.

Part T: Fire protection.

Part V: Space heating.

Part W: Fire installation.

Part X: Environmental sustainability

Part XA: Energy usage in buildings.

Annexes A, B and C are for information only.

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National Building Regulations Part O: Lighting and Ventilation

Regulations

O1 Lighting and Ventilation Requirement

- (1) Any habitable room, bathroom, shower-room and room containing a toilet pan or urinal, or any room which is a parking garage shall be provided with a means of lighting and ventilation which will enable such room to be used, without detriment to health or safety or causing any nuisance, for the purpose for which it is designed.
- (2) The requirement of sub-regulation (1) shall be deemed to be satisfied where the lighting and ventilation are in accordance with SANS 10400-O.
- (3)
 - (a) Notwithstanding the provision of any openings for natural light in accordance with sub-regulation (2) any room contemplated in sub-regulation (1) or any corridor, lobby or staircase serving such room shall be provided with a means of artificial lighting –
 - (i) for periods when natural lighting is inadequate; or
 - (ii) where the size or shape of any such room, or the glazing material used in any such opening, will not permit sufficient natural light effectively to illuminate all parts of such room.
 - (b) Notwithstanding the provision of openings for natural ventilation in accordance with sub-regulation (2) any room subject to the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), shall in terms of the said Act be provided with artificial ventilation as prescribed by such Act; and any room contemplated in sub-regulation (1) which is –
 - (i) a room which, due to conditions of high temperature, may be dangerous to safety or health.
 - (ii) a room where there will be dust, gas, vapour or volatile matter and hazardous biological agents which might be dangerous to safety or health; or
 - (iii) used for any purpose for which natural ventilation is not suitable,shall be provided with a means of artificial ventilation.

O2 Special Provision of Natural Lighting

Any habitable room in any dwelling house or dwelling unit, or any bedroom in any building used for residential or institutional occupancy shall, notwithstanding the provision of artificial lighting, be provided with at least one opening for natural light in accordance with sub-regulation O1(1).

O3 Approval of Artificial Ventilation Systems

No person shall without prior written approval of the local authority install any artificial ventilation system in any building: Provided that this prohibition shall not apply in the case of room air conditioners or other individual appliances installed for comfort.

O4 Design of Artificial Ventilation Systems

Any rational design of an artificial ventilation system shall be carried out by or under the supervision of an approved competent person who shall certify in accordance with the requirements of Regulation **A19** that the system has been designed to comply with regulation **O1**.

O5 Artificial Ventilation Plant

(1) Any plant forming part of an artificial ventilation system shall be so designed, located and protected that

- a) any condensate from such plant cannot be the cause of danger or nuisance to the public;
- b) inspection and servicing can be undertaken; and
- c) unauthorized persons cannot tamper with such plant.

(2) The requirements of sub-regulation (1) shall be deemed to be satisfied where the design, location and protection of such plant comply with SANS 10400-O.

O6 Testing of Artificial Ventilation Systems

(1) The owner shall at acceptable intervals of time submit to the local authority test reports indicating that any artificial ventilation system installed in terms of these regulations is operating in the designed manner.

(2) Records and log books shall be kept of the commissioning information, operational management, monitoring and maintenance and repair of all ventilation plant, including individual ventilation fans.

(3) Where specialist ventilation plants are provided as part of the protection measures against hazardous substances, and for the protection of occupants and to ensure safe procedures, such as in hospital theatres, such plant shall be inspected and validated at least every 12 months by an independent competent person.

O7 Fire Requirements

In addition to the requirements of this part, lighting and ventilation shall be provided to comply with Part T of these regulations.

The application of the National Building Regulations

Part O: Lighting and ventilation

1 Scope

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with part O (Lighting and Ventilation) of the National Building Regulations.

2 Normative references

The following referenced documents, in whole or in part, are indispensable for the application 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. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.

Standards

SANS 10114-1, *Interior lighting – Part 1: Artificial lighting of interiors*.

SANS 10400-A, *The application of the National Building Regulations – Part A: General principles and requirements*.

SANS 10400-N, *The application of the National Building Regulations – Part N: Glazing*.

SANS 10400-XA, *The application of the National Building Regulations – Part X: Environmental sustainability – Part XA: Energy usage in buildings*.

Other publications

Regulations for Hazardous Biological Agents, 2022 Government Notice R1887 of 2022.

3 Definitions

For the purposes of this document, the definitions given in SANS 10400-A (some of which are repeated for convenience) and the following apply.

3.1 acceptable acceptable

- a) in the opinion of any local authority, or
- b) in relation to any document issued by the council, in the opinion of the council

3.2

acceptable indoor air quality

indoor air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80 % or more) of the people exposed do not express dissatisfaction

3.3

adequate

adequate

a) in the opinion of any local authority, or

b) in relation to any document issued by the council, in the opinion of the council

3.4

air changes

amount of air movement or air leakage into or out of a building expressed in terms of the number of building volumes or room volumes exchanged

3.5

air classification

classification and limitation of use of room air and airstreams according to health, safety, and sensory irritation

3.6

artificial ventilation

process of supplying or removing air to or from an indoor space by externally powered equipment such as motor-driven fans and blowers

3.7

bioeffluent

atmospheric pollutant that emanates from the bodies of humans or animals

3.8

building line

line prescribed in any town planning scheme or any other law designating the boundaries of the area of a site outside of which the erection above ground of any building is prohibited

3.9

category 1 building

building which

a) is designated as being of class A3, A4, F2, G1, H2, H3, or H4 occupancy (see Regulation **A20**),

b) has no basements,

c) has a maximum length of 6,0 m between intersecting walls or members providing lateral support, and

d) has a floor area that does not exceed 80 m²

NOTE 1 Table A.1 in annex A outlines the difference in performance between category 1 buildings and other buildings that have the same occupancy designation in respect of several building attributes.

NOTE 2 A building may be classified as a category 1 building for the purposes of one or more parts of SANS 10400. Additional limitations may accordingly be imposed on category 1 buildings.

3.10

competent person

person who is qualified by virtue of their education, training, experience, and contextual knowledge to decide regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to them in terms of the National Building Regulations

3.11

contamination

airborne

harmful, hazardous, or noxious particles, vapours, gasses or odours suspended within a body of air

3.12

contamination removal effectiveness

ratio between the contaminant concentration in the exhaust and the mean contaminant concentration in the room

NOTE Local contamination removal effectiveness is defined as the ratio between contaminant concentrations in the exhaust and local indoor contaminant concentration as per equation 1.

$$\mathcal{E}_c = \frac{C_{EA}}{C_{IA}} \quad (1)$$

where

$\mathcal{E}_c$ is the contamination removal effectiveness;

C_{EA} is the contaminant concentration in the extract or transfer air before dilution;

C_{IA} is the contaminant concentration of the indoor air, either mean or local.

3.13

deemed-to-satisfy requirement

non-mandatory requirement, the compliance with which ensures compliance with a functional regulation

3.14

demand control ventilation

ventilation control algorithms utilising measured demand conditions and trends as inputs for achieving controlled, maintained, or reduced set points

3.15

dwelling house

single dwelling unit and any garage and other domestic outbuildings thereof, situated on its own site

3.16

dwelling unit

unit containing one or more habitable rooms and provided with adequate sanitary and cooking facilities

3.17

exhaust (air)

portion of extract air which is drawn from a room and exhausted to outside

3.18

extract (air)

air that is drawn from a room and that may be used for treatment and reuse as a fraction of the supply air

3.19

flue

passage that conveys the particulate or gaseous discharge of a heat-generating appliance to the external air

3.20

fresh air

outdoor air or supply air that is sufficiently free of airborne contaminants that can be used for maintaining the required indoor air quality (IAQ) levels

NOTE Extracted air can be treated and re-classified as fresh air in accordance with 4.3.2.4.6.

3.21

functional regulation

regulation that sets out in qualitative terms the performance requirements of a building, building element or building component in respect of a particular characteristic, without specifying the method of construction, capacities, dimensions or materials to be used

3.22

garage

enclosed area which is used or intended to be used for the parking, storing, servicing, or repairing of motor vehicles

3.23

habitable room

room that is used or designed, erected, adapted or intended to be used by persons for sleeping in, living in, the preparation or consumption of food or drink, the transaction of business, the rendering of professional services, the manufacture, processing or sale of goods, the performance of work, the gathering together of persons or for recreational purposes

3.24

indoor air quality

quantitative attributes of the respirable indoor air including gaseous composition, humidity, temperature, and contaminants

3.25

leeward recirculation zone

region in the leeward wake of the building within which turbulent airstreams can recirculate discharged air back to ventilation inlets and occupied areas on the leeward side of the building

3.26

local exhaust ventilation

extraction system that captures airborne contaminants at the emission source and transports them to the point of exhaust

3.27

make-up air

air introduced to replace extracted air

3.28

mixed mode ventilation

hybrid ventilation strategies that include zonal, seasonal, and concurrent mixing of mechanical and natural ventilation

3.29

natural ventilation

process of ventilating an indoor space without using externally powered devices

NOTE The flow of external air to an indoor space results from pressure differences arising from natural forces such as wind and buoyancy pressures.

3.30

neutral pressure plane

nominal plane of neutral pressure inside a building between the positive internal pressure that causes exfiltration and the negative internal pressure that causes infiltration

3.31

occupancy

particular use or the type of use to which a building or portion thereof is normally put or intended to be put

NOTE Regulation **A20** classifies and designates occupancies.

3.32

occupied zone

zone within a habitable space which is intended for regular occupancy and in which safe and comfort conditions are sought, typically below 1,8 m above finished floor level

3.33

outdoor air

volume of air taken from the external atmosphere and, therefore, not previously circulated through the system or ambient air that enters a building through a mechanical ventilation system, through intentional openings for natural ventilation, or by infiltration

3.34

rational assessment

assessment by a competent person of the adequacy of the performance of a solution in relation to requirements including as necessary, a process of reasoning, calculation, and consideration of accepted analytical principles, based on a combination of deductions from available information, research and data, appropriate testing and service experience

3.35

rational design

design by a competent person involving a process of reasoning and calculation and which may include a design based on the use of a standard or other suitable document

3.36

roof recirculation region

region above the roof of a building within which turbulent airstreams can recirculate discharged air back to ventilation inlets and occupied areas on the same roof

3.37

smoking area

area of a work or public space that is designated for smoking

3.38

street boundary

boundary of a site that abuts any street

3.39

suitable

capable of fulfilling or having fulfilled the intended function, or fit for its intended purpose

3.40

supply air

fresh air entering a space for the purpose of ventilation

NOTE Supply air may be treated as necessary to maintain appropriate IAQ.

3.41

surrogate occupancy

use of CO₂ tracer gas generation rate equivalent to design occupancy at design activity levels for ventilation performance evaluation

3.42

transfer air

air in a space that was transferred from another space, without being re-conditioned or re-treated, from where it was originally supplied by the ventilation system

3.43

trickle ventilator

small, adjustable opening integrated into window or door frames

NOTE Its primary purpose is to allow a controlled, continuous flow of fresh air into a building, even when the windows or doors are closed.

3.44

ventilation

process of supplying fresh air to or removing air from an indoor space for the purpose of reducing contamination levels or age of air in that space

3.45

ventilation effectiveness

ratio of the differences in contaminant concentrations between the exhaust and supply air, and average indoor and supply air as per equation 2.

$$\mathcal{E}_v = \frac{C_{EA} - C_{SA}}{C_{IA} - C_{SA}} \quad (2)$$

where

$\mathcal{E}_v$ is the ventilation effectiveness;

C_{EA} is the contaminant concentration in the extract or transfer air before dilution;

C_{SA} is the contaminant concentration in the supply air;

C_{IA} is the contaminant concentration in the breathing zone of the indoor air

3.46

zone of space

volume of open space free of any light obscuring obstructions outside an opening in an external wall or a portion of such an opening used for natural lighting calculations

4 Requirements

4.1 General

4.1.1 The functional regulations pertaining to lighting in a habitable room, bathroom, shower room or a room containing a toilet pan, contained in part O of the National Building Regulations, shall be deemed to be satisfied where the lighting in such rooms

- a) complies with the requirements of 4.2, or
- b) is the subject of a rational design prepared by a competent person.

4.1.2 The functional regulations pertaining to ventilation contained in part O of the National Building Regulations shall be deemed to be satisfied where the ventilation

- a) complies with the requirements of 4.3, or
- b) is the subject of a rational design prepared by a competent person and is constructed in accordance with the specifications issued by the said competent person.

4.2 Lighting

4.2.1 Natural lighting

4.2.1.1 General

4.2.1.1.1 Where, for the purposes of natural lighting, a room is provided with one or more openings, such opening or openings shall be situated in an external wall, or in a suitable position in the roof of the building and shall be provided with a zone of space outside it, in accordance with the requirements of 4.2.1.2.

4.2.1.1.2 Where such opening is glazed, it shall be glazed with transparent or translucent glazing material, in accordance with the requirements of SANS 10400-N and SANS 10400-XA.

4.2.1.1.3 The area of such opening, or the total area of such openings, inclusive of frames and glazing bars, shall be not less than

- a) 5 % of the floor area of the room(s) in respect of category 1 buildings that have an occupancy class of F2, H3, or H4, and
- b) 10 % of the floor area of the room(s) in respect of other buildings, or 0,2 m², whichever is the greater.

NOTE The requirements of 4.2.1 do not apply to ventilated improved pit toilets.

4.2.1.2 Zones of space for natural lighting

4.2.1.2.1 An opening provided in accordance with the requirements of 4.2.1.1 shall have a zone of space outside it, and such opening may be divided into portions, each with its own zone of space.

NOTE Figure 1 shows the zones of space that may exist when an opening is divided into portions. The lines that determine these zones depend on the size and shape of the obstruction.

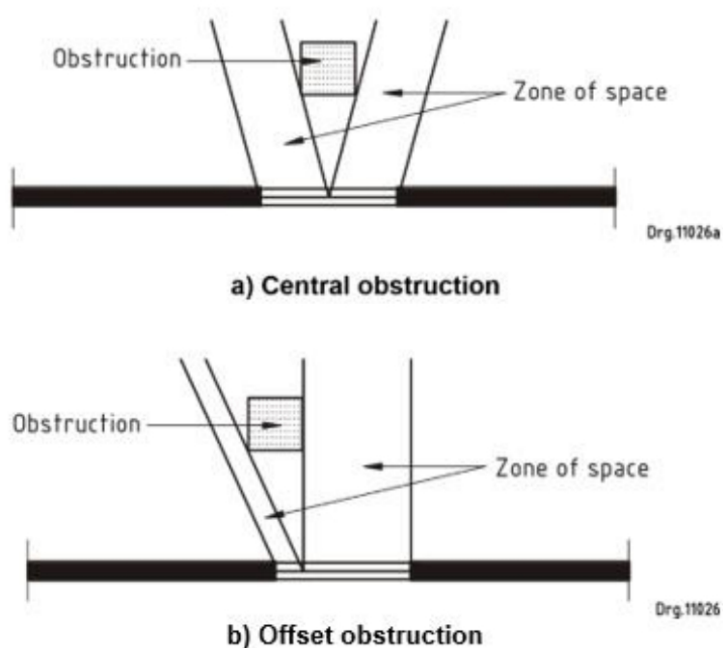


Figure 1 — Examples of zones of space with obstructions

4.2.1.2.2 A zone of space shall be limited by parallel planes passing through and extending from the highest and lowest points of such opening and by parallel planes passing through and extending from the points of such opening that are furthest apart in the lateral direction (see figure 2).

4.2.1.2.3 Such parallel planes may extend from a building at any angle to the plane of the opening.

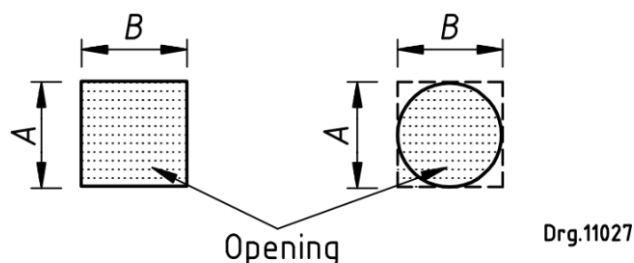


Figure 2 — Measurement of openings

4.2.1.2.4 Where the planes bounding a zone of space are not at right angles to the plane of the opening, the area of such opening shall, for the purpose of 4.2.1.1.3, be deemed to be $A \times B$, where A is the shortest distance between the planes bounding the top and bottom of such zone and B is the shortest distance between the vertical planes bounding the sides of such zone (see figure 3).

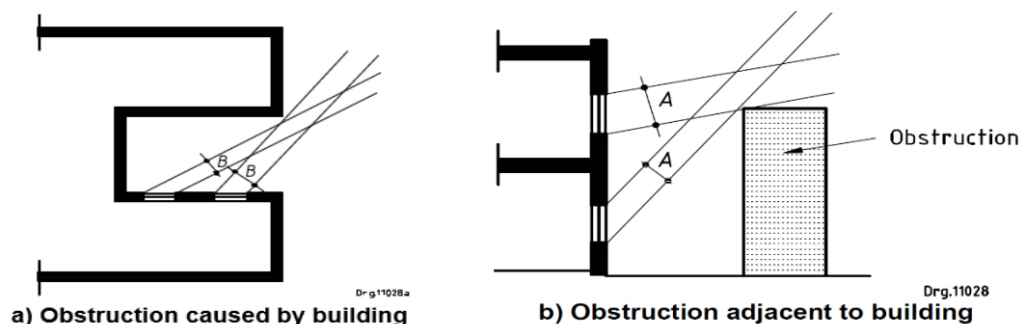


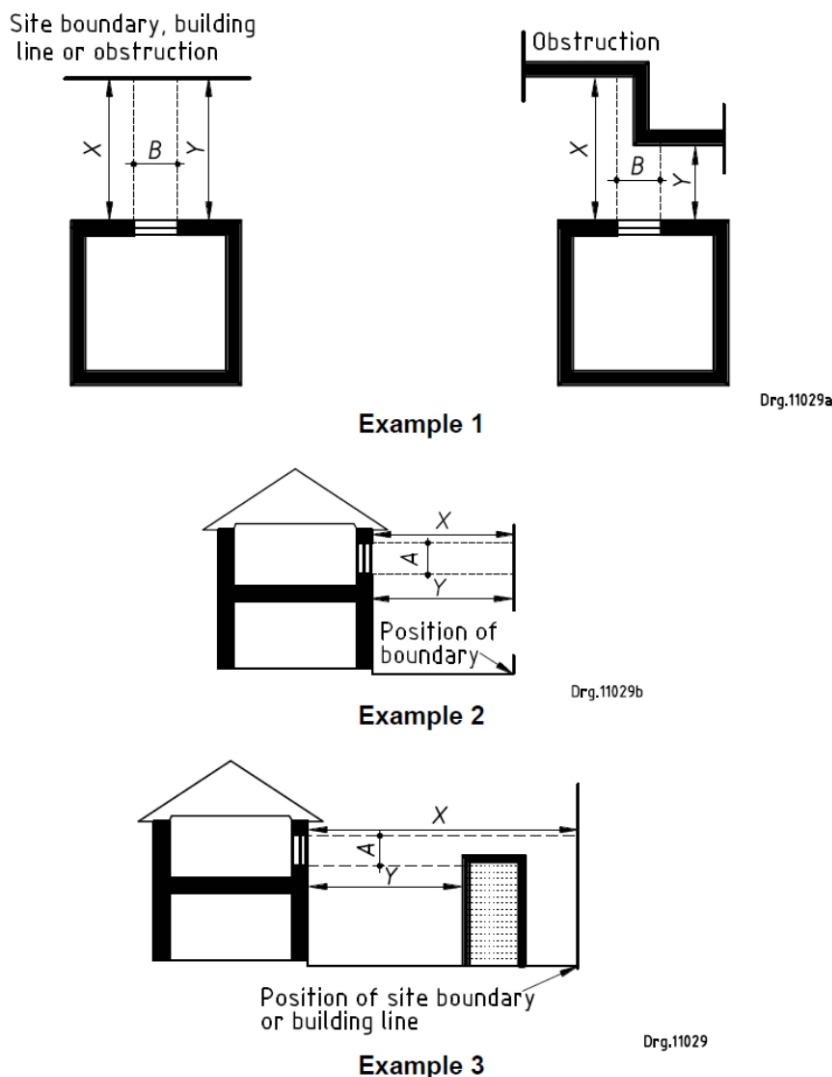
Figure 3 — Examples of zones of space at angles to openings

4.2.1.2.5 The available length of a zone of space shall be calculated either as half the sum of the lengths of the vertical planes or as half the sum of the lengths of the planes passing through the highest and lowest points of the opening.

4.2.1.2.6 The lengths of individual planes shall be measured as the distance along such plane from the opening to

- a) any obstruction on the site which intersects such plane, or
 - b) where there is no such obstruction, any statutory building line on an adjoining site, or
 - c) where there is no such obstruction or line, the boundary between the site and any adjoining site,
- provided that where a zone extends across a street reserve, the statutory building line and the boundary considered in (b) and (c), respectively, shall be taken to mean the statutory building line and street boundary of the site opposite the site concerned.

4.2.1.2.7 Figure 4 shows how the length of a zone of space can be calculated.



In all cases the length of the zone of space is $\frac{X+Y}{2}$

Figure 4 — Measurement of zones of space

4.2.1.2.8 The available length of any zone of space when calculated in accordance with 4.2.1.2.7, shall be

- a) not less than 0,5 m when measured to a boundary line, or
- b) not less than 1 m when measured to a building line, and
- c) notwithstanding the requirements contained in 4.2.1.2.9 and 4.2.1.2.10, not more than 8 m.

4.2.1.2.9 Where none of the planes bounding a zone of space intersects an obstruction on the site, the available length of such zone shall be not less than that contained in table 1, where H represents the distance measured vertically from the head of the opening to the top of the wall containing the opening.

4.2.1.2.10 Where one or more of the planes bounding a zone of space intersects an obstruction on the site, the available length of such zone shall be not less than that contained in table 1, where H represents the height of the obstruction above the level of the head of the opening concerned, provided that the shortest horizontal distance between the opening and such obstruction shall be not less than 1 m.

Table 1 — Length of zones of space

1	2
Type of room served by opening	Length of zone of space
Habitable room in dwelling house, dwelling unit or a building used for a residential or institutional occupancy	$1/3H$
Any other habitable room	$1/5H$
Bathroom, shower or room containing a toilet pan or urinal	$1/10H$

4.2.1.2.11 Figures 5 and 6 show the height of obstruction which controls the required length of a zone of space.

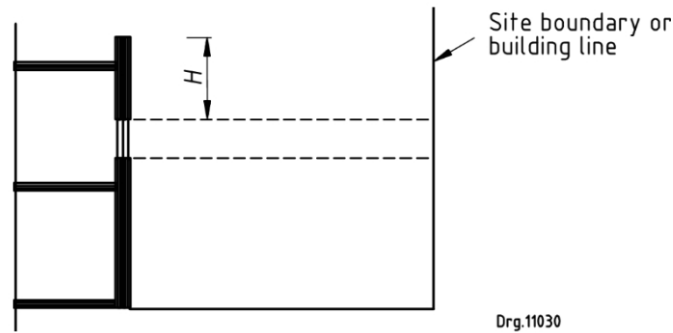


Figure 5 — Zone of space intersecting a boundary or building line

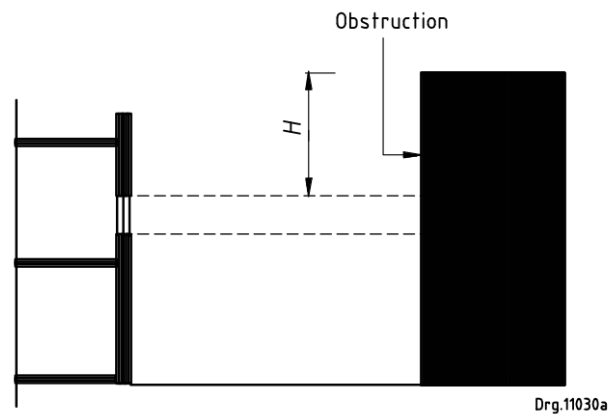


Figure 6 — Zone of space intersecting an obstruction

4.2.1.2.12 Where any projection from the surface of the wall above any opening in 4.2.1.1 is likely to significantly reduce the amount of light reaching such opening,

- at least two-thirds of the plan area of the zone of space outside such opening shall have an unrestricted vertical shaft extending upwards from the plane bounding the top of such zone; and
- no opaque projection over such zone shall extend to a line closer than 1 m away from any obstruction or lateral site boundary intersecting such zone. Figure 7 shows the vertical shaft required above a zone of space which has a projection covering part of it.

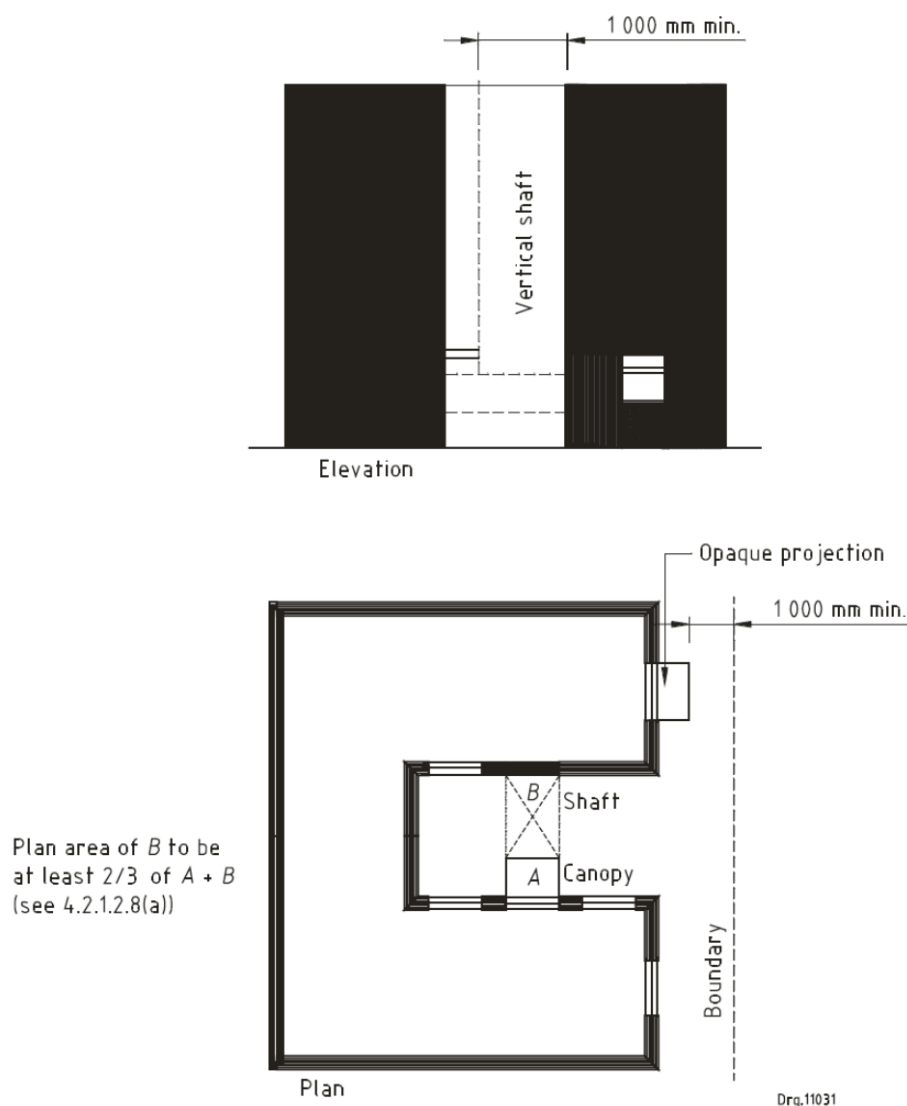


Figure 7 — Projection over zone of space

NOTE Fixed shading devices are to be considered in conjunction with the fenestration requirements in SANS 10400-XA.

4.2.1.3 Natural lighting of rooms opening onto enclosed balconies, galleries, or verandas

4.2.1.3.1 The openings to a room which opens onto a roofed and enclosed balcony, a gallery, or a veranda, shall comply with the requirements of 4.2.1.1 and 4.2.1.2.

4.2.1.3.2 The area of the openings in a portion of the outer wall of such balcony, gallery, or veranda, shall be at least 10 % of the combined floor area of the room concerned and the balcony, gallery, or veranda.

4.2.1.3.3 The portion of the outer wall of a balcony, gallery or veranda in which openings that comply with the requirements of 4.2.1.3.1 and 4.2.1.3.2 are formed, shall be provided with a zone of space that complies with the requirements contained in 4.2.1.2.

4.2.1.4 Natural lighting of rooms opening onto enclosed and covered or partially covered courts

4.2.1.4.1 Any room with an opening which opens onto an enclosed and covered or partially covered court shall comply with the requirements of 4.2.1.1 and 4.2.1.2.

4.2.1.4.2 The cover to such courts shall be adequately translucent.

4.2.2 Glare control

4.2.2.1 Where, for the purposes of natural lighting, a room is provided with one or more openings situated in an external wall, or in a suitable position in the roof of the building, the effect of glare shall be minimised to ensure visual comfort for occupants by means of one of the following devices:

- a) exterior fixed window shading;
- b) exterior adjustable window shading, such as adjustable louvres;
- c) interior adjustable window shading, such as adjustable blinds;
- d) interior fixed window shading, such as a light shelf designed to reflect light; and
- e) tinted glazing with a permanent or adjustable tinting.

NOTE The intention of such devices is to prevent direct sunlight from falling onto the working plane or prevent high light contrast between the background and the light source, while still allowing natural light to penetrate the room.

4.2.2.2 The working plane is 720 mm above finished floor level and 1,5 m from the centre of a window.

4.2.2.3 Such devices shall eliminate direct sun penetration for at least 80 % of the daytime hours of use of the space over the working plane, which is 720 mm above finished floor level and 1,5 m in from the windows.

4.2.3 Artificial lighting

Where, in any building, the requirements for lighting contained in Regulation O1 of the National Building Regulations shall be complied with by the installation of a system of artificial lighting, such lighting shall be in accordance with the relevant recommendations contained in SANS 10114-1.

4.3 Ventilation

4.3.1 Natural ventilation

4.3.1.1 Performance requirements

The functional requirements for mixed mode and naturally ventilated buildings shall be satisfied if the performance requirements described in column 7 of table 2 are met in all conditions through

- a) a rational design or rational assessment by competent persons using either building airflow simulation or established engineering design principles, or
- b) the requirements of 4.3.1.2 being adhered with.

NOTE Designers are advised to refer to annex B for informative guidance on natural ventilation test and balance.

4.3.1.2 Deemed to satisfy requirements

4.3.1.2.1 Functional requirements

The functional requirements for naturally ventilated buildings shall be satisfied if the requirements in 4.3.1.2.2 to 4.3.1.2.4 (inclusive) are met or exceeded.

4.3.1.2.2 General

4.3.1.2.2.1 Where, for the purposes of natural ventilation, a room is provided with an opening or openings to the outside,

- a) the position of such opening or openings in relation to each other and to internal doors to such room shall be such as to enable such room to be ventilated, and
- b) the arrangement and sizes of such openings in a garage shall be such that there is no local build-up in the quantity of noxious fumes or gases in such garage.

4.3.1.2.2.2 Every such opening shall be controllable and either be

- a) an opening or door in an external wall,
- b) an openable aperture within a glazed window assembly, in an external wall or in a suitable position in the roof, or
- c) an opening in an internal surface, connected directly to a ventilating flue driven by wind or thermal buoyancy.

NOTE Where concerns exist that users in congregate settings will override apertures, trickle ventilators can be used to meet the minimum ventilation requirements.

4.3.1.2.2.3 Natural ventilation flues shall

- a) have air outlets protected by a sufficiently durable grille, louvre, or weather cowl fitted with a screen through which a 12 mm diameter sphere cannot pass, and
- b) be provided with access for cleaning purposes.

4.3.1.2.2.4 The total area of an opening, a door, or an external openable aperture that complies with the requirements of 4.3.1.2.2.2(a), or (b) shall be not less than the greater of 5 % of the floor area of the room, and

- a) 0,1 m² in respect of category 1 buildings that have an occupancy class of E4, F2, H3, H4 or H5, and
- b) 0,2 m² in respect of other buildings.

4.3.1.2.2.5 The total area of openings that comply with the requirements of 4.3.1.2.2.2 shall be not less than 2 % of the floor area of the room.

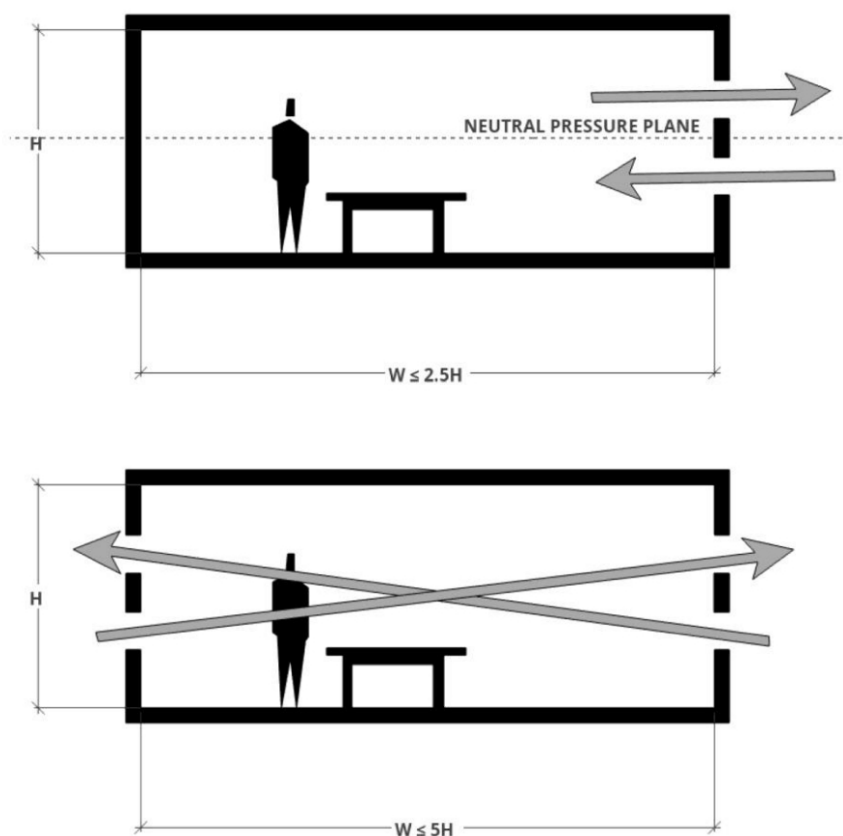
NOTE 1 When roof apertures are combined with low level apertures the minimum opening sizes for stack ventilation or flues are sufficient.

NOTE 2 In any building which is not permanently occupied, such as a holiday home or chalet, windows providing ventilation might remain closed for long periods. In hot humid areas this can lead to problems such as dampness and mould growth, and some form of supplementary ventilation might be desirable. Trickle ventilators or air bricks provide a partial solution but as these might not be sufficient on their own, some other form of permanent ventilation, such as a roof vent, should also be considered.

4.3.1.2.2.6 For naturally ventilated zones in buildings

- a) the distance between any point in the occupied zone of a room and the nearest ventilation aperture in the same space shall not exceed 2,5 times the floor to ceiling height, and
- b) with heights exceeding 3,5 m, ventilation apertures shall be provided to serve the upper and lower room separately, above and below the neutral pressure plane respectively.

NOTE Refer to figure 8 for the maximum depth of naturally ventilated rooms.



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Figure 8 — Maximum depth of naturally ventilated rooms

4.3.1.2.3 Natural ventilation of rooms opening onto enclosed balconies, galleries, verandas and courts

4.3.1.2.3.1 The openings to a naturally ventilated room which opens onto any roofed and enclosed balcony, a gallery, or a veranda, shall comply with the requirements of 4.3.1.2.1 and any such balcony, gallery, or veranda shall be provided with

- a) doors or other apertures openable to the outside with an area of not less than 5 %, and
- b) apertures openable to the inside, of not less than 8 % of the combined floor area of the room and the balcony, gallery, or veranda concerned.

4.3.1.2.3.2 Any room with an opening which opens onto an enclosed and covered or partially covered court shall comply with the requirements of 4.3.1.2.1

- a) if not occupied for any purpose
 - 1) have a covered plan area of not more than one-third of the plan area of such court; or
 - 2) be provided with additional openings from such court to the outdoor air to the extent that the total area of all such openings is equal to at least two-thirds of the plan area of such court; or
- b) if occupied for any purpose, shall be provided with additional openings from such court to the outdoor air to the extent that the total area of all such openings is equal to at least two-thirds of the plan area of such court.

4.3.1.2.3.3 Where natural ventilation is required and the cover extends over more than one-third of any enclosed court, additional ventilation openings may be provided either as shown in figure 9 or through the building itself.

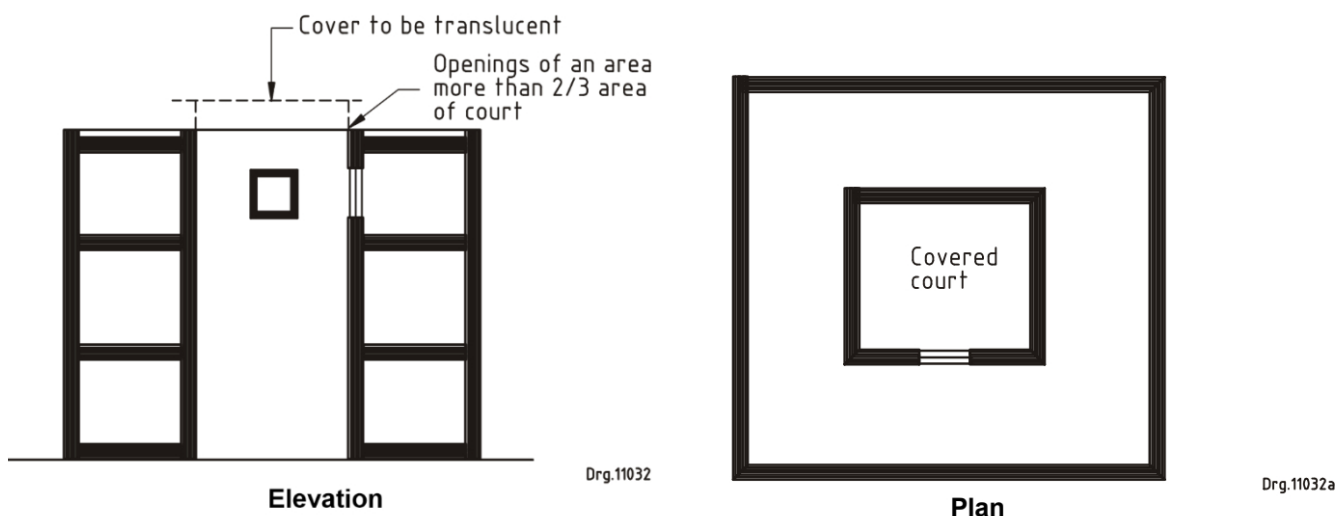


Figure 9 — Lighting and ventilation of court

4.3.1.2.4 Mixed mode ventilation

4.3.1.2.4.1 Where the functional requirements for an indoor zone cannot be met directly using natural ventilation alone, hybrid or mixed mode ventilation systems can be used. The following mixed mode ventilation configurations are considered acceptable

- a) Concurrent mixed mode systems which use artificial ventilation to supplement the natural ventilation shortfall.

- b) Change-over mixed mode ventilation systems which can be switched between natural and artificial ventilation modes daily as conditions allow.
- c) Seasonal mixed mode ventilation systems which can be switched between natural and artificial ventilation modes seasonally as conditions allow
- d) The artificial ventilation systems of a mixed mode ventilation system shall comply with the general requirements of 4.3.2.3.

4.3.1.2.4.2 Mixed mode ventilation systems shall provide room conditions which are in accordance with column 7 of table 2.

4.3.2 Artificial ventilation

4.3.2.1 Functional requirements

The functional requirements of an artificially ventilated room shall be satisfied where the requirements of 4.3.2.2 are met or exceeded.

4.3.2.2 Performance requirements

The performance requirements for artificially ventilated buildings shall be satisfied where the requirements described in 4.3.2.3 are met through

- a) rational design or assessment by competent persons using either building airflow simulation or established engineering principles, or
- b) performance verification by a competent person through
 - 1) documented steady state CO₂ concentration measurement at normal or surrogate occupancy, or
 - 2) documented airflow measurements in accordance with established engineering practices, or
 - 3) tracer gas decay evaluation excluding CO₂.

NOTE Refer to annex B for methods of tracer gas decay measurement.

4.3.2.3 General requirements

4.3.2.3.1 Outdoor air

4.3.2.3.1.1 The portion of outdoor air used in any artificial ventilation system shall be introduced to the ventilation system through an inlet positioned to ensure that such air is, as far as possible, free from local environmental airborne contamination. Where it is not possible to so position such inlet, the system shall incorporate suitable devices to

- a) reduce contamination levels of the introduced portion of outdoor air to a level suitable to achieve an acceptable indoor air quality, and
- b) prevent discharge of airborne contaminants or materials which might have originated from or accumulated in ducts, from entering the building spaces.

4.3.2.3.1.2 Air inlets forming part of an artificial ventilating system shall be protected by a sufficiently durable grille, louvre, or weather cowl fitted with a screen through which a 12 mm diameter sphere cannot pass.

4.3.2.3.2 Artificially ventilated room and space

4.3.2.3.2.1 A room or space which is required to be artificially ventilated and is used for an occupancy given in column 1 of table 2 shall be ventilated at a rate not less than that determined in 4.3.2.4.

4.3.2.3.2.2 In the case of a ticket kiosk situated in a parking garage, the air supply to such kiosk shall be sufficient to create positive pressure within the kiosk.

4.3.2.3.2.3 The arrangement and sizes of air inlets and outlets in a room which is only artificially ventilated shall be selected and arranged to ensure an even and uniform distribution and circulation of air throughout the occupied zone of the room without the creation of air current velocities within the occupied zone of more than

- a) 0,5 m/s for cooled air discharged into the room,
- b) 0,25 m/s for cooled air discharged at floor level, and
- c) 0,8 m/s for heated air discharged into the room.

NOTE Compliance with the maximum room air velocities is intended for comfort purposes only and does not imply compliance with the requirements for IAQ, ventilation effectiveness, or minimum fresh air rates.

4.3.2.3.2.4 Where air-conditioning units are utilized and cannot comply with the fresh air requirements of 4.3.2.3.2.1,

- a) a supplementary artificial or natural ventilation system shall be installed to ensure compliance with the minimum requirement for fresh air, and
- b) the requirements of 4.3.1 shall be met when designing a supplementary natural ventilation system.

4.3.2.3.3 Exhaust air systems requirements

4.3.2.3.3.1 The exhaust outlets for air which has been used for artificial ventilation purposes shall be so constructed, located, and arranged to ensure that

- a) such air does not cause a nuisance or contaminate air which is likely to be drawn into or ventilate an existing building, and
- b) exhaust air does not enter the occupied zone of indoor or outdoor access areas.

NOTE Reference to "existing building" in this clause includes any building on the same site as the building being ventilated as well as any buildings on any adjoining site.

4.3.2.3.3.2 Exhaust outlets forming part of an artificial ventilating system shall be protected by a sufficiently durable grille, louvre, or weather cowl fitted with a screen through which a 12 mm diameter sphere cannot pass.

4.3.2.3.3.3 Where an artificial exhaust ventilation system serves a room

- a) designated as an airborne precaution room or designed to be occupied by persons with infectious droplet or airborne spread diseases or,
- b) referred to in Regulation O1(3)(b), or
- c) containing a toilet pan or urinal, shower cubicle or bath, or used as a sauna, darkroom or refuse storage room,

air from such room shall not be recirculated to, or permitted to pass into, any other room, whether such room falls into the same occupancy category or not.

4.3.2.3.3.4 Exhaust air systems shall not be permitted to leak or be vented into a ceiling void or space within the building envelope but be discharged or exhausted to the outdoor air.

4.3.2.3.3.5 All exhaust air from internal spaces shall be discharged or exhausted directly to the outside of the building, and not into any ceiling void or space within the building envelope.

4.3.2.3.3.6 Artificial exhaust ventilation systems serving air classification zones 3 or higher shall not be directly connected to any artificial lighting system for the purpose of on/off control. Indirect connections including occupancy sensors with run-on timers are permitted.

4.3.2.3.3.7 In the case of a room containing a bath, shower, toilet pan or urinal under conditions of intermittent use in a dwelling unit or private dwelling house or any such room serving a bedroom, the exhaust system's run-on time shall be determined by the following equation:

$$t = 68 \times A \div Q \quad (3)$$

where

t is the fan run on time (minutes);

A is the floor area (m²);

Q is the air flow (l/s).

4.3.2.3.3.8 Notwithstanding 4.3.2.3.2, for bathrooms not larger than 8 m², in occupancy classes H3, H4 and H5, with low-level infiltration inlets, and served independently by one or more exhaust fans extracting at high-level,

- a) a minimum ventilation capacity of not less than 2,4 L·s⁻¹·m⁻² (8,75 m³·h⁻¹·m⁻²) will be acceptable without the need for a rational ventilation design, and
- b) the exhaust system's run-on time shall be either not less than 30 min or may be determined by equation (3) for higher airflow rates or smaller rooms.

NOTE Any artificial ventilation system developed in terms of 4.3.2.3.3.8 could obtain an approximately 90 % reduction in airborne contaminants after the room is vacated and by the time the fan is automatically turned off. This is to ensure that sufficient residual contaminants and moisture are removed from the room so that a damp environment does not develop.

4.3.2.3.3.9 The artificial ventilation system serving a parking garage (occupancy J4 as per Regulation A20) shall be separate from any other artificial ventilation system, provided that contaminated air exhausted from such garage may be circulated through a transformer, machine or similar service room to dissipate heat from machines before passing to the outdoor air. The arrangement and sizes of air inlets and outlets in every garage required in terms of this part of SANS 10400 to be artificially ventilated shall be such as to ensure that the level of noxious or toxic fumes or gases at any location in such garage does not rise above the safe occupational exposure limits for motor vehicle emissions as determined by the relevant national legislation (see foreword).

4.3.2.3.3.10 Where a kitchen contains an extraction facility for the purpose of extracting heat or vapour from the room, such facility where it is to be subjected to an atmosphere containing grease in suspension,

- a) shall be fitted with a means which will filter the air entering such facility to prevent such grease being carried into the system or, where such means cannot be fitted, an easily accessible trap or settling chamber shall be installed in the duct leading from such facility,
- b) shall be provided at every change in direction of such duct with means of easy inspection and cleaning of the interior of the duct, and
- c) the artificial ventilation system required therefore, shall be constructed or lined throughout with a smooth surfaced non-combustible material and shall not be connected to any other extraction facility or artificial ventilation system.

4.3.2.3.3.11 Where airborne toxic substances could be released into the room or space at rates sufficient to exceed safe occupant exposure limits,

- a) exhaust ventilation designed to remove such substances shall be provided,
- b) the ventilation effectiveness for such room shall be greater than 0,8,

c) where such contamination has localized emission sources, local exhaust ventilation shall be used to achieve a local contamination removal effectiveness near the emission source of greater than 0,8 and average room contamination removal effectiveness greater than 1, and

d) tracer gas decay analysis shall be used to verify the system performance.

4.3.2.3.3.12 In the case of a motor-repair garage, photographic darkroom, working area in a commercial dry-cleaning establishment, private or central kitchen in a hotel, motel, resort, dormitory and similar facilities or any washroom or room that contains a toilet pan or urinal located in an office-type occupancy or intended for use by the public, the extraction ventilation quantity shall exceed the supply air quantity to ensure negative pressure in the area concerned.

4.3.2.3.3.13 Any extraction systems handling air of category 2 and higher, as described in 4.3.2.4.6, shall be under a negative pressure within the building envelope. Any ducted airways located after the extraction unit, which remain within the building envelope, shall be subjected to a pressure leakage test, and validated by a competent person.

4.3.2.3.3.14 Exhaust fans shall be located as near to the exhaust discharge point as possible and exhaust ducting within the building and near ventilation inlets shall not be under positive pressure relative to the spaces through which they pass.

4.3.2.3.3.15 In the case of a laboratory,

a) any fume cupboard(s) extraction provided shall not be integrated into the laboratory's room extraction system,

b) extraction systems from fume cupboards in different laboratories shall not be integrated without airtight backflow protection per laboratory room,

c) the air supply per laboratory shall be sufficient to ensure that any fume cupboard(s) can remove all fumes, gas, vapour or volatile matter likely to be generated in such cupboard(s) without affecting the desired air pressure control within the laboratory, and

d) air supply points shall be located so as not to impact on fume cabinet performance.

4.3.2.3.3.16 The exhaust outlet of any extraction facility for untreated and potentially harmful air shall

a) be discharged outside of the roof recirculation region, and

b) not enter the building leeward recirculation zone and be constructed in such a way as to ensure that the exhaust plume from the facility is not entrained into the leeward recirculation zone or into the building via any building opening or ventilation inlet.

4.3.2.3.3.17 Excluding naturally ventilated clinical areas, any room referred to in Regulation O1(3)(b) where heat, dust, gas, vapour, volatile matter, or hazardous biological agents are liberated in one or more localized areas,

a) each such area shall be provided with a suitable cascading air pressure control, and an extraction facility, which shall safely exhaust the contaminated air from such area. The rate and location of the exhaust shall be sufficient to ensure appropriate removal or dilution of such heat, dust, gas, vapour, volatile matter, or hazardous biological agents via negative pressure ventilation systems and then discharged directly to the outdoors.

b) discharge air treatment and configuration shall comply with the facilities requirements stipulated in the Regulations for Hazardous Biological Agents, 2022 Government Notice R1887 of 2022 as amended in terms of Control of Exposure to HBA and Maintenance and Monitoring of Control Measures and Facilities.

- c) exhaust outlets shall be separated from ventilation inlets by at least 8 m horizontally or 3 m vertically
- d) exhaust outlets shall not discharge toward occupied zones,
- e) discharge velocity of air potentially contaminated with hazardous biological agents shall be not less than 14 m/s and shall comply with 4.3.2.3.3.16.

NOTE Vertical discharge upward is best practice to clear the building recirculation zones.

4.3.2.3.4 Control of air-conditioning condensate

Where air-conditioning units are installed in the perimeter wall of a building, and where such wall abuts on a public street or place, the units shall be installed, subject to the pathway accessibility requirements of SANS 10400-S, and operated in such a way that condensate formed by the operation of the unit is prevented from dripping onto such street or place by

- a) the use of a unit which disposes of all condensate by evaporation, or
- b) arranging for the condensate from the unit to be collected and disposed of into a drain.

4.3.2.4 Ventilation rates

4.3.2.4.1 The minimum acceptable ventilation rates in an occupied zone shall be calculated using the following formula:

$$q_t = (n \cdot q_p + A \cdot q_b) \cdot k_d \quad (4)$$

where

- q_t is the calculated minimum fresh-air ventilation rate required in L/s;
- n is the maximum number of people in the room (use default occupancy from table 2 if unknown);
- q_p is the minimum fresh-air ventilation rate required per person from column 3 of table 2 in L/s·person;
- A is the floor area in m²;
- q_b is the minimum fresh-air ventilation rate required per m² from column 2 of table 2 in L/s·m²;
- k_d is the room air distribution effectiveness factor from table 3.

NOTE 1 Equation 4 is used to calculate the summation of the resultant ventilation rates required for an indoor space contaminated with human bioeffluents and includes a compensation factor for the ventilation effectiveness of room air distribution modes from table 3.

NOTE 2 The additive method used to determine ventilation rates has been adapted from ASHRAE 62.1, REHVA Guide 2, EN 13141-1, EN 15251; EN 16798-3 and considers the adaptation state of room occupants.

4.3.2.4.2 Demand control ventilation may be used to adjust the occupancy portion ($n \cdot q_p$) of the outdoor air intake rate as operating conditions change. Occupancy sensing, occupancy schedules, or CO₂ based demand control ventilation may be used to adjust the ventilation rates with the following exceptions:

- a) The fresh-air rates shall not be less than the minimum per person fresh-air component prescribed in column 3 of table 2.
- b) The fresh-air rates shall not be less than the building fresh-air component (L/s·m²) prescribed in column 2 of table 2.
- c) The outdoor air component of recirculated air shall not be less than that prescribed in 4.3.2.4.6.

d) CO₂ based demand control ventilation shall not be used for rooms where significant indoor CO₂ sources, other than human occupants, are present or for rooms with CO₂ removal devices.

e) In zones with contaminants exceeding air category 2, as described in 4.3.2.4.6.

4.3.2.4.3 Demand control in multi zone ventilation systems shall always satisfy the minimum ventilation requirements prescribed in 4.3.2.3.2 for each zone served simultaneously while occupied. Acceptable demand control ventilation strategies shall include the following:

a) CO₂ based control using indoor limits from table 2 and continuous outdoor reference.

b) Room occupancy sensing with sufficient run-on time to achieve 4 full room air changes with outdoor air.

c) Occupancy schedules with sufficient run-on time to achieve 4 full room air changes with outdoor air and overrides for unusual occupancy demands.

4.3.2.4.4 Table 2 details the minimum artificial ventilation rates for different types of occupancies.

Table 2 — Minimum artificial ventilation rates for different types of occupancies

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Public halls							
Assembly halls for sedentary activity (public dining halls, pubs, arcades)	0,30	2,50	0,67	2		2 300	
Assembly halls for vigorous physical activity (fitness centres, dance halls, night clubs)	1,00	10,00	1,00	2		550	
Other assembly areas	0,40	7,00	1,00	1		850	
Churches	0,50	10,00	1,00	1		600	
Theatres and cinemas	0,30	5,00	2,86	1		1 050	
Indoor sports auditoriums	0,70	7,00	1,00	2		800	
Auditorium lobbies	0,30	4,00	1,00	1		1 450	
Laundries							
Laundries	0,40	4,00	15,00	2		600	
Commercial dry cleaners (working areas)	0,80	4,00	15,00	3		350	
Soiled laundry storage	0,80	4,00	50,00	3		100	
Clean storage and collection	0,40	7,00	15,00	1		450	
Educational buildings							
Lecture halls, conference halls and auditoria	0,60	5,00	2,86	1		900	

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m² Area	Fresh air rate L/s·person	Default occupancy density m²/person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m² Area	Max CO₂ above outdoor Parts per million	Notes
Educational buildings							
Classrooms, primary and secondary schools	0,30	3,80	1,54	1		1 450	
Art studios	0,70	7,00	5,00	2	3,50	600	
Laboratories (general)	2,00	10,00	15,00	3	2,00	150	Laboratory hood extraction is class 4 air.
Libraries	0,40	7,00	10,00	1		550	

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Dining facilities							
Restaurants and dining rooms	0,70	7,00	1,00	2		800	
Cafeterias	0,70	7,00	1,00	2		800	
Bars and cocktail lounges	0,70	7,00	1,00	2		800	
Kitchens	1,40	7,00	15,00	3	3,50	200	Grease hood extraction is class 4 air
Dwelling units							
Kitchens	0,40	4,00	5,00	2	25,00	1 050	
Other living areas	0,30	2,50	10,00	1		1 150	
Bathrooms and shower rooms	0,70	7,00	5,00	2	10,00	600	
Rooms containing a toilet pan or urinal	1,40	7,00	5,00	3	12,50	450	
Shops							
Malls, arcades, warehouses	0,40	7,00	10,00	1		550	
Wholesale stores	0,40	7,00	10,00	1		550	
Beauty and nail salons	0,70	7,00	15,00	2	3,00	350	
Sales floors, showrooms, dressing rooms	0,70	7,00	10,00	2		450	
Sports and amusement facilities							
Ballrooms and Night Clubs	0,70	7,00	1,00	2		800	
Bowling alleys and ice rinks (seating area)	0,40	7,00	1,00	1		850	
Playing area (gymnasiums, etc.)	0,70	7,00	1,00	2		800	
Locker rooms	0,40	4,00	1,00	2	2,50	1 400	

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Spectator areas	0,30	3,80	0,67	1		1 550	
Health spas and slimming salons	1,00	10,00	15,00	2		250	
Garages							
Parking garages	0,40	4,00	50,00	2	3,70	250	
Ticket kiosks	0,70	7,00	50,00	2	2,50	150	
Motor car repairs	0,80	4,00	50,00	3	3,70	100	
Hotels, motels, resorts, dormitories and similar facilities							
Lobbies	0,40	4,00	5,00	2		1 050	
Conference rooms,	0,40	7,00	5,00	1		700	
Assembly rooms	0,30	2,50	0,83	1		2 300	
Bedrooms	0,30	2,50	10,00	1		1 150	
Living rooms	0,30	2,50	10,00	1		1 150	
Central kitchens	0,70	7,00	15,00	2	3,50	350	
Private kitchens	0,70	7,00	5,00	2		600	
Libraries							
General	0,40	7,00	10,00	1		550	
Bookstock	0,70	7,00	50,00	2		150	
Offices							
General and waiting	0,40	7,00	15,00	1		450	
Conference and boardrooms	0,40	7,00	5,00	1		700	
Cleaners Store	0,80	4,00	15,00	3		350	
Stages, radio movie and film studios	0,30	5,00	1,43	1		1 150	
Rooms containing baths, shows, toilet pans or urinals							
Serving dwelling units or bedrooms	1,40	7,00	10,00	3	12,50	300	
All others	1,40	7,00	1,00	3	12,50	750	

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Transportation							
Waiting rooms, ticket and baggage areas, corridor and gate areas, platforms, concourses	0,70	7,00	10,00	2		450	
Other industrial							
Freezer rooms	0,00	5,00	50,00	3		NA	
Chemical Storage Rooms	0,80	4,00	50,00	3	7,50	100	
General Manufacturing	0,90	5,00	7,00	2		550	
Shipping/Receiving	0,60	5,00	2,00	2		1 000	
Light assembly	0,60	3,80	7,00	2		750	
Health care facilities diagnostic and treatment areas							
Medication room	0,70	7,00	10,00	2		450	
Physical Therapy	0,50	10,00	10,00	1		400	
Hydrotherapy	1,00	10,00	10,00	2	2,50	300	
Birth room	0,70	7,00	10,00	2		450	
Imaging rooms	4,00	10,00	10,00	4		100	
Dental Treatment	0,90	5,00	5,00	3		650	
General examination room	0,60	3,80	5,00	1		900	
Physical therapy exercise area	0,90	10,00	14,29	2		250	
Physical therapy individual room	0,30	5,00	5,00	1		950	
Prosthetics and orthotics room	0,90	5,00	5,00	2		650	
Psychiatric consultation room	0,30	2,50	5,00	1		1 550	
Psychiatric examination room	0,30	2,50	5,00	1		1 550	
Psychiatric group room	0,30	2,50	2,00	1		2 000	
Psychiatric seclusion room	0,30	5,00	20,00	2		550	
Speech therapy room	0,30	2,50	5,00	1		1 550	
Urgent care examination room	0,60	3,80	5,00	1		900	
Urgent care observation room	0,30	2,50	5,00	1		1 550	

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Urgent care treatment room	0,90	3,80	5,00	1		750	
Urgent care triage room	0,90	5,00	5,00	1		650	
Pharmacy waiting/Sub-waiting (Indoor)	1,40	7,00	5,00	3		450	No recirculation, safe exhaust ^a
Outpatient waiting/sub-waiting (indoor)	2,00	10,00	5,00	3		300	No recirculation, safe exhaust ^a
TB services							
Bronchoscopy, sputum collection, examination room and general treatment room	2,80	7,00	10,00	4		150	
Airborne precaution wards	4,00	32,00	10,00	4	10,00	50	Pressure negative to adjacent areas no recirculation, safe exhaust ^a
TB waiting	2,00	32,00	10,00	3	10,00	100	Pressure negative to adjacent areas no recirculation, safe exhaust ^a
Inpatient nursing							
General wards, paediatric wards,	0,70	7,00	10,00	2		450	
Labour, recovery and postpartum	0,70	7,00	10,00	2		450	
Airborne infection/protective environment wards and anterooms or airlocks	4,00	32,00	10,00	4		50	Pressure negative to adjacent areas no recirculation, safe exhaust ^a

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Surgery and critical care							
Intensive care and delivery rooms	5,00	10,00	10,00	3		100	
Burns wards	15,00	10,00	10,00	4		–	Pressure positive to adjacent areas, Negative pressure anteroom required. Prescribed minimum rates are not inclusive of aseptic requirements
Trauma room	10,00	10,00	10,00	3		50	Pressure positive to adjacent areas
ER waiting room	10,00	10,00	10,00	3		50	Pressure negative to adjacent areas
Radiology	10,00	10,00	10,00	4		50	
Medication rooms	10,00	10,00	10,00	2		50	
Operating rooms (Major – ISO 5-7)	35,00	10,00	10,00	2		–	Pressure positive to adjacent areas HEPA Filtration at Air Terminals Recirculation within OR only with Air Treatment Prescribed minimum ventilation rates not inclusive of regulatory clinical requirements ^b

Table 2 — Minimum artificial ventilation rates for different types of occupancies (*continued*)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Operating rooms (Minor) – ISO 8	15,00	10,00	10,00	2		–	Pressure positive to adjacent areas Recirculation within OR only with Air Treatment Prescribed minimum rates are not inclusive of regulatory clinical requirements ^b
Operating rooms (containment and sepsis)	15,00	10,00	10,00	3	17,00	–	Pressure negative to adjacent areas No Recirculation Prescribed minimum ventilation rates are not inclusive of regulatory clinical requirements
Operating theatre suites (ancillary areas)	15,00	10,00	10,00	3		–	Pressure positive to adjacent areas Recirculation within suite ancillary areas only with Air Treatment Prescribed minimum rates are not inclusive of regulatory clinical requirements
Medication rooms	10,00	10,00	10,00	2		50	

Table 2 — Minimum artificial ventilation rates for different types of occupancies(concluded)

1	2	3	4	5	6	7	8
Occupancy type	Fresh air rate L/s·m ² Area	Fresh air rate L/s·person	Default occupancy density m ² /person	Air category classification (see 4.3.2.4.6.4)	Minimum exhaust air rate L/s·m ² Area	Max CO ₂ above outdoor Parts per million	Notes
Laboratories							
Microbiological	1,00	10,00	50,00	2		100	
General biochemistry, cytology, and histology,	1,00	10,00	50,00	2		100	
Nuclear medicine, pathology, and serology	4,00	10,00	50,00	4		–	
Biosafety level 1	2,00	10,00	50,00	3		50	Untreated laboratory hood extraction is class 4 air
Biosafety level 2	2,00	10,00	50,00	3		50	Untreated laboratory hood extraction is class 4 air
Biosafety level 3	5,00	10,00	50,00	3		–	No Recirculation to adjacent areas untreated laboratory hood exhaust is class 4 air
Smoking area							
Smoking rooms	4,00	10,00	5,00	4	11,50		
^a Also see 4.3.2.3.3.17.							
^b ISO classification of theatres are in accordance with ISO 14644-1.							

4.3.2.4.5 The cumulative ventilation rate calculated from table 2 shall be multiplied by the factors from table 3 to determine the minimum required ventilation rates for any type of room.

Table 3 — Room air distribution effectiveness factors

1	2	3	4
Configuration	Supply air type	Extract air location	Effectiveness factor k_d
1	Ceiling supply of cooled air	Floor or ceiling	1,0
2	Ceiling supply of heated air, where supply air jet does not reach within 1,4 m of floor level	Ceiling	1,2
3	Low velocity floor or underfloor supply of cooled air with vertical thermal stratification and low vertical airflow velocities	Ceiling	0,8
4	Floor supply of heated air	Ceiling	1,4
5	High or low-level supply air closer than 1 m from any extract point or	Extract near or above heating supply. Extract near or below in cooling supply	2,0
6	Other	Further than 1,2 m from any supply air register	1,0

4.3.2.4.6 Air category classification and recirculation

4.3.2.4.6.1 Air leaving each space through exhaust, return, or air transfer systems shall be categorised according to the health safety and sensory irritation classification 4.3.2.4.6.4 or column 5 of table 2 as applicable.

4.3.2.4.6.2 The air may be treated and redesignated for recirculation and reuse as permitted in 4.3.2.4.6.4, provided that the zone concentrations of any contaminants of concern, such as CO₂, are maintained below prescribed or regulatory limits.

4.3.2.4.6.3 The fresh air quotient as defined in 3.22 shall not comprise only treated and recirculated air. The required fresh air rate shall comprise a portion of outdoor air not less than the greater of equations (5) or (6) below:

$$Q_{OA-min} = Q_{FA} \cdot (1 - \eta_{eff}) \div \varepsilon_v \quad (5)$$

$$Q_{OA-min} = 0,75 \cdot n \cdot q_p \div \varepsilon_v \quad (6)$$

where

Q_{OA-min} is the minimum outdoor air volume flow;

Q_{FA} is the fresh air volume flow from equation (4);

η_{eff} is the minimum total efficiency of the decontamination system (e.g filtration) for the considered airborne contaminant.

n is the maximum number of people in the room (use default occupancy from table 2 if unknown);

q_p is the minimum outdoor air ventilation rate required per person from table 2 in L/s-person;

ε_v is the ventilation effectiveness (can be substituted with k_d^{-1} from table 3);

NOTE The ISO 16890 series of standards describes filtration efficiency of particulate matter in the context of a size fraction of natural aerosols suspended in ambient air. The different classes of filtration efficiency are defined according to the particle size range as they relate to human health, ePM10, ePM2.5 and ePM1. The ISO 16890 series of standards prescribed filtration efficiencies are appropriate for use as the decontamination efficiency of many aerosol contaminants in 4.3.2.4.6. The filtration efficiencies described in EN 779, SANS 1424 and ASHRAE 52.2 MERV scales are not similarly applicable.

4.3.2.4.6.4 Room air and airstreams shall be classified and limited for recirculation as described in table 4. The sensory categories described in column 1 of table 4 are referenced in column 5 of table 2.

Table 4 — Air classification and recirculation

1	2	3	4	5	6
Health safety and sensory irritation classification	Example	Recirculation within originating room	Exhaust to supply carry over during energy recovery	Transferred to other spaces	Treatment and reclassification
Air category:					
1 Air with low contaminant concentration with low hazard and sensory irritation intensity	a) general purpose office b) residential rooms	Permitted	Permitted	Permitted to equivalent and higher category spaces	Permitted
2 Air with moderate contaminant concentration and sensory irritation intensity	a) machine rooms b) restaurants c) residential bathrooms (no toilet pan) d) residential kitchens	Permitted	Permitted (less than 10 % of supply)	Permitted to similar use but higher category spaces	Permitted
3 Air with high contaminant concentration with high sensory irritation intensity	a) residential kitchen extraction b) bathrooms with toilet pan c) commercial laundry extraction	Permitted	Permitted (less than 5 % of supply)	Not permitted	Permitted
4 Air containing dust, gas, vapour or volatile matter and hazardous biological agents at levels which might be dangerous to safety or health	a) airborne isolation room b) fume hood extraction c) commercial kitchen grease extraction	Not permitted	Not permitted	Not permitted	Permitted only where not prohibited by the National Health Act (Act No. 61 of 2003) or the Occupational Health and Safety Act (Act No. 85 of 1993)
NOTE 1 Sensory irritation excludes auditory and visual effects.					
NOTE 2 Mixed or transferred air assumes the classification of the highest contaminant classification source or destination.					
NOTE 3 Air treatment is achieved by removing air from a space and passing air through an air decontamination system.					

4.3.2.4.7 Test and balance

The ventilation performance of mechanically ventilated buildings that have an occupancy class other than F2, H3, H4 or H5, D4, J1, J2, J3 or J4 should be proven to comply with 4.3.2.3.2 before final occupation.

4.4 Designated smoking areas and smoking rooms

Where the room or space is a dedicated smoking room or smoking area, notwithstanding 4.3.2, the ventilation shall comply with the following requirements:

- a) Smoking rooms shall be designed to extract smoke from the room and to supply fresh air to the room in such a way that a negative pressure of 10 Pa or inflow of 1,1 m/s is maintained in such a room, under all weather and operating conditions, and the contaminated air is prevented from passing back into the building.
- b) The extracted air shall be exhausted to the environment in such a way that it will not be re-entrained into the building nor cause any nuisance or harm to any building on the same site as the building being ventilated or to any building on an adjoining site.
- c) Naturally ventilated smoking areas shall be separated from building ventilation apertures, doors, openable windows, or verandas by at least 8 m.
- d) Doors to smoking areas shall have automatic door closers but shall not open automatically. Door closers shall not include any hold-open feature.
- e) Make-up air shall be introduced to dedicated smoking rooms by a separate and dedicated mechanical device that continuously supplies and extracts air to the outside during occupied hours.
- f) Make-up air shall not be introduced from an existing ventilation system in the building.
- g) Smoking rooms and areas shall be provided with a dedicated supply and extraction system.
- h) Transfer air from the building shall not be considered for use as makeup air.

4.5 Radon control

For informative guidance on radon control, refer to annex C.

Annex A (informative)

Differences in performance between category 1 buildings and other buildings

Table A.1 — Principal differences between category 1 buildings and non-category 1 buildings

1	2
Technical aspect	Differences between user performance levels
Size and type of building	Category 1 buildings are restricted to those which have no basements, have floor areas of less than 80 m ² , and have a maximum length of 6,0 m between intersecting walls or members providing lateral support.
Maintenance cycles	Category 1 buildings might require more frequent maintenance.
Earthquakes	Not applicable.
Windstorms	Not applicable.
Deflection and deviation from the horizontal and vertical	Deflections and deviation from the horizontal and vertical are greater in category 1 buildings than those associated with non-category 1 buildings and might be visible/noticeable to a trained eye, although structural performance and safety is not impaired.
Expected damage in walls and floors	The degree of expected damage will generally be greater in category 1 buildings; such damage will nevertheless be of a minor nature and be repairable during the course of normal redecoration.
Behaviour in fire	Restrictions will be placed on the size and layout of the building in category 1 buildings.
Severe condensation and consequential mould growth	No prohibition is placed on the use of category 1 buildings with poor thermal performance in areas with high winter rainfall and humidity such as the Southern Cape Condensation Problem Area, if it can be demonstrated that the building is upgradable to a non-category-1 building without having to rebuild the structure.
Attack by biological agents	Not applicable.
Rising damp	Not applicable.
Resistance of walls and roofs to rain penetration	Minor ingress might be experienced in infrequent major storms but not to the extent that any permanent damage might be caused.
Hail resistance	Elements other than normal glazing in category 1 buildings might be more susceptible to hail damage in severe hailstorms.
Resistance to local damage/soft body impact	The resistance to local damage when struck by sharp-edged objects and the ability to hold fittings and the impact resistance to soft body impacts will be lower in the case of category 1 buildings than that for non-category 1 buildings. The reduction in performance does not compromise the safety of the structure in any way under all normal circumstances of use.
Accuracy of construction	Tolerances will be greater (i.e. relaxed) in category 1 buildings.
Lighting and ventilation	Reduction in category 1 buildings in size of openings for occupancy classes E3, H3 and H4 only.

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Annex B

(informative)

Natural ventilation test and balance

B.1 Where the natural ventilation design is the subject of a rational design, a proof of performance certificate can be submitted together with form 4 as stipulated by Regulation A19 (12.b).

B.2 The ventilation performance of naturally ventilated buildings other than those with an occupancy of F2, H3, H4 or H5, D4, J1, J2, J3 or J4 can be proven experimentally in accordance with 4.3.2.2 before final occupation.

B.3 Performance verification should be completed by a competent person through

- a) tracer gas decay evaluation or
- b) steady-state CO₂ assessment at normal or a surrogate design occupancy,

B.4 Refer to ASTM D6245-18 for acceptable guidance on using CO₂ concentrations to assess indoor air quality and ventilation, and ASTM E741-18 or ISO 12569 for CO₂ measurement methods.

Annex C (informative)

Ventilation for radon risk control

C.1 Radon is a rare radioactive gas belonging to the noble gas series. It occurs as an intermediate step in the normal slow radioactive decay of thorium, radium, and uranium. Under normal conditions, radon is gaseous and easily inhaled.

C.2 Radon gas is considered a health hazard. For many it is the largest contributor to an individual's background radiation dose, but the level of the hazard differs geologically from location to location. Radon is dense and can accumulate in low areas of poorly ventilated buildings, especially in crawl spaces of steel framed buildings or basements and cellars.

C.3 Indoor radon accumulation and exposure is an emerging area of concern for residential and other buildings in South Africa. The extent of the risk is currently not known and remains an area of developing research.

C.4 What is understood is that residential buildings near current or previous gold or uranium mining activities are among building categories with an elevated level of risk. Also, buildings constructed from materials such as fly ash derived from industrial processes may present elevated exposure risks.

C.5 Radon control programs should be developed for the following buildings and spaces:

- a) unsealed cellars and basements constructed with natural rock;
- b) buildings constructed using materials derived from industrial waste including fly ash;
- c) basements and crawl spaces of buildings constructed from light steel-frame systems; and
- d) negative pressure rooms with fresh air ventilation rates of 2 ACH or less and located at ground level or below should have continuous radon monitoring or be sealed from radon ingress.

C.6 Where radon levels or radon risk are deemed or measured to be high, mechanical or natural ventilation systems should be installed and commissioned in accordance with the requirements of this part of SANS 10400.

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Bibliography

ASHRAE 62.1, *Ventilation and acceptable indoor air quality.*

ASTM D6245-18, *Standard guide for using indoor carbon dioxide concentrations to evaluate indoor air quality and ventilation.*

ASTM E741-18, *Standard test method for determining air change in single zone by means of a tracer gas dilution.*

EN 779, *Particulate air filters for general ventilation – Determination of the filtration performance.*

EN 13141-1, *Ventilation for buildings – Performance testing of components/products for residential ventilation – Externally and internally mounted air transfer devices.*

EN 15251, *Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.*

EN 16798-3, *Energy performance of buildings – Ventilation for buildings – Part 3: For non-residential buildings – Performance requirements for ventilation and room-conditioning systems.*

ISO 12569, *Thermal performance of buildings and materials – Determination of specific airflow rate in buildings – Tracer gas dilution method.*

ISO 14644-1, *Cleanrooms and associated controlled environments – Part 1: Classification of air cleanliness by particle concentration.*

ISO 16890, *Air filters for general ventilation (all parts).*

REHVA Guide 2, *Ventilation effectiveness.*

SANS 1424, *Filters for use in air-conditioning and general ventilation.*

SANS 10400-T, *The application of the National Building Regulations – Part T: Fire protection.*